Identifying High Risk SQL Before The Upgrade

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This presentation was given by Craig Shallahamer (craig@orapub.com) at the 2015 IOUG/Collaborate conference in Las Vegas, NV USA

The Truth

It is impossible to perfectly match production.

Why impossible?

Differences!

hardware

operating system

oracle

transaction mix

application

bind variables

usage patterns

concurrency

data volume

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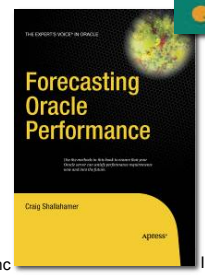
About Me...

- Long time Oracle DBA
- Specialize in Oracle Database performance and predictive analysis
- Performance researcher
- Blogger: A Wider View About Oracle Performance Tuning
- Author: Oracle Performance Firefighting and Forecasting Oracle Performance.
- Conference speaker
- Teacher and mentor
- Oracle ACE Director



Connect with Craig and OraPub.

Email: craig@orapub.com

Twitter: @CShallahamer

OraPub.Com: Everything starts here!

LinkedIn: Connect and network with Craig and the OraPub Group.

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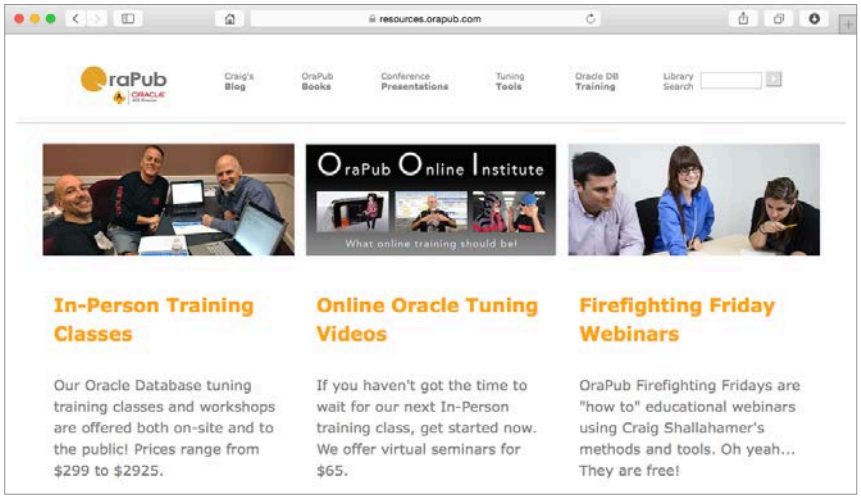
OraPub offers a one-stop location for specialized training in Oracle Database performance tuning, designed to help DBAs get the answers and skills they need through engaging and useful resources.



My Goal:

Identify SQL likely to perform poorly in the upgraded environment before the upgrade.

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Big Problem

The Plan

- Work and time – key to everything
- Fundamental system comparison
- Dealing with CPU speed differences
- Dealing with work differences
- Dealing with highly functional focused benchmarks

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Example of elapsed time.

Supposed a query must access 100,000 logical IOs and each LIO takes 0.020ms. Therefore, the elapsed time will be 2,000ms or 2.0 seconds.

```
E (ms/exec)  = units of work (LIO/exec) X time per work (ms/LIO)

2000 ms/exec = 100,000 LIO/exec         X 0.020 ms/LIO
```


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What is the average SQL elapsed time?

SQL ordered by Gets

- Resources reported for PL/SQL code includes the resources used by all SQL statements called by the code.
- Total Buffer Gets: 338,974,131
- Captured SQL account for 99.6% of Total

Buffer Gets	Executions	Gets per Exec	%Total	CPU Time (s)	Elapsed Time (s)	SQL Id	SQL Modu
296,867,461	10	29,686,746.10	87.58	12530.67	27016.25	6mpgg9kthmtm4	AHLWUEFF
30,903,598	300	103,011.99	9.12	235.69	686.01	akpdj9s4ug2s2	JDBC Thin Client
18,552,460	116,739	158.92	5.47	326.80	1275.65	bz0hcf42a1tr9	AHLWUEFF

```
E (sec/exec)     = Total Elapsed Time (sec) / Total Executions (exec)

2701.6 sec/exec = 27016.25 sec              / 10 exec
```

SQL ordered by Gets

- Resources reported for PL/SQL code includes the resources used by all SQL statements called by the code.
- Total Buffer Gets: 338,974,131
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Buffer Gets	Executions	Gets per Exec	%Total	CPU Time (s)	Elapsed Time (s)	SQL Id	SQL Module
296,867,461	10	29,686,746.10	87.58	12530.67	27016.25	6mpgg9kthmtm4	AHLWUEFF
151,868,722	20,037	7,579.41	44.80	1744.62	3564.62	1g6t3vmkupthp	AHLWUEFF
43,678,940	275,394	158.61	12.89	3884.10	9359.38	2paw1s1b4t4ab	ahl.pln.workbench.server.XxAdatAhlPlnWorkb
30,903,598	300	103,011.99	9.12	235.69	686.01	akpdj9s4ug2s2	JDBC Thin Client
18,552,460	116,739	158.92	5.47	326.80	1275.65	bz0hcfd2a1tr9	AHLWUEFF

```
E (s/exec) = units of work (LIO/exec) X time per work (sec/LIO)

2702 sec/exec  = 29,686,746 LIO/exec  X (27,016 sec / 296,867,461 LIO)

2701 sec/exec  = 29,686,746 LIO/exec  X 0.000091 sec/LIO
```

Source: CMG

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Focusing on time: CPU & wait

WORKLOAD REPOSITORY report for

DB Name	DB Id	Instance	Inst num	Release	RAC	Host
PROD15	3466472990	PROD15	1	10.2.0.3.0	NO	clue

Top 5 Timed Events

Event	Waits	Time(s)	Avg Wait(ms)	% Total Call Time	Wait Class
CPU time		3,641		66.3	
db file sequential read	489,550	587	1	10.7	User I/O
db file scattered read	12,142	565	47	10.3	User I/O
direct path read temp	34,932	470	13	8.6	User I/O
log file parallel write	6,253	235	38	4.3	System I/O

```
source: http://filebank.orapub.com/perf_stats/AWR_PROD15.html
60 minute interval, lio 23,647,386
```

Focusing on work.

Load Profile

	Per Second	Per Transaction
Redo size:	948,397.88	1,761,544.94
Logical reads:	6,562.64	12,189.37
Block changes:	740.05	1,374.57
Physical reads:	735.51	1,366.14
Physical writes:	464.54	862.84
User calls:	101.98	189.42
Parses:	22.08	41.01
Hard parses:	2.68	4.98
Sorts:	14.01	26.02
Logons:	0.32	0.59
Executes:	82.31	152.89
Transactions:	0.54	

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Compare

Fundamentally compare both systems.

Profile both systems and compare.

OP and Blog Search: “otba”

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Check if their “nature” is fundamentally different. If so, check to ensure the difference is in your favor.

OP and Blog Search: “otba”

To profile: Get an AWR report during the "same" business scenario for both systems and do an Oracle Time Based Analysis (OTBA).

OP and Blog Search: "otba"

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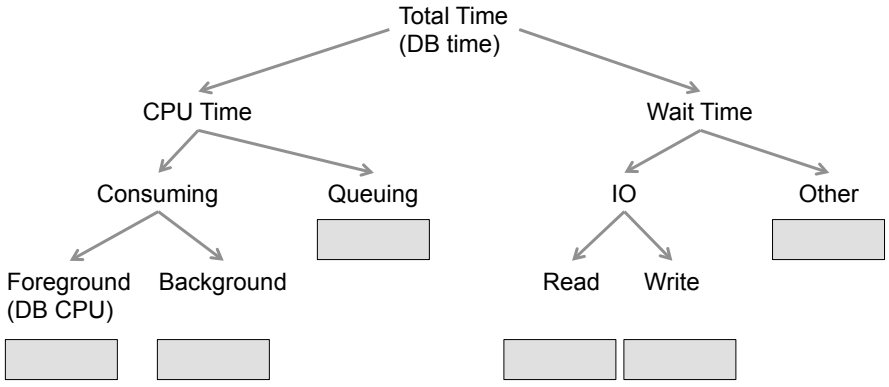
Do OTBA: Fill in the blanks



Workload Profile

- Logical reads/s :_____
- Physical reads/s:_____
- Redo size/s :_____

There sum of all the time will likely not exactly equal the database time.

Are the characteristics of the big chunks of time the same?

Is the workload characteristic the same?

Is the OTBA profile telling us the same story? If not, our job is much more difficult!

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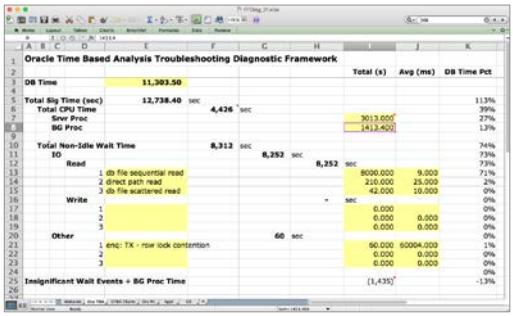

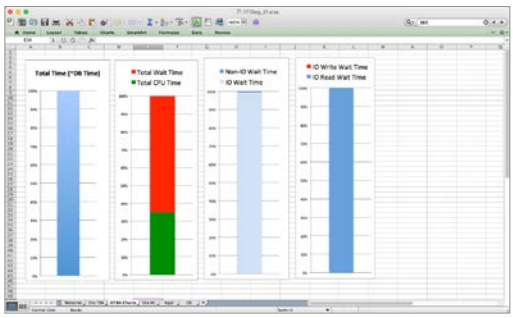

Learn how to do an OTBA?

1. OraPub Firefighting Diagnostic Spreadsheet
2. OraPub online seminars
3. OraPub Firefighting Friday "How To" Webinars

CPU

Removing differences in CPU speeds.

Blog Search: “compare sql”

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“The SQL elapsed time is better in QAT than PROD. So, we are OK to upgrade.”

Really?

“But the CPUs are twice as fast in QAT than PROD. So, wouldn’t you expect the SQL to run twice as fast in QAT?”

10s in production * production is 2x as fast as QAT = 20s in QAT

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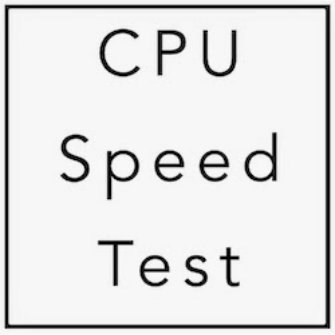
I’ve got a speed test tool.



The output is a “OraPub Speed Rating.”
The higher the speed rating, the “faster” the CPU.

OP Search: “speed test”

We need a standardized elapsed time.

```
Standardized Et = SQL elapsed time X system speed value

PROD        60s =       20s        X    300
QAT         60s =       10s        X    600
```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Scenario #1

**"The SQL runs for 20s in QAT and for 10s in PROD.
Is this a problem?"**

```
Standardized Et = SQL elapsed time X system speed value

PROD       6000s =       10s        X    600
QAT        6000s =       20s        X    300
```

Scenario #2

**"The SQL runs for 30s in QAT and for 10s in PROD.
Is this a problem?"**

Standardized Et = SQL elapsed time X system speed value

PROD	**6000s =**	**10s**	**X**	**600**
QAT	**9000s =**	**30s**	**X**	**300**

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Scenario #3

**"The SQL runs for 15s in QAT and for 10s in PROD.
Of course it runs slower in QAT the CPUs are slower.
So everything is OK, right?"**

Standardized Et = SQL elapsed time X system speed value

PROD	**6000s =**	**10s**	**X**	**600**
QAT	**4500s =**	**15s**	**X**	**300**

We probably expected the PROD time to be 7.5s.

Work

Removing differences in statement work processed.

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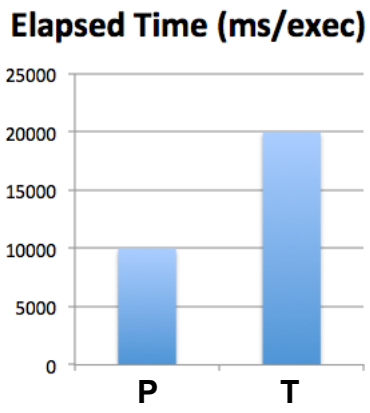
An Oracle Database upgrade is planned and a test environment has been setup.

The DBAs says, “A key SQL’s elapsed time has increased. We’ve got a problem with the new Oracle release!”

You can say, “Of course it has increased. The test environment’s workload has increased!”

A key SQL's elapsed time has increased. We've got a problem with the new Oracle release!



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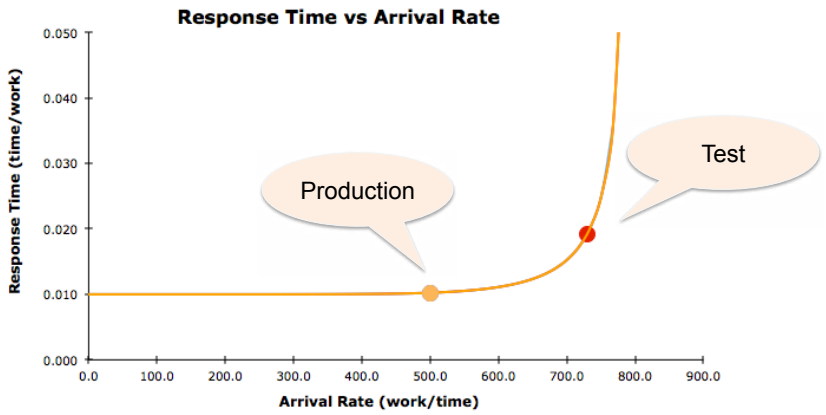
Of course ET has increased. The test environment's workload has increased!

Arrival Rate is the workload

#	ET (ms/exec)	Work (lio/exec)	Rt (ms/lio)	AR (lio/ms)
P	10000	1000000	0.01	500
T	20000	1000000	0.02	730

Of course it has increased. The test environment's workload has increased!



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Four ways to more truly ID WL risk.

- The trick is using work and the time to process a piece of work creatively.
- Here are four ways to ID risk when the workload or time to process work changed.
  1. For the instance, has the database time per LIO increased? If so, that's risk.
  2. For the instance, has the workload changed? If so, that's risk.
  3. For the SQL statement, has the LIO per execution increased? If so, that's risk.
  4. For the SQL statement, has the elapsed time per LIO increased? If so, that's risk.

Function

Dealing with highly functional focused benchmarks.

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What if it's not about SQL?

What if it's about module and action?

Here's a real-life situation.

- Many different load situations
- Many workloads are simulated within a single load run. So, it's impossible get to begin/end snapshot for each business case.
- The "same" SQL may have bind variables and literals mixed together and the other will not.
- Interim/staging tables can have different names, which changes the SQL.

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The Good News

- Full AWR collection including historical data for the past 30 days, refreshed weekly.
- Module and action are instrumented.
- Many times only one SQL per action.
- Lots of people involved looking for potential issues.

My first idea
Good but not good enough

Module:Action	PROD	QAT	Diff	Risk
abc123:s4	90	130	+40	yes
bex65a:s9	60	110	+50	yes
u9usxi:s1	72	65	-7	no
rufuw8:s3	80	32	-48	yes, too good

It's a good idea because the business focuses Module:Action.

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...but it's a bad idea...

- It's a good idea because the business focuses Module:Action.
- It's a very bad idea because:
  - the elapsed times of the SQL varies wildly base on the bind variables.
  - the benchmark is not based on a single business scenario, but lots of scenarios!
  - and each scenario is not separated.
- The solution is the problem is to collect multiple samples and analyze.

Data collection script

```
select   sql.snap_id,
         (sum(elapsed_time_delta)/(sum(executions_delta)+&small))
           /1000 time_ms_per_exec
from     dba_hist_sqlstat sql,
         dba_hist_snapshot snap
where    sql.dbid = &dbid
  and    sql.instance_number = &inst
  and    sql.snap_id = snap.snap_id
  and    snap.dbid = sql.dbid
  and    snap.instance_number = sql.instance_number
  and    begin_interval_time
           between to_timestamp('&time_start','DD-Mon-YYYY HH24:MI:SS')
               and to_timestamp('&time_end'   ,'DD-Mon-YYYY HH24:MI:SS')
  and    module = '&module'
  and    action = '&action'
group by sql.snap_id
having sum(executions_delta) > 0
/
```


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Below are the sample sets.

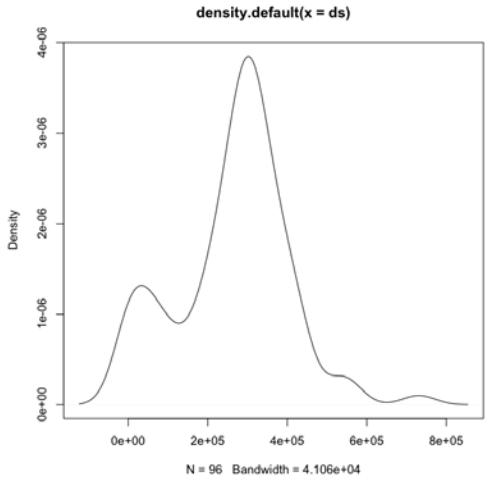
PROD

AWR_SNAP_ID	MS_EXEC
42279	452755.628
42280	274606.76
42281	290645.504
42282	337663.981
42283	346569.841
42285	287695.492
42286	267113.746
42290	278673.634
42291	340263.042
42293	175130.302
42294	295253.419
42295	86328.695
42296	528176.942
42323	229941.703
...	

QAT

AWR_SNAP_ID	MS_EXEC
42656	167493.398
42657	308300.116
42661	522362.559
42662	178295.657
42666	351850.657
42667	506665.697
42668	255506.617
42669	280213.363
42671	528078.228
42672	704579.255
42673	338872.524
42674	200097.813
42675	137736.383
42676	263571.957
...	

Timing for a specific module and action.



PROD

```
> summary(ds)
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
     0.1 188400.0 291600.0 263900.0 340700.0 731100.0
```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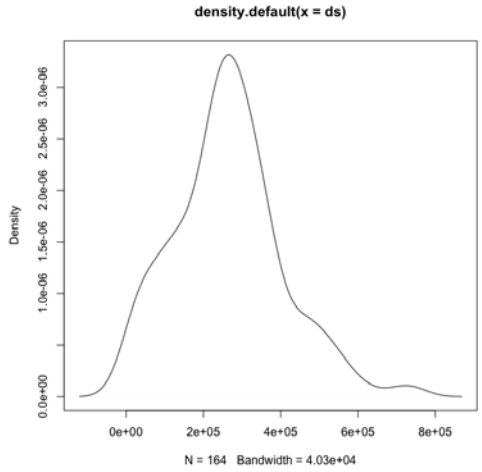
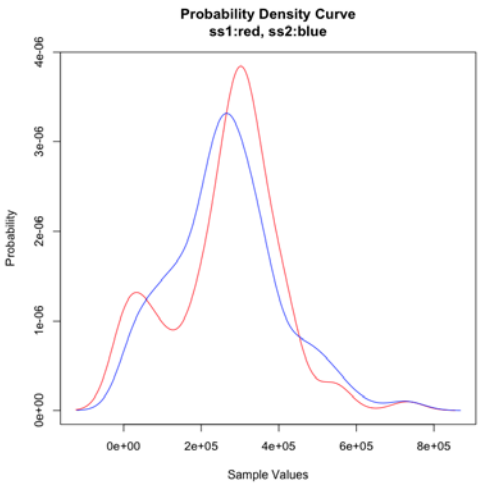


QAT

```
> summary(ds)
    Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
     9.8 171300.0 260100.0 264800.0 337600.0 747500.0
```



For this module and action, are the times different?

```
> wilcox.test(ds1,ds2)
        Wilcoxon rank sum test with continuity correction

data:  ds1 and ds2
W = 8228, p-value = 0.5435
```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Resources

Resource listing

- **Presentations**: OraPub search: "risk sql"
- **Craig's Blog** – Search: "risk", "compare"
- **Training** from OraPub
  - Oracle Forecasting & Predictive Analysis
  - Oracle Performance Firefighting (I)
  - Adv Oracle Performance Analysis (II)
  - Super Seminars: One day Super Saturdays
- **OraPub Online Institute – Any [Device, Time, Location]**
  - Tuning Oracle Using An AWR Report
  - Using Skewed Performance Data To Your Advantage
- **Books**
  - Oracle Performance Firefighting.
  - Forecasting Oracle Performance.

June 17-19
Tampa, FL

May 11-15
New Jersey

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IOUG

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