

ORACLE®

# Mastering the AWR Report

Vlado Barun  
Oracle Real-World Performance Team  
Oracle Product Development

# Safe Harbor Statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

# Agenda

- 1 About the Real World Performance Team
- 2 AWR Intro
- 3 AWR from an OLTP system
- 4 AWR from a Batch system
- 5 Recap

# Agenda

- 1 About the Real World Performance Team
- 2 AWR Intro
- 3 AWR from an OLTP system
- 4 AWR from a Batch system
- 5 Recap

# What is Real-World Performance ?

**Bridging the Divide from Today's Performance to What is Possible**

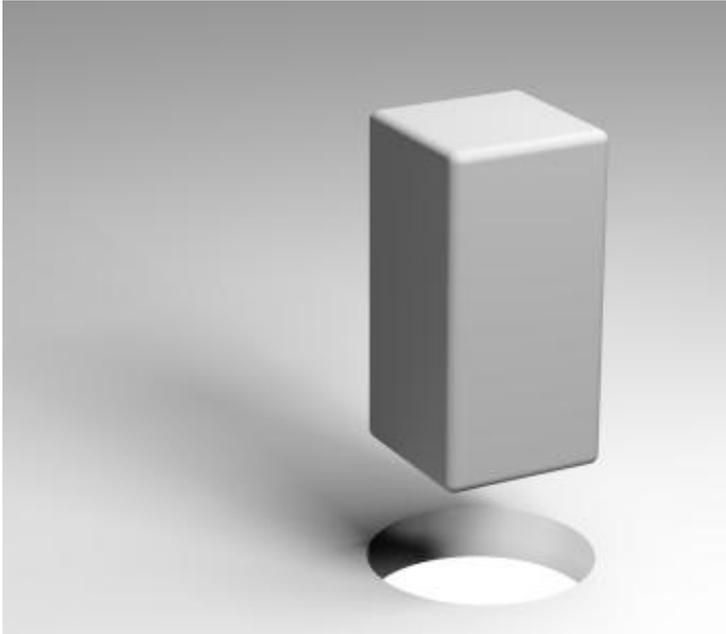


# Real-World Performance

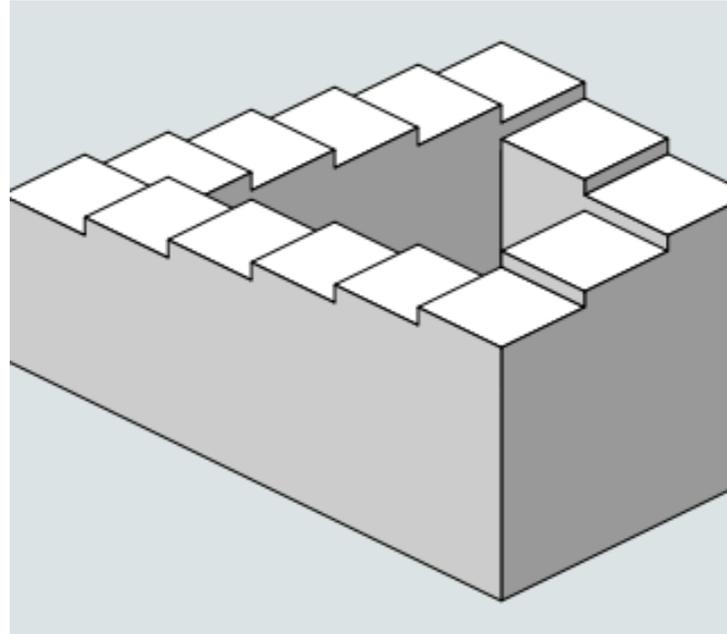
## Who We Are

- Part of the Database Development Organization
- Global Team located in USA, Europe, Asia
- 300+ combined years of Oracle database experience
- Innovate to achieve exceptional Database Performance
- Our methods:
  - Use the product as it was designed to be used
  - Numerical and logical debugging techniques
  - Educate others about the best performance methods and techniques
  - Avoid and eliminate “tuning” by hacking/guessing/luck

# Root Causes of Suboptimal Database Performance



The database is not being used as it was designed to be Used



The application architecture/code design is Suboptimal

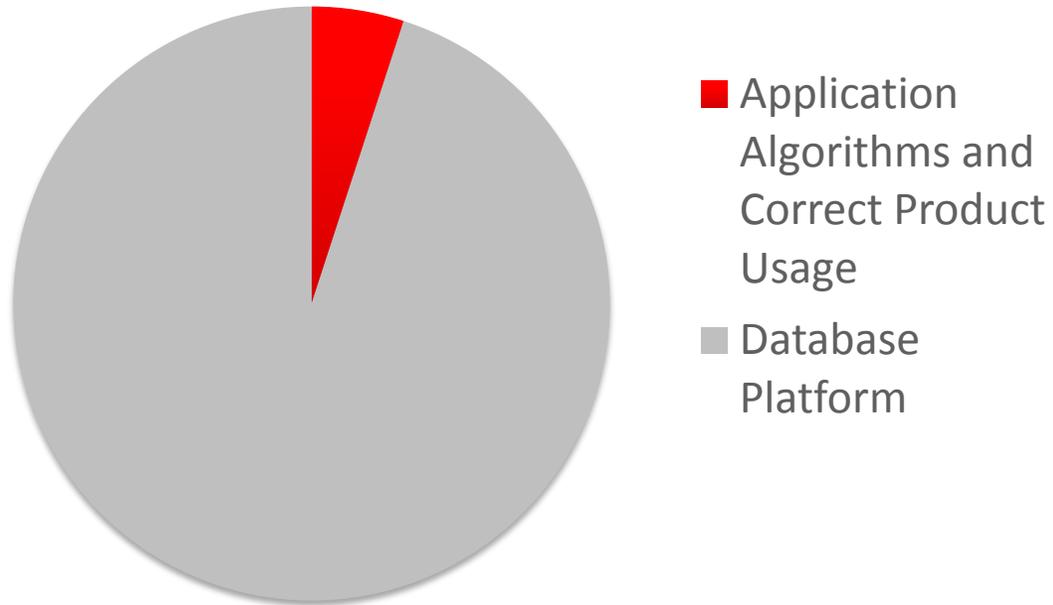


There is a suboptimal algorithm in the database

# The Real World Performance Perception Problem

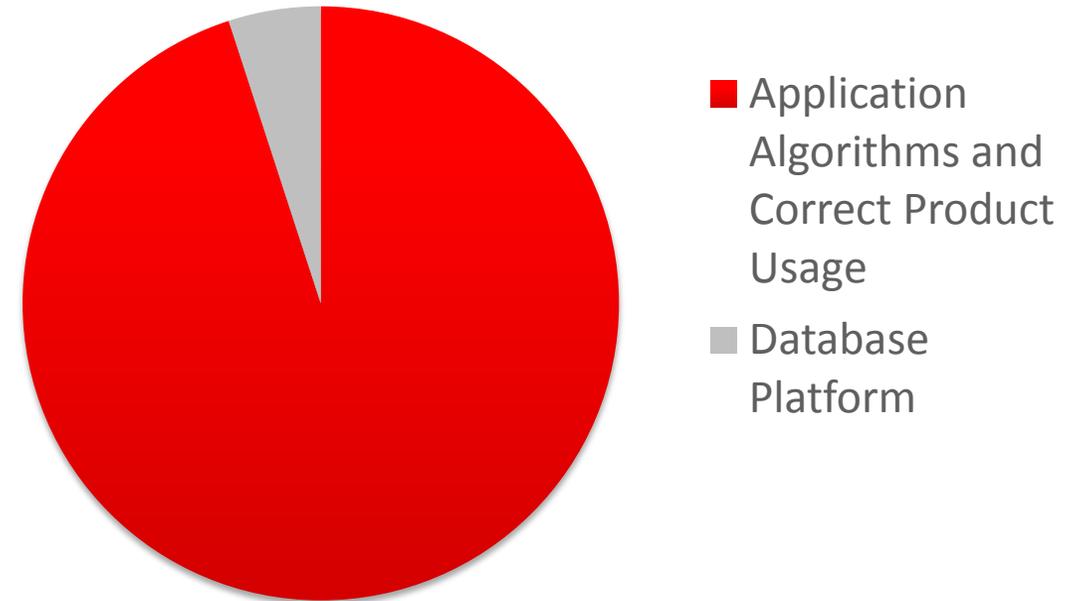
## Where database users look for performance improvements

Perception

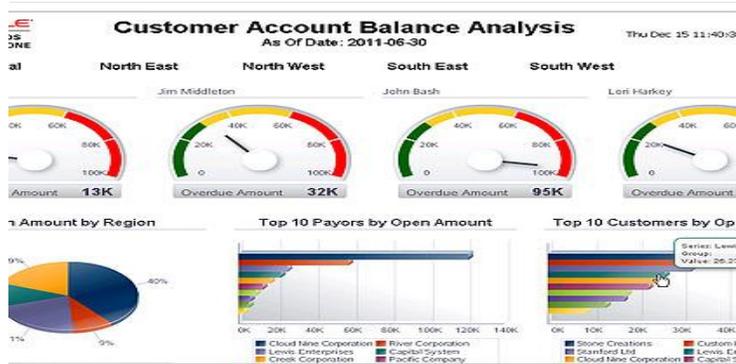


## The best place to look for performance Improvements

Reality



# Recent Results 1000X Projects



Baseline: ~ 4.3 Hours

Code Changes: 4.3 Hours

Correct Usage: 29 secs

Bug Fixes: 11.5 secs

Final: 11.5 secs

Speed up: **1346x**



Baseline: ~ 2.4 Days

Code Changes: 27 Mins

Correct Usage: 7.5 Mins

Bug Fixes: 3 Mins 27 Secs

Final: 3 Mins 27 Secs

Speed up: **1002x**



Baseline: 4.06 hours

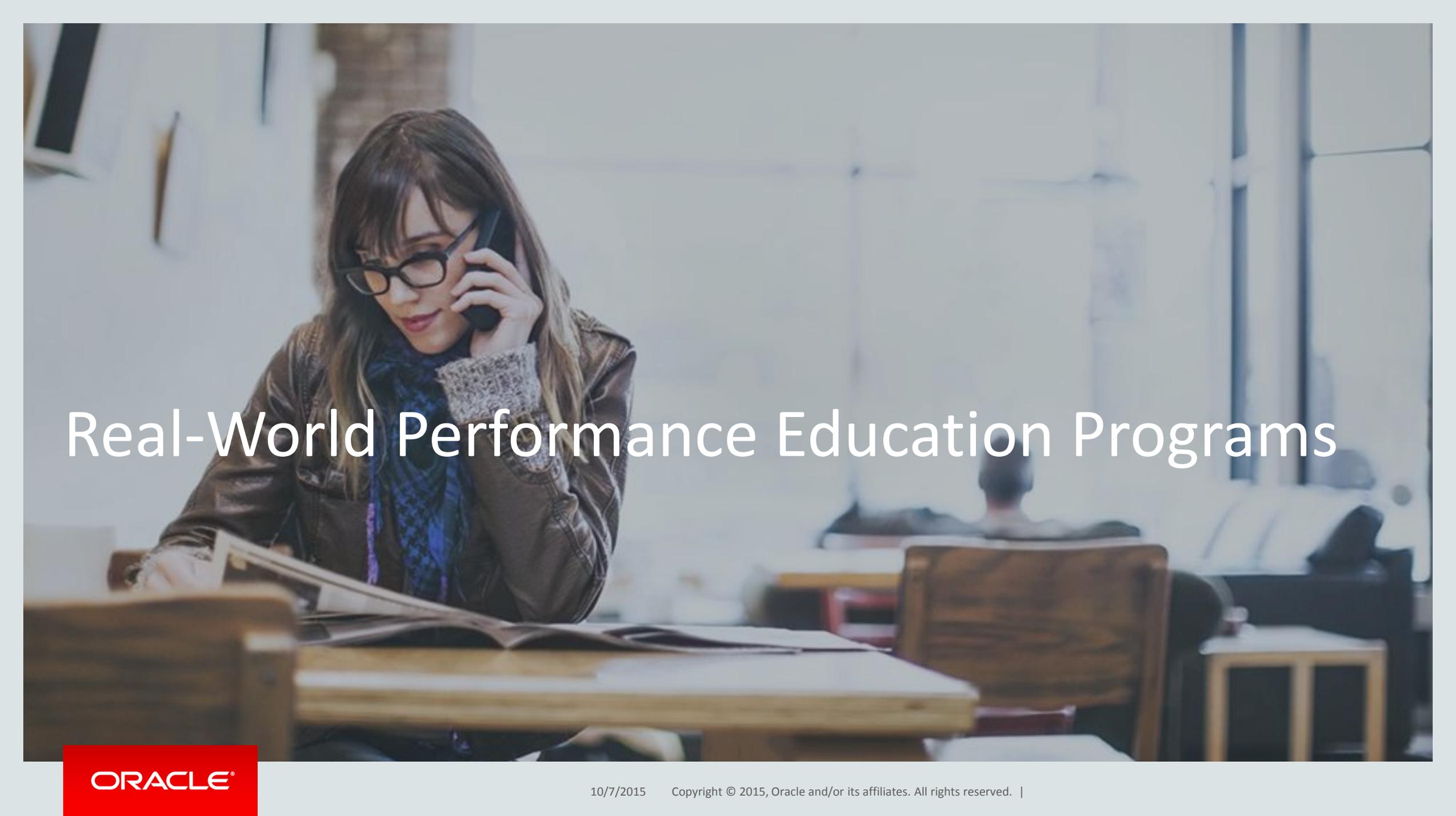
Code Changes: 3.65 Secs

Correct Usage: 3.65 Secs

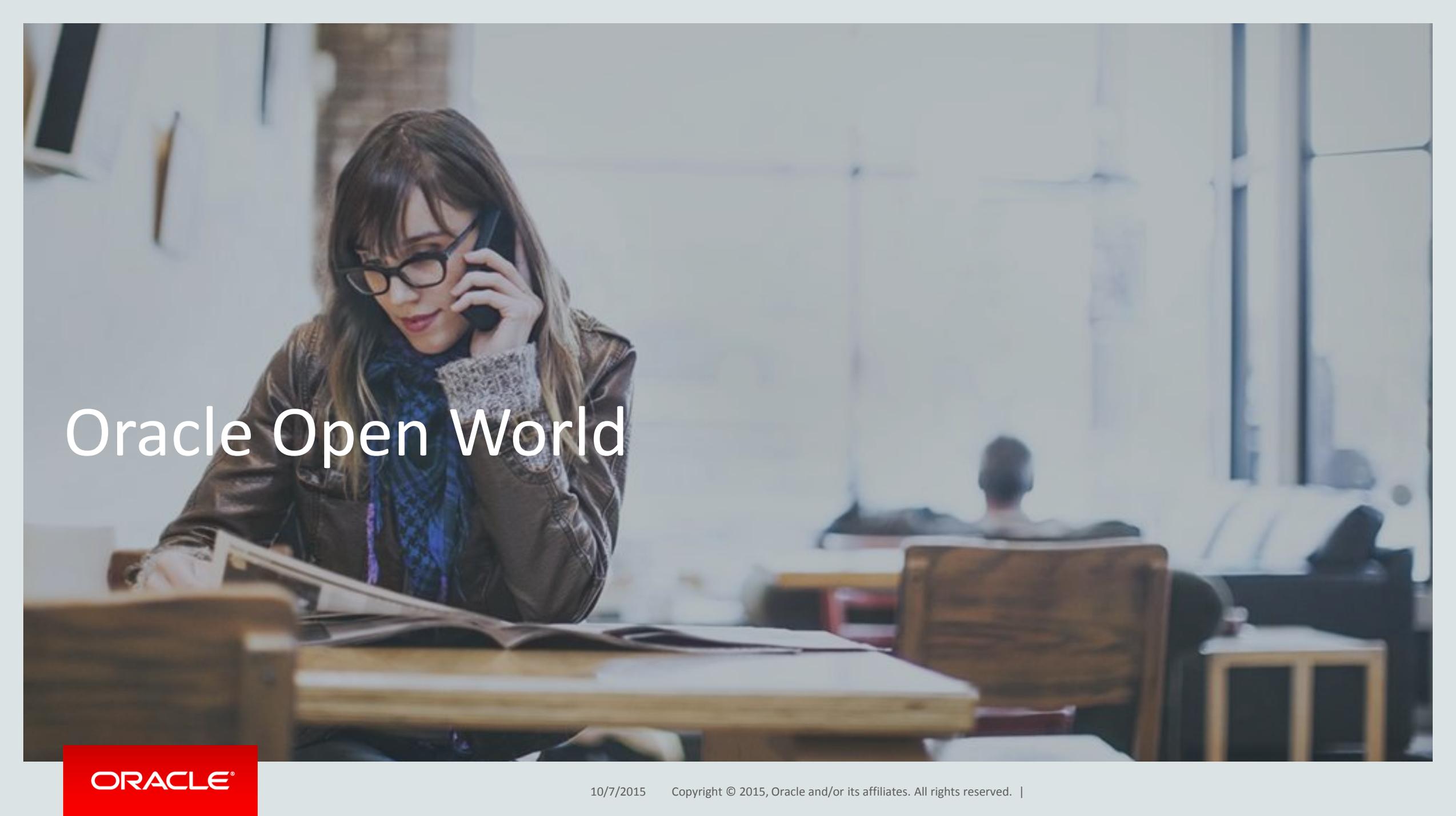
Bug Fixes: 3.65 Secs

Final: 3.65 Secs

Speed up: **4007x**



# Real-World Performance Education Programs



# Oracle Open World

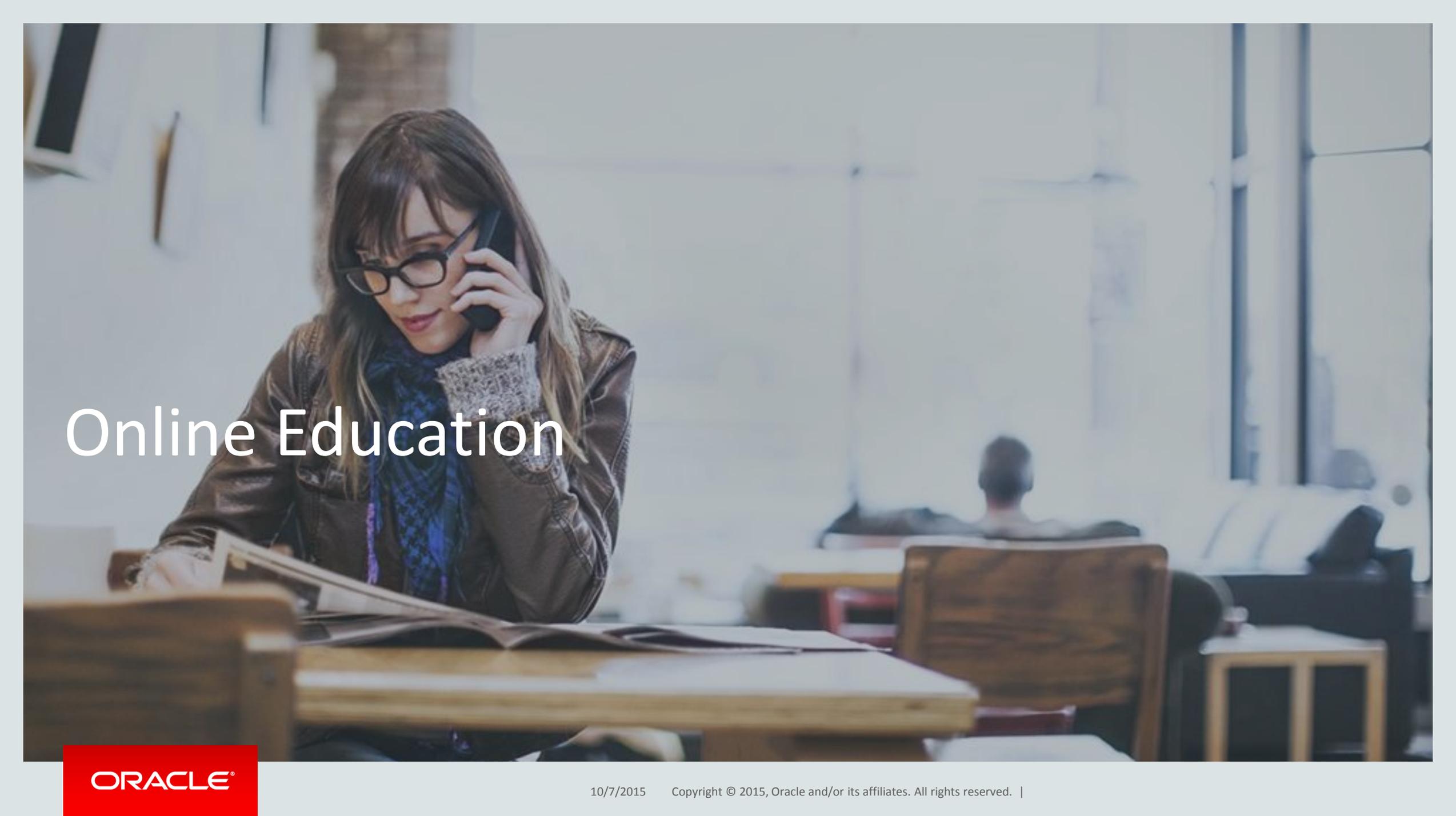
# Real-World Performance

## Oracle Open World 2014 Sessions

What the Real-World Performance Team Learns from Your Automatic Workload Repository Report

Real-World Performance of Star and Snowflake Schemas, Part 1: The Theory

Real-World Performance of Star and Snowflake Schemas, Part 2: The Reality



# Online Education

# Real-World Performance

## Online Video Series

- Real-World Performance Engineers discussing and demonstrating performance issues, root causes and when to apply the correct techniques
  - The Optimizer
  - Core DB Performance
  - Extreme OLTP
  - Extreme DW
- <http://www.oracle.com/goto/oll/rwp>



# Real-World Performance Training

# Real-World Performance Classroom Training

## Classroom Training

- 4 Day Class of Intensive Performance Training
  - Topics: The Optimizer, Core DB Performance, Extreme OLTP and DW
  - Classroom, Demos, Hands On, Test and Quizzes
  - Training given by Real-World Performance Engineers
  - Designed for Architects, Developers and DBAs
  - 4 months training in 4 days
- Contact RWP or your local Oracle team to apply

# Real-World Performance Training

## What you will learn

- Understand how the optimizer works and how it is influenced
- Learn the fundamentals of core database performance
  - Database Computer Science
  - Application Algorithms
  - When to apply the correct tools and techniques
- Extreme OLTP
  - Connection Management, Contention and Tools
- Extreme Data Warehousing
  - Working with large data sets
  - DW Techniques: Set based processing, Exadata, Database In-Memory, Parallel

# Real-World Performance Classroom Training

## Classroom Training

- 4 Day Class of Intensive Performance Training
  - Topics: The Optimizer, Core DB Performance, Extreme OLTP and DW
  - Classroom, Demos, Hands On, Test and Quizzes
  - Training given by Real-World Performance Engineers
  - Designed for Architects, Developers and DBAs
  - 4 months training in 4 days
- Contact RWP or your local Oracle team to apply

# Agenda

- 1 About the Real World Performance Team
- 2 **AWR Intro**
- 3 AWR from an OLTP system
- 4 AWR from a Batch system
- 5 Recap

# Why do we need diagnostic tools like AWR?

The universal experience of programmers who have been using measurement tools has been that their intuitive guesses fail.

- Donald Knuth

# Automatic Workload Repository (AWR)

- **Collects database performance metrics**
  - Objects (access and usage statistics)
  - SQL Statement statistics
  - Wait events statistics
  - System statistics
  - Time Model Statistics based on time usage for activities
  - Every 1 hr by default
- **Stored in DBA\_HIST% views**

# Automatic Workload Repository (AWR)

- **How to access?**

- AWR/ASH/ADDM Reports

- scripts in \$ORACLE\_HOME/rdbms/admin
- OEM
- SQL Developer
- ...

- custom scripts

- SQLT

- Other tools...

# Standard Reports from AWR

- AWR Report
  - Diagnostic information on the instance or database level
  - Information for the system as a whole
- ADDM Report
  - Recommendations based on AWR information
- ASH Report
  - More granular information such as the session level

# AWR Report

**Instance, database reports of database activity**  
**HTML reports are preferred**

```
SQL>REM
SQL>REM For Current Database Instance
SQL>@?/rdbms/admin/awrrpt.sql
SQL>REM
SQL>REM For Full RAC Clusterwide Report
SQL>@?/rdbms/admin/awrgrpt.sql
SQL>REM
SQL>REM For SQL Exec History(Detecting Plan Changes)
SQL>@?/admin/awrsqrpt.sql
```

# AWR Report

## WORKLOAD REPOSITORY report for

DB Name	DB Id	Instance	Inst num	Startup Time	Release	RAC
PDCDB	2678171438	pdcdb2		2 04-Aug-13 18:08	12.1.0.1.0	YES

Host Name	Platform	CPUs	Cores	Sockets	Memory (GB)
dabdb010	Linux x86 64-bit	32	16	2	252.41

	Snap Id	Snap Time	Sessions	Cursors/Session	Instances	Pluggable Databases Open
Begin Snap:	3286	12-Sep-13 15:30:16	469	4.0	2	13
End Snap:	3287	12-Sep-13 16:00:27	458	4.2	2	13
Elapsed:		30.19 (mins)				
DB Time:		431.57 (mins)				

## Report Summary

### Top ADDM Findings by Average Active Sessions

Finding Name	Avg active sessions of the task	Percent active sessions of finding	Task Name	Begin Snap Time	End Snap Time
Top SQL Statements	14.30	42.21	ADDM:2678171438_2_3287	12-Sep-13 15:30	12-Sep-13 16:00
Shared Pool Latches	14.30	17.18	ADDM:2678171438_2_3287	12-Sep-13 15:30	12-Sep-13 16:00
PL/SQL Execution	14.30	14.26	ADDM:2678171438_2_3287	12-Sep-13 15:30	12-Sep-13 16:00
Java Execution	14.30	7.00	ADDM:2678171438_2_3287	12-Sep-13 15:30	12-Sep-13 16:00
Undersized SGA	14.30	2.63	ADDM:2678171438_2_3287	12-Sep-13 15:30	12-Sep-13 16:00

### Load Profile

	Per Second	Per Transaction	Per Exec	Per Call
DB Time(s):	14.3	0.4	0.00	0.01
DB CPU(s):	9.7	0.3	0.00	0.00

# AWR Report

## EM Access to Reports

- AWR report can be accessed by navigating
  - Database Tab
  - Automatic Workload Repository
  - Select snapshots
- You may find the command line interface is quicker !

# AWR Report

## EM Access to Reports

Cluster: bugap\_apd211 > Cluster Database: bugap.us.oracle.com > Database Instance: bug1ap\_apd211 > Automatic Workload Repository >

Logged in As JSARICOS

### Snapshots

Switch Database Instance: bug1ap\_apd211

A snapshot is a collection of database statistics at a single point in time. You can use the information in snapshots to diagnose database problems.

Page Refreshed Jun 5, 2011 10:55:14 PM CDT

### Select Beginning Snapshot

Go To Time:      
(Example: 12/15/03)

Select	ID	Capture Time	Collection Level	Within A Baseline
<input type="radio"/>	83534	Jun 5, 2011 11:00:09 AM	TYPICAL	
<input type="radio"/>	83535	Jun 5, 2011 11:30:06 AM	TYPICAL	
<input type="radio"/>	83536	Jun 5, 2011 12:00:11 PM	TYPICAL	
<input type="radio"/>	83537	Jun 5, 2011 12:30:26 PM	TYPICAL	
<input type="radio"/>	83538	Jun 5, 2011 1:00:07 PM	TYPICAL	
<input type="radio"/>	83539	Jun 5, 2011 1:30:06 PM	TYPICAL	
<input type="radio"/>	83540	Jun 5, 2011 2:00:20 PM	TYPICAL	
<input type="radio"/>	83541	Jun 5, 2011 2:30:01 PM	TYPICAL	
<input type="radio"/>	83542	Jun 5, 2011 3:00:26 PM	TYPICAL	
<input type="radio"/>	83543	Jun 5, 2011 3:30:13 PM	TYPICAL	
<input type="radio"/>	83544	Jun 5, 2011 4:00:18 PM	TYPICAL	
<input type="radio"/>	83545	Jun 5, 2011 4:30:11 PM	TYPICAL	
<input type="radio"/>	83546	Jun 5, 2011 5:00:03 PM	TYPICAL	
<input type="radio"/>	83547	Jun 5, 2011 5:30:08 PM	TYPICAL	
<input type="radio"/>	83548	Jun 5, 2011 6:00:10 PM	TYPICAL	
<input type="radio"/>	83549	Jun 5, 2011 6:30:38 PM	TYPICAL	
<input type="radio"/>	83550	Jun 5, 2011 7:00:14 PM	TYPICAL	
<input type="radio"/>	83551	Jun 5, 2011 7:30:12 PM	TYPICAL	
<input checked="" type="radio"/>	83552	Jun 5, 2011 8:00:13 PM	TYPICAL	
<input type="radio"/>	83553	Jun 5, 2011 8:30:03 PM	TYPICAL	

[Home](#) | [Targets](#) | [Deployments](#) | [Alerts](#) | [Compliance](#) | [Jobs](#) | [Reports](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

Copyright © 1996, 2009, Oracle and/or its affiliates. All rights reserved.

# ADDM Report

## ADDM

- Performs performance diagnostic analysis and makes recommendations for improvement.
- The ADDM report should accompany any AWR report as a matter of standard practice

```
SQL>REM  
SQL>REM For Current Database Instance  
SQL>@?/rdbms/admin/addmrpt.sql
```

# ADDM Report

```
addm_2404_soft.html      addm_2400_connect.html      ASH Report - From 05-Jun-11 ...      AWR Report for DB: CON2DEM...

ADDM Report for Task 'ADDM:1867783795_2_1140'
-----

Analysis Period
-----
AWR snapshot range from 1139 to 1140.
Time period starts at 05-JUN-11 06.47.50 PM
Time period ends at 05-JUN-11 07.03.06 PM

Analysis Target
-----
Database 'CON2DEMO' with DB ID 1867783795.
Database version 11.2.0.2.0.
ADDM performed an analysis of instance con2demo2, numbered 2 and hosted at
adczardb04.us.oracle.com.

Activity During the Analysis Period
-----
Total database time was 17287 seconds.
The average number of active sessions was 18.87.

Summary of Findings
-----
  Description                Active Sessions      Recommendations
  -----                -----                -----
  Percent of Activity
1  Top SQL Statements        11.85 | 62.81         5
2  Soft Parse                .91 | 4.8              2

-----
-----

Findings and Recommendations
-----
```

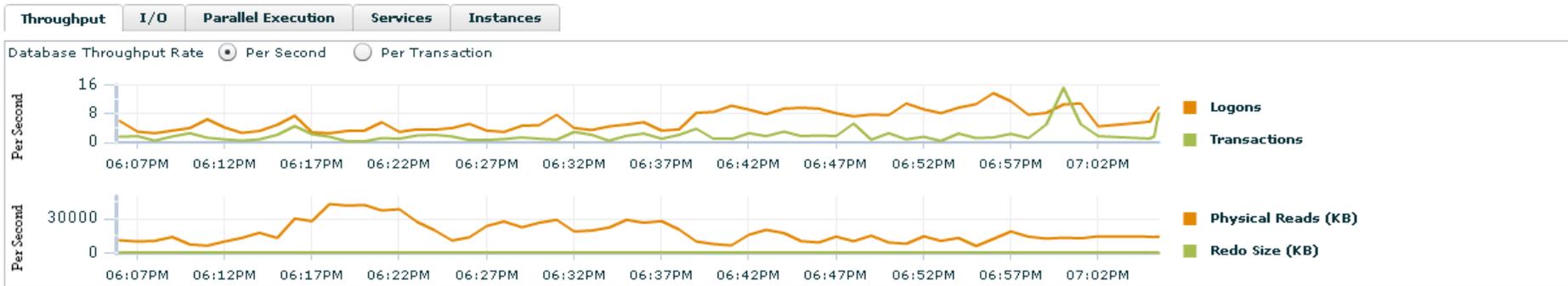
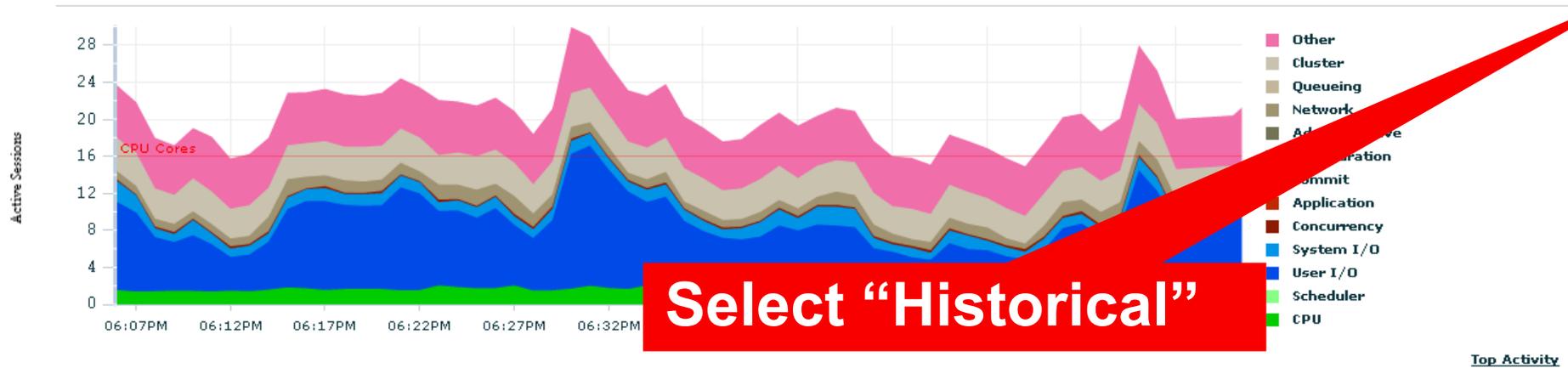
# ADDM Report

## EM Access to Reports

- ADDM report can be accessed by navigating
  - Performance Tab
  - “Historical” Right hand drop down menu
  - Select snapshot
  - (Run ADDM) Button

# ADDM Report

## EM Access



### Additional Monitoring Links

Top Sessions and Top SQL data from ASH can be found on the [Top Activity](#) page.

- [Top Activity](#)
- [Top Consumers](#)
- [Cluster Cache Coherency](#)
- [Database Locks](#)
- [Top Segments](#)
- [SQL Monitoring](#)

### Additional Instance Monitoring Links

- [Duplicate SQL](#)
- [Search Sessions](#)
- [SQL Tuning Sets](#)

# ADDM Report

## EM Access

Choose analysis icon of interest

Database Control

Cluster Database

Logged in As SYSTE

Switch Database Instance con2demo\_con2demo2

Page Refreshed Jun 5, 2011 11:44:58 PM CDT Refresh

### Database Activity

The icon selected below the graph identifies the ADDM analysis period. Click on a different icon to select a different analysis period.

Run ADDM Finding History

Active Sessions

1:00 2 4 6 8 10 12 PM 2 4 6 8 10 Jun 5, 2011

Zoom

Wait User I/O CPU

TIP For an explanation of the icons and symbols used in this page, see the [Icon Key](#)

### ADDM Performance Analysis

Task Name ADDM:1867783795\_2\_1141 (End Time:Jun 5, 2011 7:10:27 PM)

Task Owner SYSTEM Average Active Sessions 19 Period Start Time Jun 5, 2011 7:03:05 PM CDT Period Duration 7.4 Instance con2demo\_con2demo2 (minutes)

Impact (%)	Finding	Occurrences (24 hrs ending with analysis period)
59.7	Top SQL Statements	8 of 33
4.8	Soft Parse	6 of 33

Run ADDM Report

# ASH Report

## ASH

- Active Session History reports can provide fine granularity tightly scoped reports e.g. for a short time period (< AWR interval) or
- for an individual session or a particular module.

```
SQL>REM  
SQL>REM For Current Database Instance  
SQL>@?/rdbms/admin/ashrpt.sql
```

# ASH Report

addm\_2404\_soft.html    addm\_2400\_connect.html    ASH Report - From 05-Jun-11 ...    AWR Report for DB: CON2DEM...    +

## ASH Report For BUGAP/bug2ap

DB Name	DB Id	Instance	Inst num	Release	RAC	Host
BUGAP	1679034986	bug2ap	2	11.2.0.2.0	YES	apd212

CPUs	SGA Size	Buffer Cache	Shared Pool	ASH Buffer Size
4	9,334M (100%)	6,144M (65.8%)	2,624M (28.1%)	8.0M (0.1%)

	Sample Time	Data Source
Analysis Begin Time:	05-Jun-11 21:29:53	V\$ACTIVE_SESSION_HISTORY
Analysis End Time:	05-Jun-11 21:34:53	V\$ACTIVE_SESSION_HISTORY
Elapsed Time:	5.0 (mins)	
Sample Count:	2,242	
Average Active Sessions:	7.47	
Avg. Active Session per CPU:	1.87	
Report Target:	None specified	

### ASH Report

- [Top Events](#)
- [Load Profile](#)
- [Top SQL](#)
- [Top PL/SQL](#)
- [Top Java](#)
- [Top Call Types](#)
- [Top Sessions](#)
- [Top Objects/Files/Latches](#)
- [Activity Over Time](#)

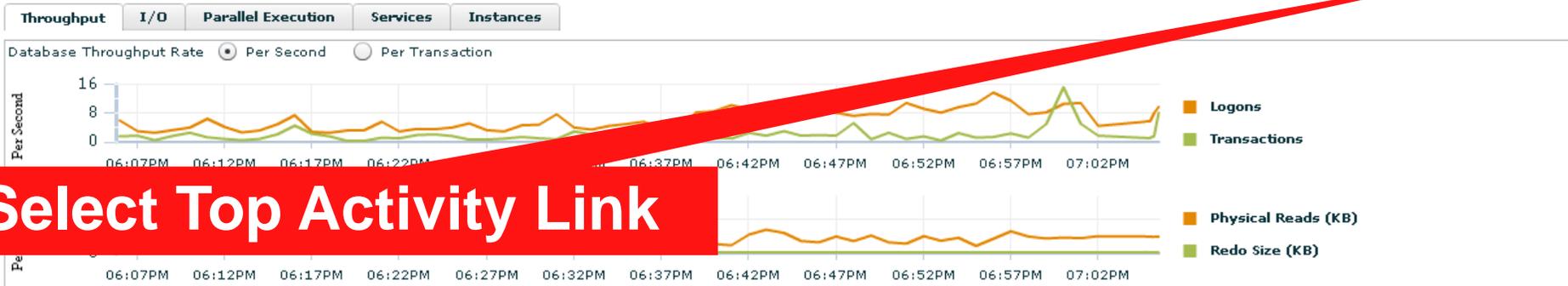
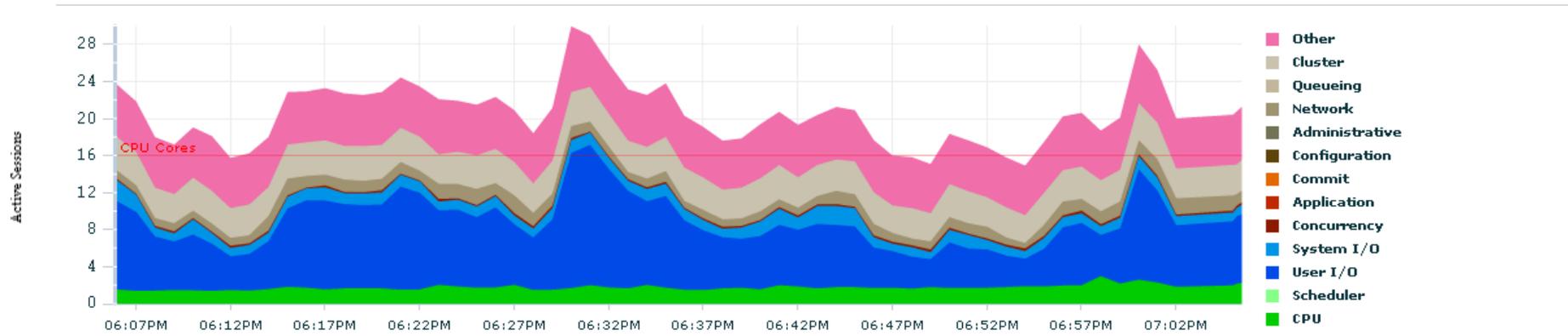
[Back to Top](#)

# ASH Report

## EM Access to Reports

- ASH report can be accessed by navigating
  - Performance Tab
  - “Top Activity” Link
  - Slide moving window over period of interest
  - (Run ASH Report) Button

# ASH Report



## Additional Monitoring Links

Top Sessions and Top SQL data from ASH can be found on the Top Activity page.

- [Top Activity](#)
- [Top Consumers](#)
- [Cluster Cache Coherency](#)
- [Database Locks](#)
- [Top Segments](#)
- [SQL Monitoring](#)

## Additional Instance Monitoring Links

- [Duplicate SQL](#)
- [Search Sessions](#)
- [SQL Tuning Sets](#)

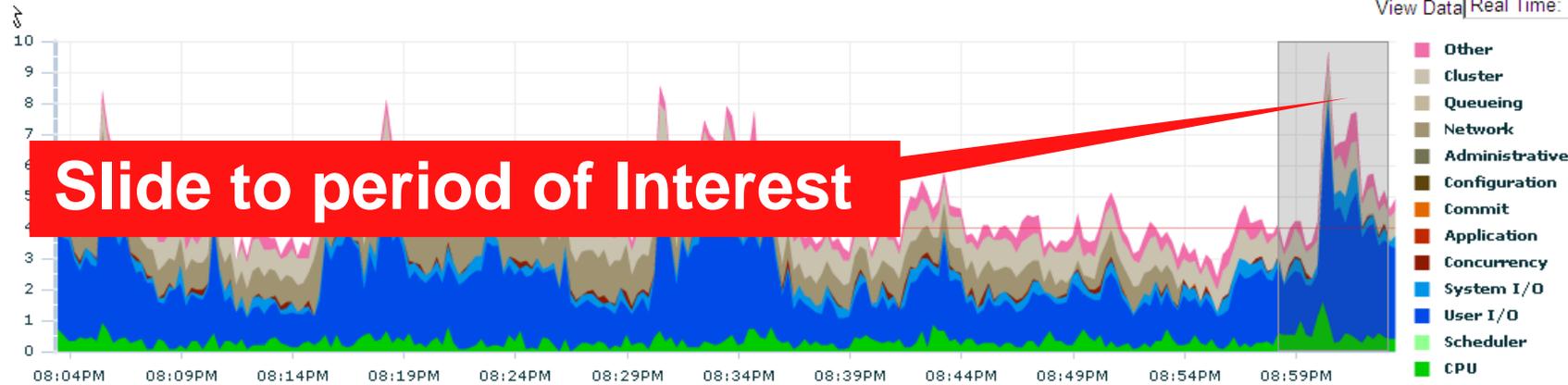
# ASH Report

## Activity

Switch Database Instance

Click the shaded box to change the time period for the detail section below.

View Data



## Detail for Selected 5 Minute Interval

Start Time Jun 5, 2011 8:58:13 PM

### Top SQL

Actions

Select All | Select None

Select	Activity (%)	SQL ID	SQL Type
<input type="checkbox"/>	15.56	5ansr7r9htpq3	UPDATE
<input type="checkbox"/>	13.23	4ajc80997p6dt	SELECT
<input type="checkbox"/>	12.80	1y65mdbbsms10	PL/SQL EXECUTE
<input type="checkbox"/>	8.36	5c7wf4xdpurrc	SELECT
<input type="checkbox"/>	5.82	ccdpdk07d1m	SELECT

### Top Sessions

View

Activity (%)	Count	Session Name	OS User	Program
10.55	43	oracle@adc60001aru	oracle@adc60001aru	TNS V1-V3
7.47	66	oracle@apd212 (SMON)	oracle@apd212	SMON
5.85	821	oracle@apd212 (J000)	oracle@apd212	J000
5.73	5	ORACLE.EXE	oracle@apd212	ORACLE.EXE

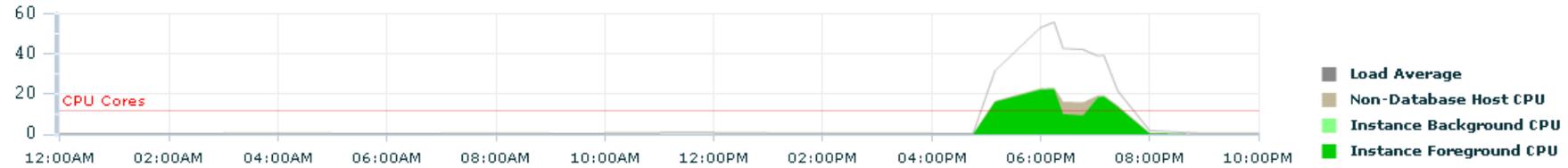
Run ASH Report

# ASH Report

Jun 04, 01:00AM Jun 04, 07:00AM Jun 04, 01:00PM Jun 04, 07:00PM Jun 05, 01:00AM Jun 05, 07:00AM Jun 05, 01:00PM Jun 05, 07:00PM

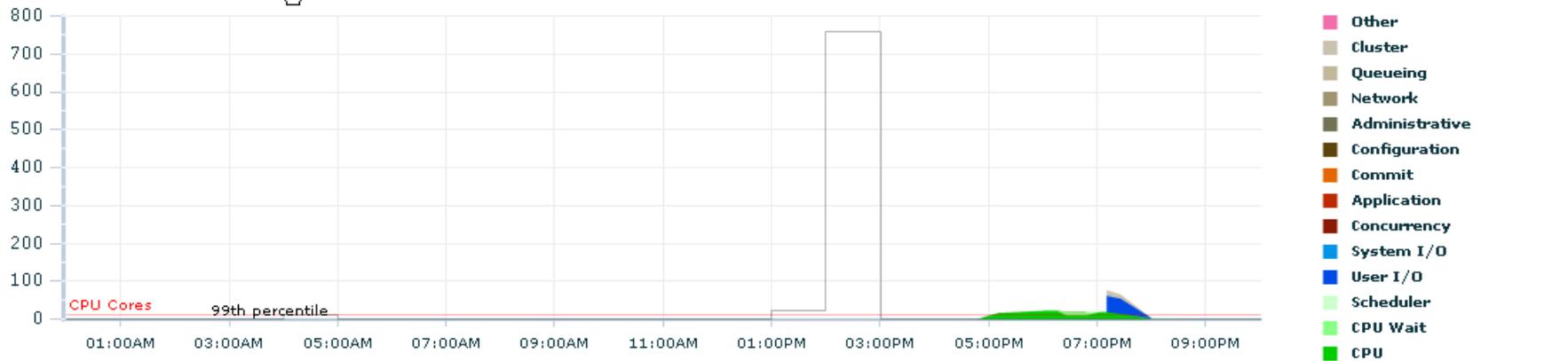
26 27 28 29 30

Host: Average Runnable Processes  Show Load Average



Run ASH Report

Average Active Sessions  Foreground Only  Foreground + Background



Top Activity



throughput **I/O** Parallel Execution Services

Instance Throughput Rate  Per Second  Per Transaction



# AWR Architecture Analysis

## More than just wait events and top SQL

- Large amount of data in the AWR report
- Tells us about the way that the system has been architected and designed as well as about how it is performing
- Often see common mistakes

# Agenda

- 1 About the Real World Performance Team
- 2 AWR Intro
- 3 AWR from an OLTP system**
- 4 AWR from a Batch system
- 5 Recap

# AWR from an OLTP system

Ready for Black Friday?

# AWR from an OLTP system

- Testing system for Black Friday readiness
- Cannot generate load expected on test system
- Do you see any problems with this system scaling up from this test?
- Will we survive Black Friday ?

## End of preview ...

- This will be an interactive session, where the presenter and the audience will work together in diagnosing the root cause of the performance degradation
- Thus, to not spoil the interactive experience and participation in this challenge, the preview ends here
- The complete set of slides will be available on-line after the session

# **Hardware and Software Engineered to Work Together**

ORACLE®