# Identification of Performance Problems without the Diagnostic Pack

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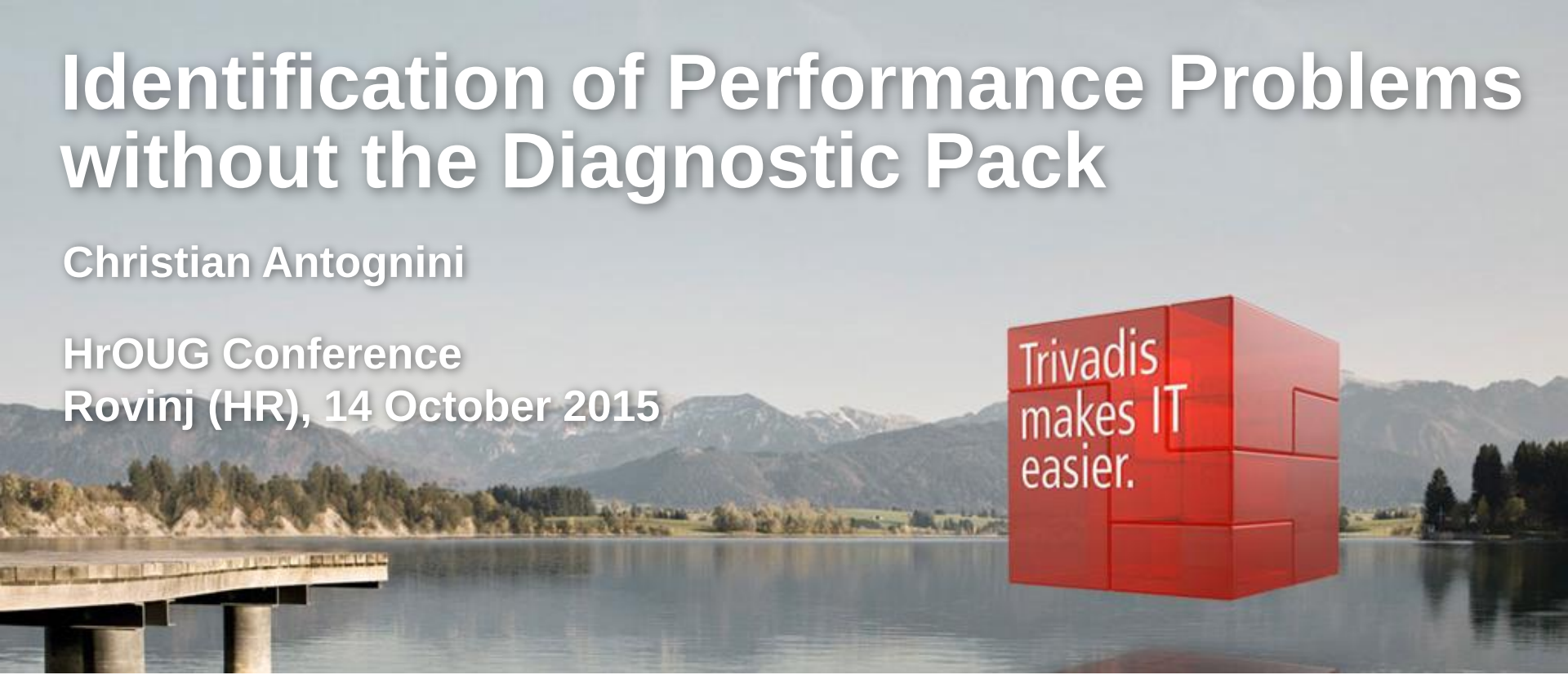
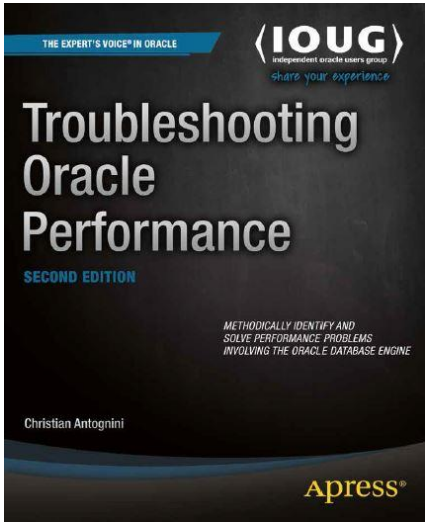


# @ChrisAntognini

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Focus: get the most out of Oracle Database

- Logical and physical database design
- Query optimizer
- Application performance management

Author of Troubleshooting Oracle Performance (Apress, 2008/14)

OakTable Network, Oracle ACE Director

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# Agenda

1. Introduction
2. Analysis of Reproducible Problems
3. Real-Time Analysis of Irreproducible Problems
4. Postmortem Analysis of Irreproducible Problems
5. Third-party Tools

# Introduction

# Disclaimer

The techniques described in this presentation are useful only to identify performance problems that are caused by the database layer.

# Objective of a Performance Analysis

Discover the most time-consuming SQL statements or PL/SQL code invocations.

For each of those time-consuming statements, gather additional information that can help in understanding the problem.

- Execution plan
- Runtime statistics like the number of processed rows and the CPU utilization
- Experienced wait events

# Basic Questions that Require Answers

Is the problem reproducible at will?

- Yes: everything is much easier than if you can't! Sec. 2
- No: see next bullet…

For irreproducible problems, is it possible to wait till the problem occurs again?

- Yes: a real-time analysis has to be carried out Sec. 3
- No: a repository holding historical performance statistics is required Sec. 4

# Analysis of Reproducible Problems

# Approach

The most efficient way to approach a reproducible problem is to take advantage of one of the available tracing and profiling features to perform a controlled measurement while an application is experiencing the problem.

The analysis starts by tracing the database calls through SQL trace.

- If most of the time is spent executing SQL statements, the trace file(s) contain all the necessary information for a detailed analysis.
- If most of the time is spent executing PL/SQL code, a profiling of the PL/SQL code is needed.

# Analysis Without Diagnostics Pack

The analysis doesn't depend on the availability of the Diagnostic Pack option.

The only feature you could consider to use is Real-time Monitoring.

- Except in 12c, it's useful for single executions only
- Diagnostic and Tuning Pack required

# Tracing Database Calls

There are a number of ways to enable SQL trace.

- ALTER SESSION
- DBMS_MONITOR
- DBMS_SESSION

When enabled, SQL trace generates trace files containing not only the executed SQL statements, but also in-depth performance figures about their execution.

The trace files have to be analysed with a profiler.

- *TKPROF*
- Third party (e.g. *TVD$XTAT* and *Method R Profiler*)

# Profiling PL/SQL Code

The database engine provides two profilers integrated in the PL/SQL engine.

- Call-level profiler (a.k.a. hierarchical profiler; introduced in 11.1): DBMS_HPROF
- Line-level profiler: DBMS_PROFILER

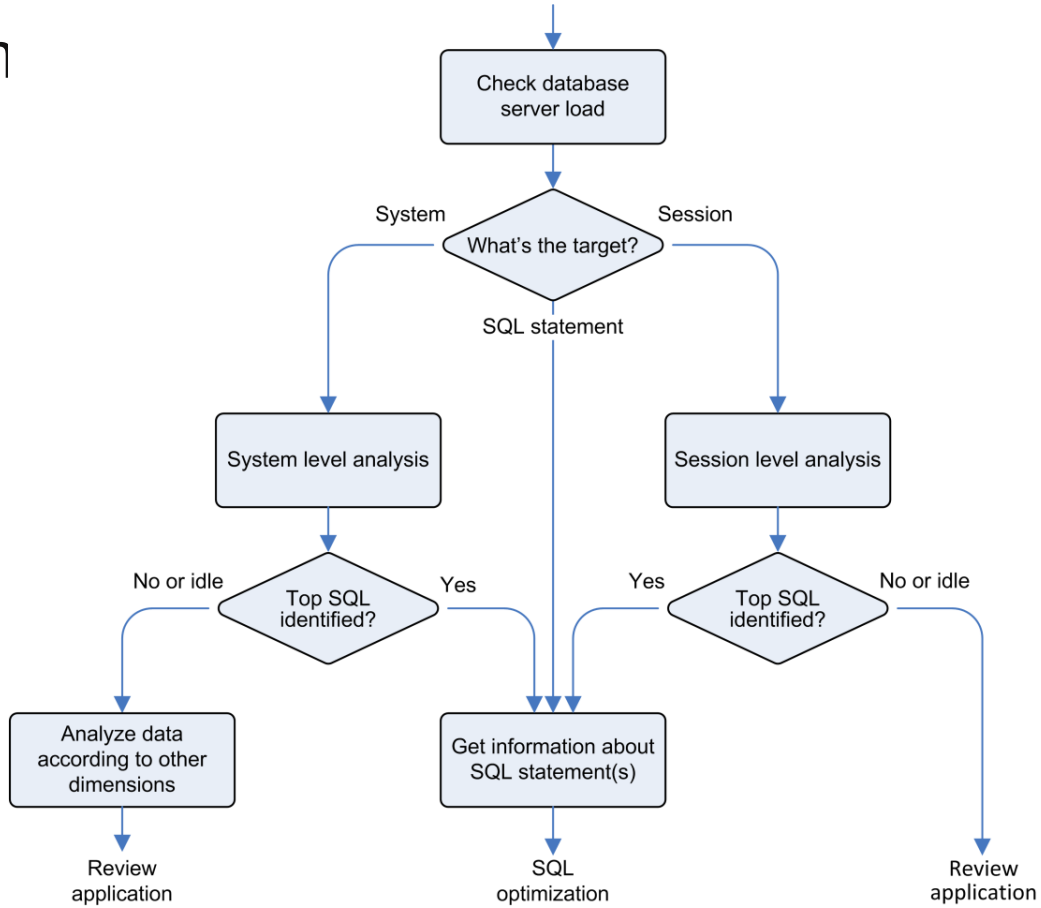
Except if line-level information is needed, the call-level profiler is superior.

The easiest way to use a profiler is to take advantage of the support provided by graphical tools.

- *SQL Developer*
- Third party (e.g. *TOAD* and *PL/SQL Developer*)

# Real-Time Analysis of Irreproducible Problems

# Approach



# Dynamic Performance Views Provide the Necessary Information

OS Statistics

Time Model Statistics

Wait Classes and Wait Events

System and Session Statistics

Metrics

- Diagnostic Pack required for metrics history only

Current Sessions Status

Active Session History

- Diagnostic Pack required

SQL Statement Statistics

Real-time Monitoring

- Diagnostic and Tuning Pack required

# Analysis Without Diagnostics Pack

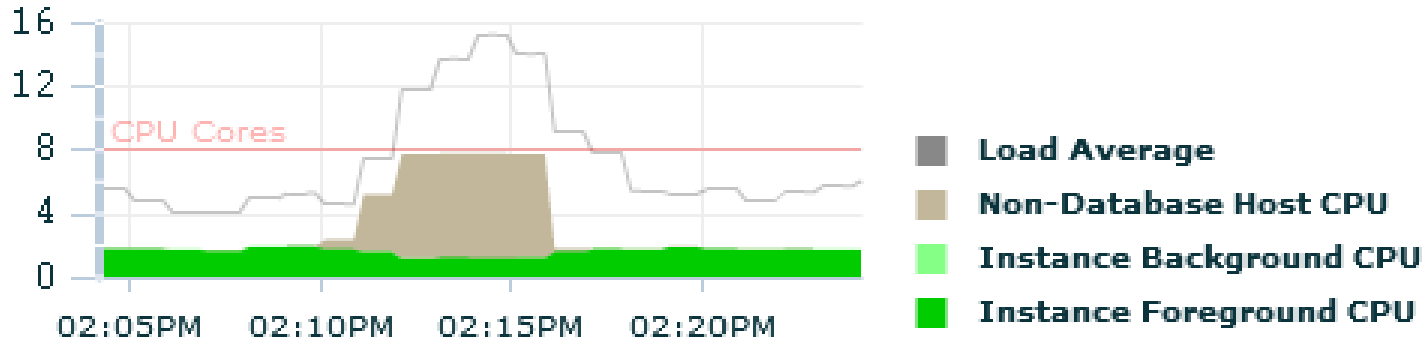
There are two main challenges:

- Enterprise Manager can't be used
  - Third-party tools that provide similar features exist
- Most of the dynamic performance views provide only cumulated statistics
  - Metrics are an exception
  - Utilities that sample the cumulated statistics are needed

This section focuses on a set of scripts that are freely available, so they can be used on any system.

# Database Server Load

Check not only whether the database server is CPU bound, but also whether there are processes not related to the database instance that consume a lot of CPU time.

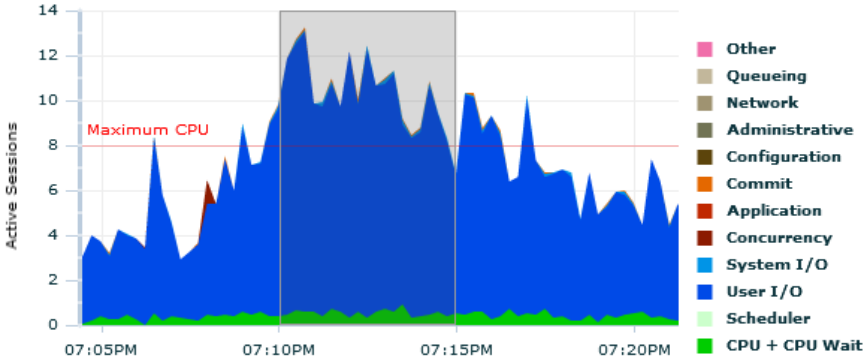


# Database Server Load Based on V$OSSTAT and V$METRIC

```
SQL> @host_load.sql 16

BEGIN_TIME DURATION DB_FG_CPU DB_BG_CPU NON_DB_CPU OS_LOAD NUM_CPU
---------- -------- --------- --------- ---------- ------- -------
14:05:00      60.10      1.71      0.03       0.03    4.09       8
14:06:00      60.08      1.62      0.03       0.04    4.13       8
14:07:00      59.10      1.89      0.03       0.04    4.96       8
14:08:00      60.11      1.93      0.03       0.03    5.29       8
14:09:00      60.09      1.73      0.03       0.59    4.60       8
14:10:00      60.10      1.57      0.02       3.64    7.50       8
14:11:00      60.16      1.15      0.02       6.60   11.82       8
14:12:00      60.11      1.21      0.02       6.60   13.77       8
...
```

# System Level Analysis




Several steps have to be carried out:

1. Check the average number of active sessions and the portion of time they spend for every wait class
2. Check system-wide time model statistics
3. Check whether few SQL statements are responsible for most of the activity
4. (Optional) Check whether specific sessions/components/… are responsible for most of the activity

# System Level Load Based on V$SYS_TIME_MODEL and V$SYSTEM_WAIT_CLASS

```
SQL> @system_activity.sql 15 20

Time       AAS Othr% Net% Adm% Conf% Comm% Appl% Conc% SysIO% UsrIO% CPU%
-------- ---- ----- ---- ---- ----- ----- ----- ----- ------ ------ ----
19:10:11  9.7   0.0  0.0  0.0   0.0   0.4   0.0   0.0    0.9   94.8  3.8
19:10:26 10.0   0.0  0.0  0.0   0.0   0.5   0.0   0.0    1.0   94.6  3.9
19:10:41 10.0   0.0  0.0  0.0   0.0   0.4   0.0   0.0    1.0   94.8  3.8
19:10:56  9.9   0.0  0.0  0.0   0.0   0.4   0.0   0.0    1.0   94.6  4.0
19:11:11  9.8   0.0  0.0  0.0   0.2   1.0   0.0   0.0    1.2   93.7  4.0
19:11:26  9.5   0.0  0.0  0.0   0.0   0.4   0.0   0.0    0.9   94.8  3.9
...
```

# System Level Time Model Based on V$SYS_TIME_MODEL

```
SQL> @time model.sql 15 2

Time     Statistic                                    AvgActSess Activity%
-------- ------------------------------------------- ---------- ---------
19:14:49 DB time                                            9.8      98.6
         .DB CPU                                            0.3       3.4
         .sql execute elapsed time                          9.7      97.3
         .PL/SQL execution elapsed time                     0.1       1.2
         background elapsed time                            0.1       1.4
         .background cpu time                               0.0       0.4
...
```

# Top Sessions Based on V$SYSSTAT, V$SYS_TIME_MODEL, V$SESS_TIME_MODEL and V$SESSION

```
SQL> @active_sessions.sql 15 1 10

Time      #Sessions #Logins SessionId  User Program           Activity%
-------- --------- ------- ---------- ---- ---------------- ---------
19:14:49       117       0 195        SOE  JDBC Thin Client       1.8
                           224        SOE  JDBC Thin Client       1.5
                           225        SOE  JDBC Thin Client       1.5
…
                           16         SOE  JDBC Thin Client       1.4
                           171        SOE  JDBC Thin Client       1.4
                           68         SOE  JDBC Thin Client       1.4
                           Top-10 Tot                           14.9
…
```

# System Level Analysis with Snapper

Snapper is a script developed by Tanel Põder.

Its key functionality is to sample V$SESSION.

During the sampling, it checks the status of the specified sessions and, for active sessions, it gathers information about their activity.

It’s a very flexible and powerful script that accepts many parameters.

# System Level Analysis with Snapper – List Top SQL Statements

```
SQL> @snapper.sql ash=sql_id 15 1 all

-------------------------
Active% | SQL_ID
-------------------------
   196% | c13sma6rkr27c
   186% | 8dq0v1mjngj7t
   122% | bymb3ujkr3ubk
   107% | 7hk2m2702ua0g
    82% | 0yas01u2p9ch4
    63% | 8z3542ffmp562
    62% | 0bzhqhhj9mpaa
    30% | 5mddt5kt45rg3
```

# Session Level Analysis with Snapper – List Top Wait Events

```
SQL> @snapper.sql ash=event 15 1 172

-------------------------------------------
Active% | EVENT
-------------------------------------------
    22% | db file sequential read
     1% | ON CPU
     1% | db file parallel read
```

With Snapper it's possible to target either one, several or all sessions

# SQL Statement Information

For SQL statements that are responsible for a large part of the activity, more information is needed.

Runtime statistics

- V$SQLAREA sqlarea.sql
- V$SQL sql.sql
- V$SQLSTATS sqlstats.sql

Execution plan DBMS_XPLAN

# Postmortem Analysis of Irreproducible Problems

# Approach

To analyse a performance problem that happened in the past, a repository containing performance statistics covering the period of time to analyse is required.

Oracle provides two repositories:

- Automatic Workload Repository (AWR)
  - Diagnostic Pack required
- Statspack

# Automatic Workload Repository vs. Statspack

| | |
|---|---|
| AWR is fully integrated and automatically installed | Statspack requires a manual installation |
| AWR stores system-level, SQL-level as well as session-level (ASH) data | Statspack stores system-level and SQL-level data |
| AWR is an Enterprise Edition option available as of 10g only | Statspack is free of charge and available with all editions since 8i |
| Enterprise Manager provides a GUI for AWR | No Enterprise Manager integration |

# Analysis Without Diagnostics Pack

Almost everything provided by an AWR report is provided by a Statspack report.

- There's no major difference in reading the two reports.

What's really missing is the persisted ASH data.

- Third-party implementations that allow to implement the roadmap discussed in the previous section exist

# Third-party Tools

# Third-party Tools

A number of third-party tools that doesn't require the Diagnostic Pack option exists!

Refer to Kyle Hailey's Best Oracle Performance Tools list for an overview.

I presently advise to use *Lighty for Oracle*.

- It has a very good price/performance ratio!
- It supports well the approaches for the analysis of irreproducible problems (both in real time and postmortem) described in this presentation and in my book

# Core Messages

It’s possible to work without the Diagnostic Pack option

- Doesn’t make things easier, though

A toolkit is required

- Scripts and/or a graphical tool

With and without Diagnostic Pack option it’s essential to approach performance problems in a methodological way!

# References

Troubleshooting Oracle Performance, 2nd Edition, Apress (2014)
http://antognini.ch/top/

Kyle Hailey's Best Oracle Performance Tools list
http://datavirtualizer.com/best-oracle-performance-tools/

The scripts referenced through the presentation can be downloaded from
http://antognini.ch/downloads/top2/

Tanel Põder's Snapper can be downloaded from
http://blog.tanelpoder.com/files/scripts/snapper.sql

# Questions and Answers

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