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Oracle Database Performance Management

Oracle Enterprise Manager 12c

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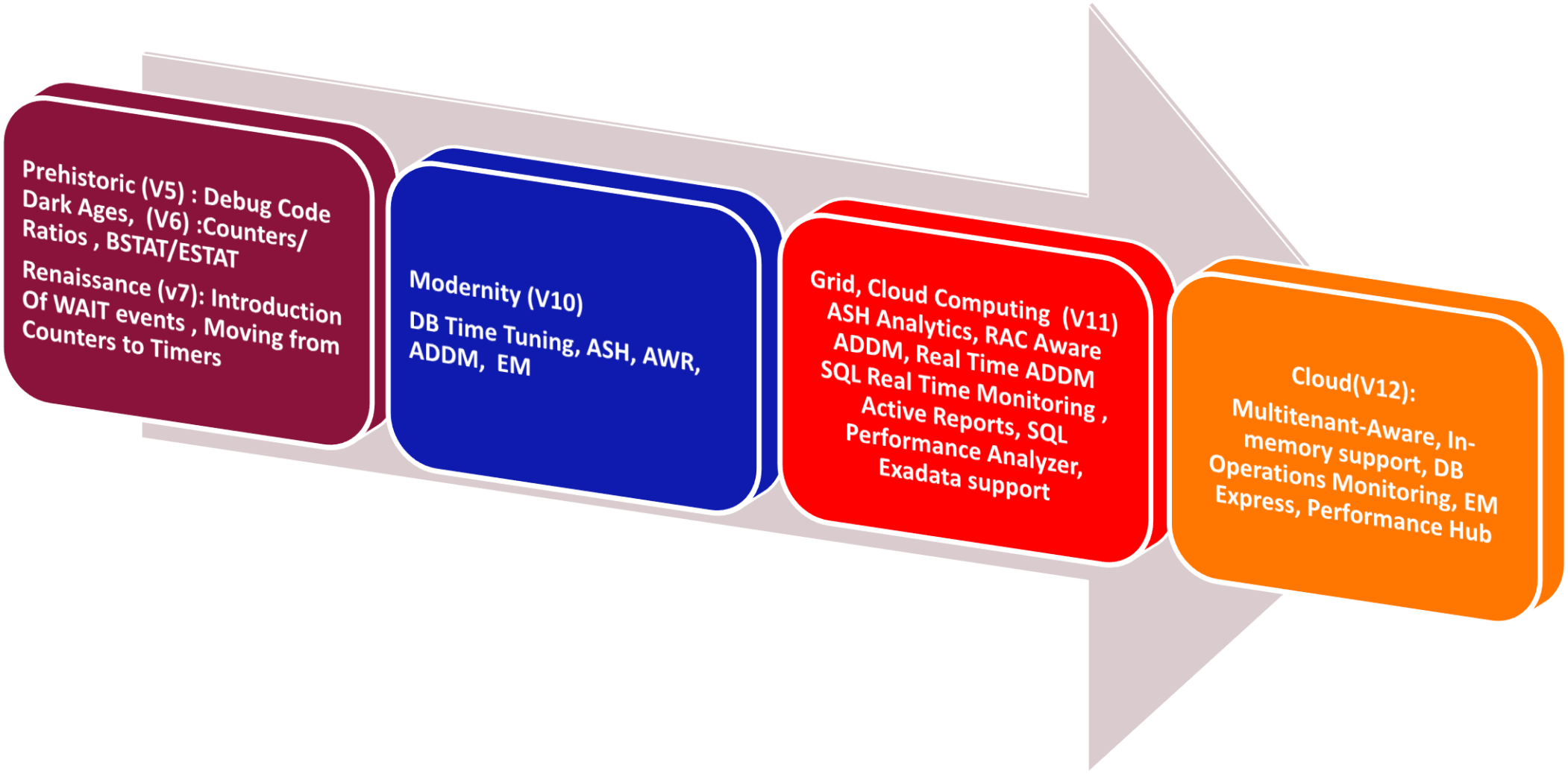
Continuous Innovation



DB Tuning Process

Will optimizer_index_caching improving my sequential reads…

1. Find a problematic metric
2. Implement a possible Fix

Default value is 0, …so let's set it to 50…

3. Wait for end-user feedback

Did it work?

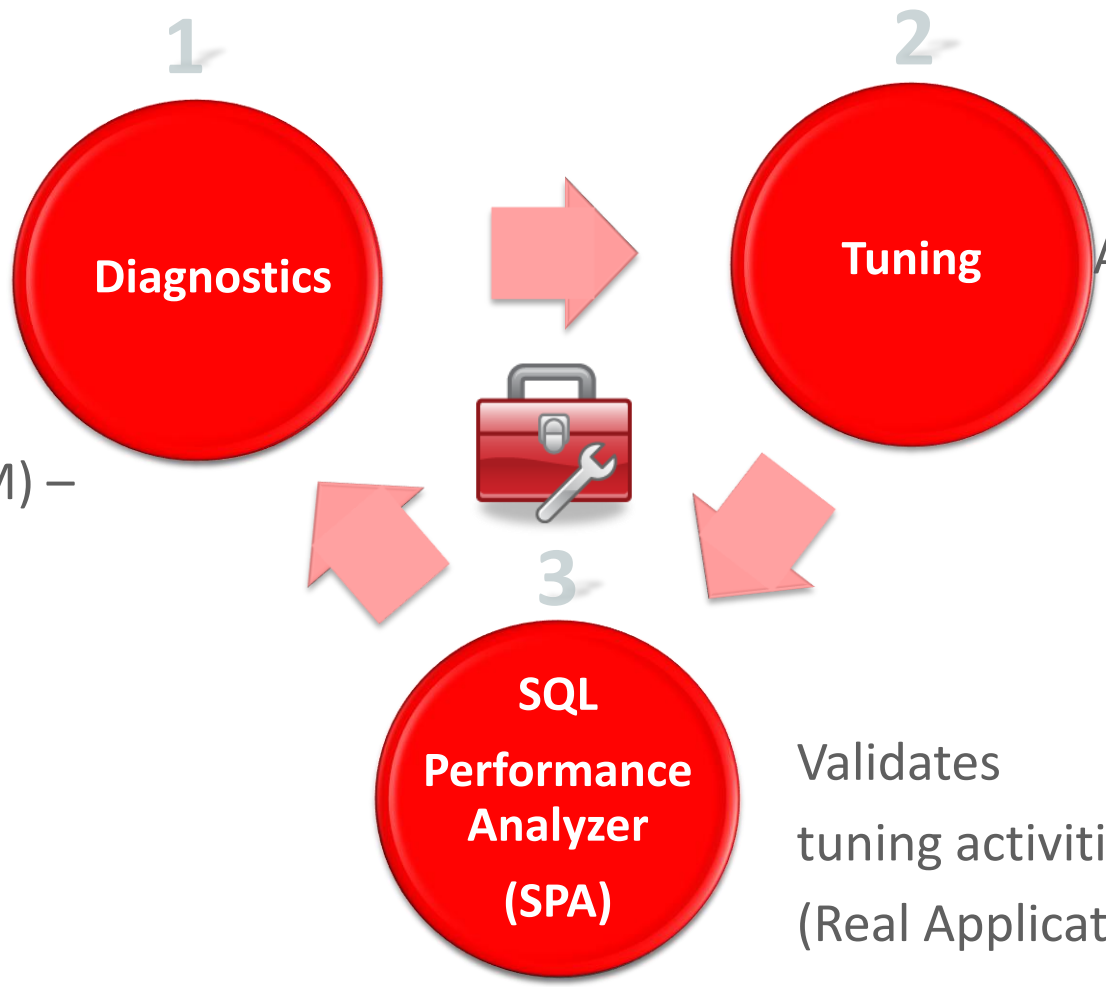
Are customers complaining?

The "trial and error" method can consume more than 50% of the DBA time

Recommended DB Tuning Process

Built-in, self-diagnostics engine:

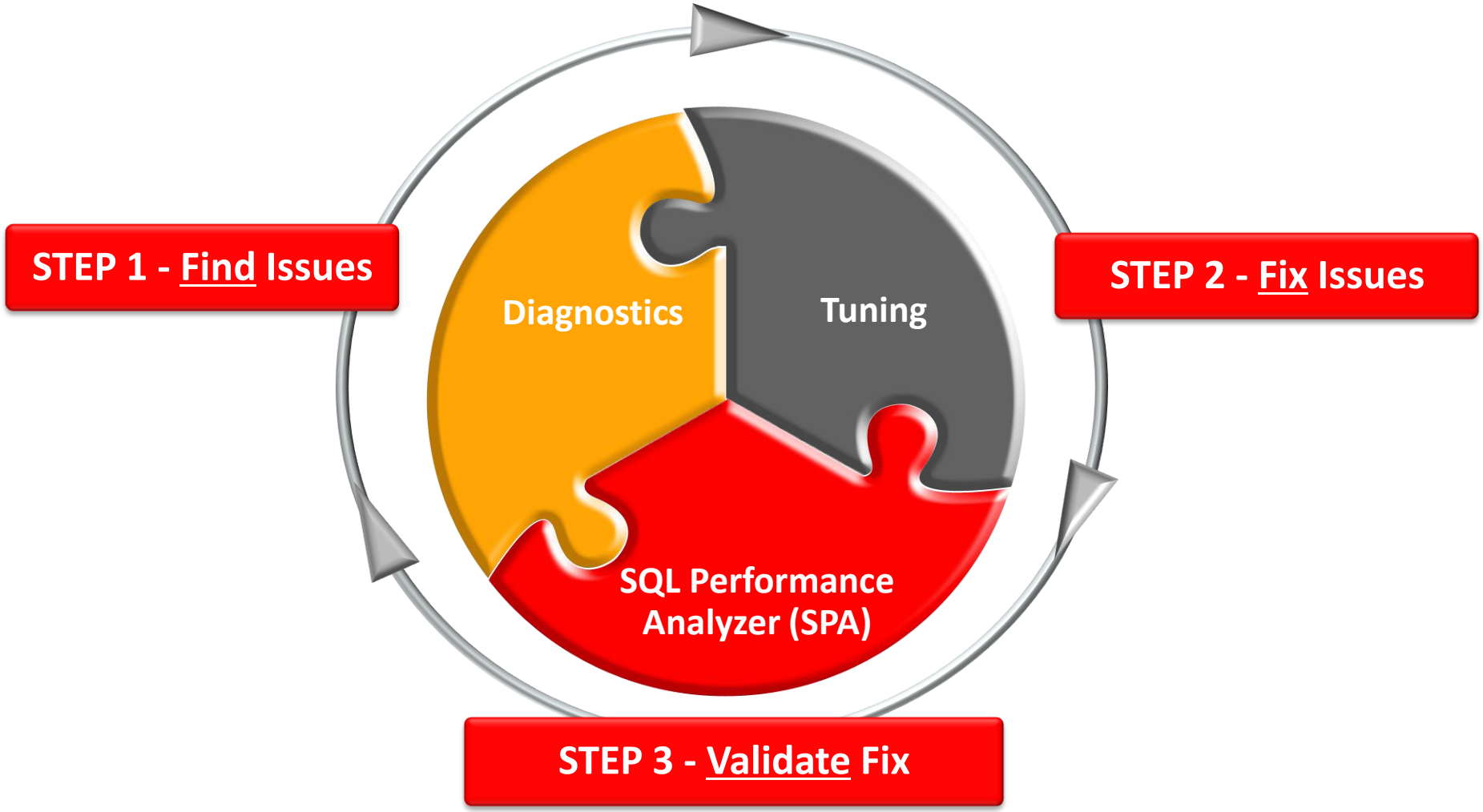
Automatic Database Diagnostics Monitor (ADDM) – (Diagnostics Pack)



Automates complex and time consuming task of application tuning (Tuning Pack)

Validates tuning activities (Real Application Testing)

Find → Fix → Validate



THE FIND

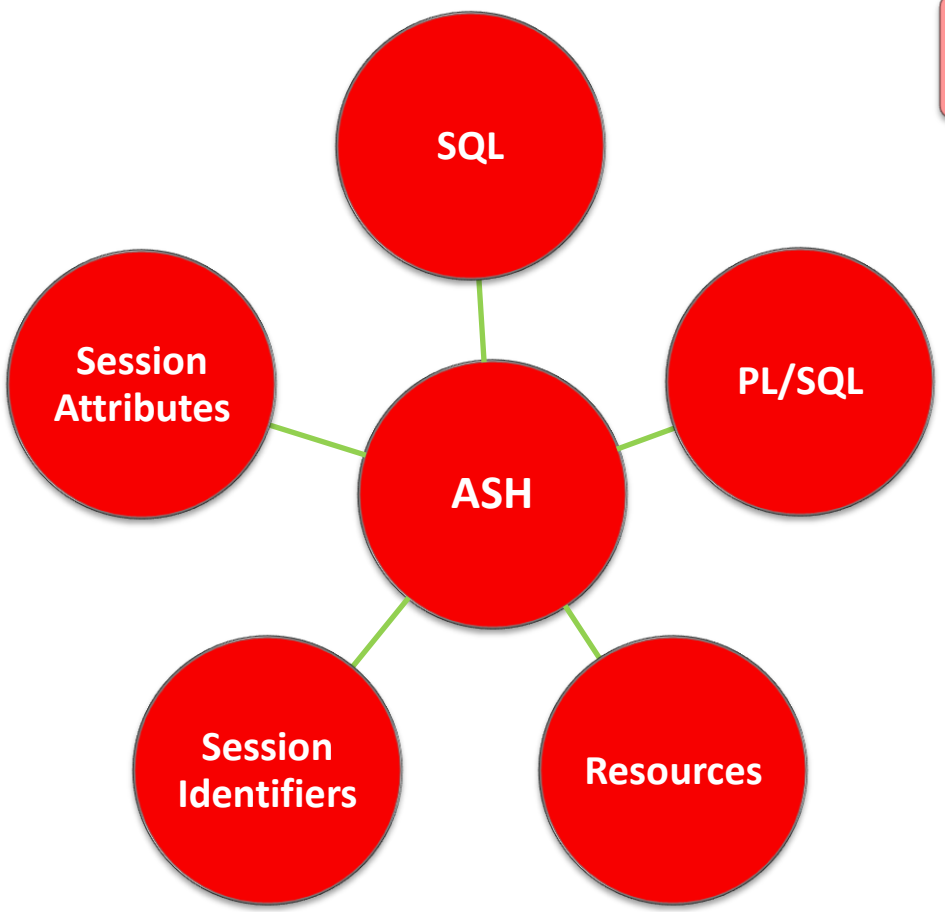
Find-Fix-Validate Methodology and Toolset

Find:

- Gather Data: Performance and workload data capture → AWR
  - System statistics, wait information, SQL Statistics, etc.
- Data Analysis and Problem Identification → ADDM
  - What types of operations are consuming most time?
  - Which resources is the bottleneck?
  - What is the root cause?
  - How can problem be remediated?
- If multiple problems identified, which is most critical?
- Which solution will give me most benefit?
- For SQL Related problems, ADDM points recommends running SQL Tuning Advisor → ADDM

Rich feature-set provides comprehensive support for diagnosing problems: System Session, Targeted or Transient, Hung or slow moving databases, etc. Built into the Oracle kernel and highly optimized (already part of the SGA)

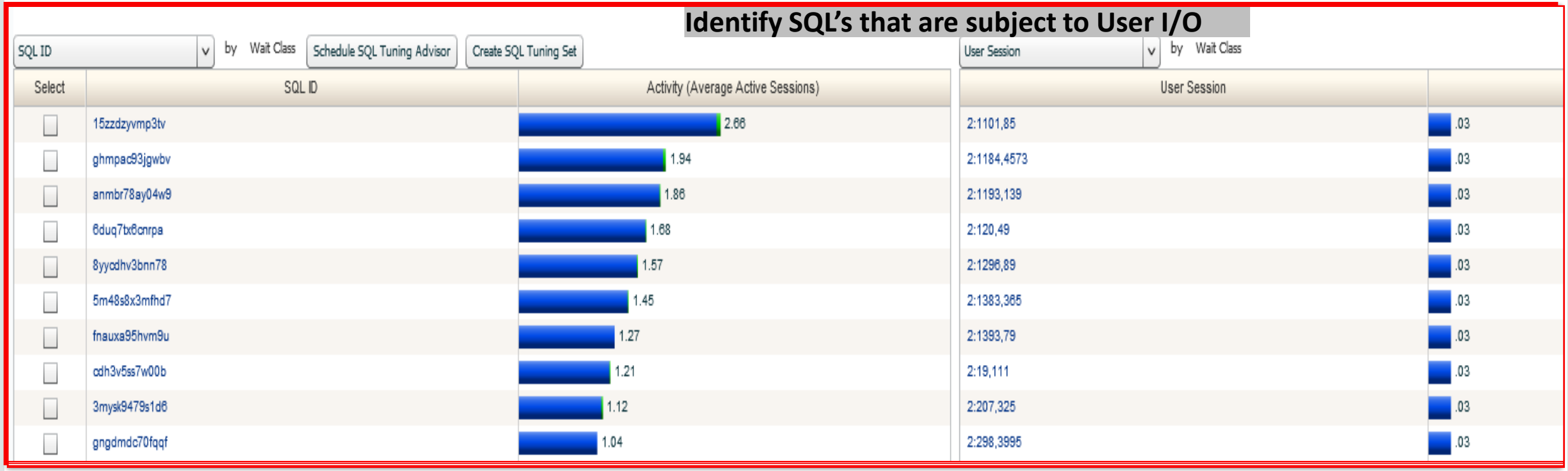
User Session Performance Dimensions



- **SQL**
  - SQL ID
  - Plan Hash
  - Operation
  - OpCode
- **PL/SQL**
  - PL/SQL
  - Top Level PL/SQL
- **Resources**
  - Wait Class
  - Wait Event
  - Object
  - Blocking Session
- **Identifiers**
  - Instance
  - Services
  - User Session
  - Parallel Process
  - Program
  - Session Type
- **Attributes**
  - Consumer Group
  - Module
  - Action
  - Client
  - Trans. ID

Case Study : Understanding I/O Bottle Neck with ASH Analytics

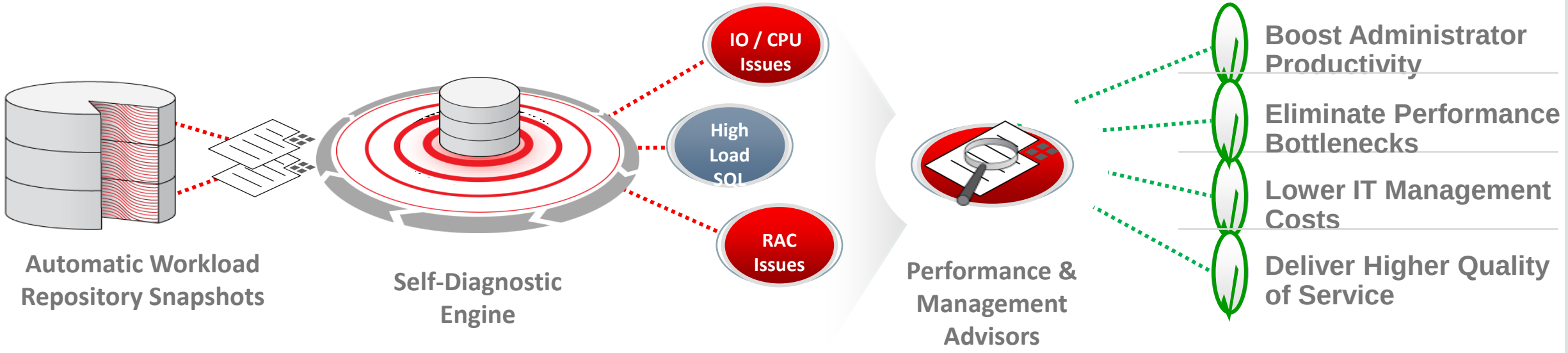
Identify SQL's that are subject to User I/O



- Graphical ASH report for advanced analysis
- Provides visual filtering for recursive drill-downs
- Select any time period for analysis
- Analyze performance across many dimensions

- Different visualizations: Stacked chart or Tree Map
- Collaborate with others using Active Reports

Automatic Performance Diagnostics Monitor (ADDM)



- Runs proactively out of the box, reactively when required
- Top-down analysis using Automatic Workload Repository snapshots
- Real-time performance and historic analysis with Automatic Database Diagnostic Monitor
- Resolve performance issues faster with drill-down root-cause analysis
- Classification tree based on Oracle performance tuning expertise
- Performance expert; now a RAC specialist too in Oracle Database 11g

Automatic Performance Diagnostics

Continuous Evolution in Database Performance Management

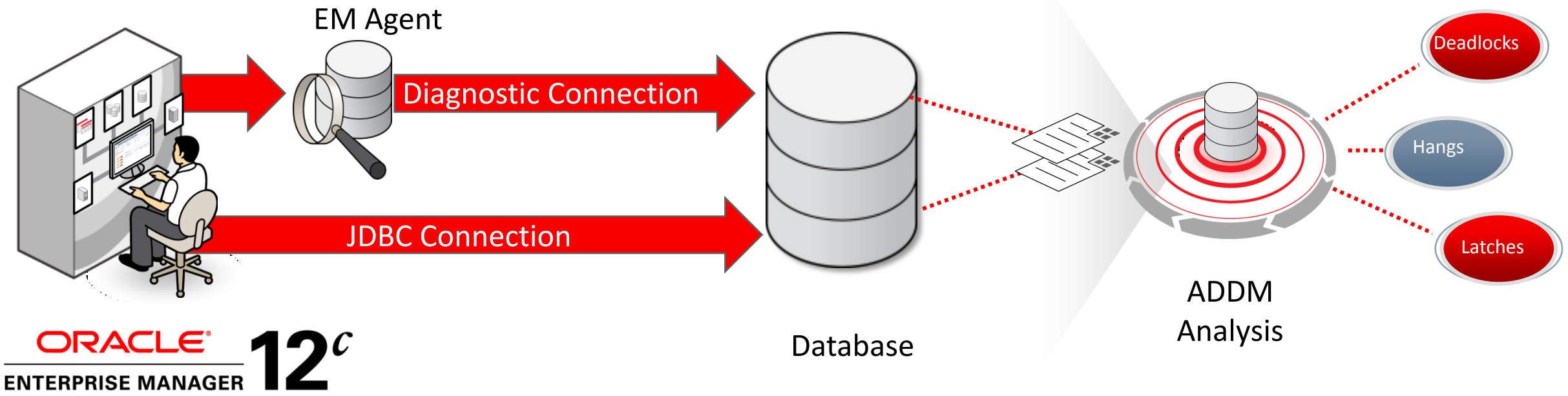
- Diagnose persistent performance issues
- Uses AWR snapshots
- Regular interval
- Automatic / Manual

- In-depth performance comparison across two periods
- Relies on AWR data
- Manual

- Hung or extremely slow databases
- Uses a normal and diagnostic mode connection
- Manual

- Proactively detect & diagnose transient high-impact problems
- Built inside the DB
- Automatically runs every 3 seconds

Real-Time ADDM—Architecture



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- Makes a lightweight connection without acquiring additional locks and resources, bypassing the SQL layer through the agent
- Also attempts to initiate standard JDBC connection
- Data returned by either connection is analyzed by ADDM

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Real-Time ADDM Enhancements

Oracle Database 12*c*

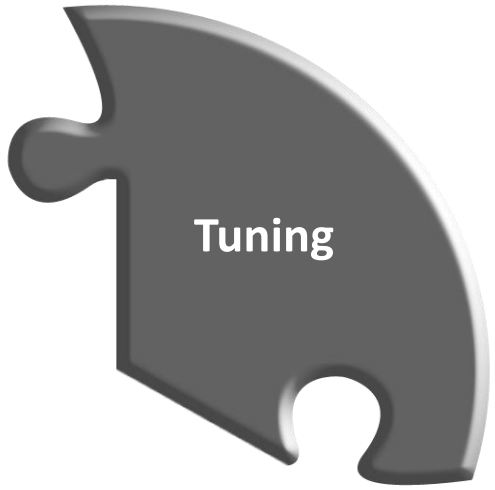
- Automatic real-time problem detection and analysis
- Database self-monitors for serious performance issues
- Recognize bad performance trends and trigger analysis:
  - High CPU, I/O spikes, memory, interconnect, hangs, deadlocks
  - Identify a problem before it threatens application performance
- Short duration (5 min spikes) ADDM analysis
  - Actionable advice for critical issues
  - Richer data set available for analysis
- Reports (analysis and data) stored in AWR for historical analysis
  - ADDM, SQL Monitoring reports

Find: Performance Diagnostics Summary

Topics Covered

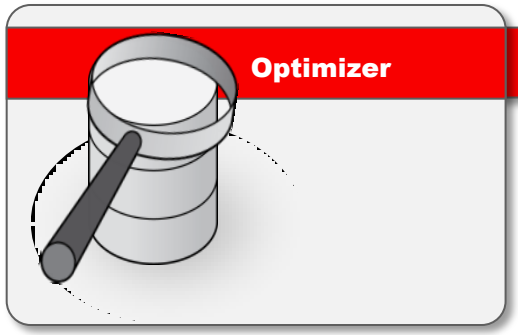
- Database Time
- AWR
- Enterprise Manager ASH: Transient / Targeted Performance Analysis
- ADDM: Proactive Performance Management and Diagnosis
- The above toolset helps identify the potential problems and recommends appropriate solutions
- For SQL related issues, ADDM recommends SQL Tuning Advisors…

Next Steps: Tune the identified SQL problems



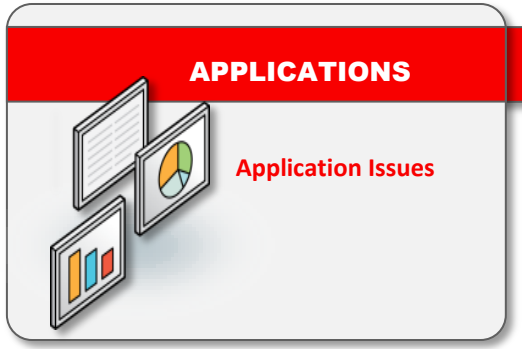
THE FIX

SQL Performance Issues: Broad Categories



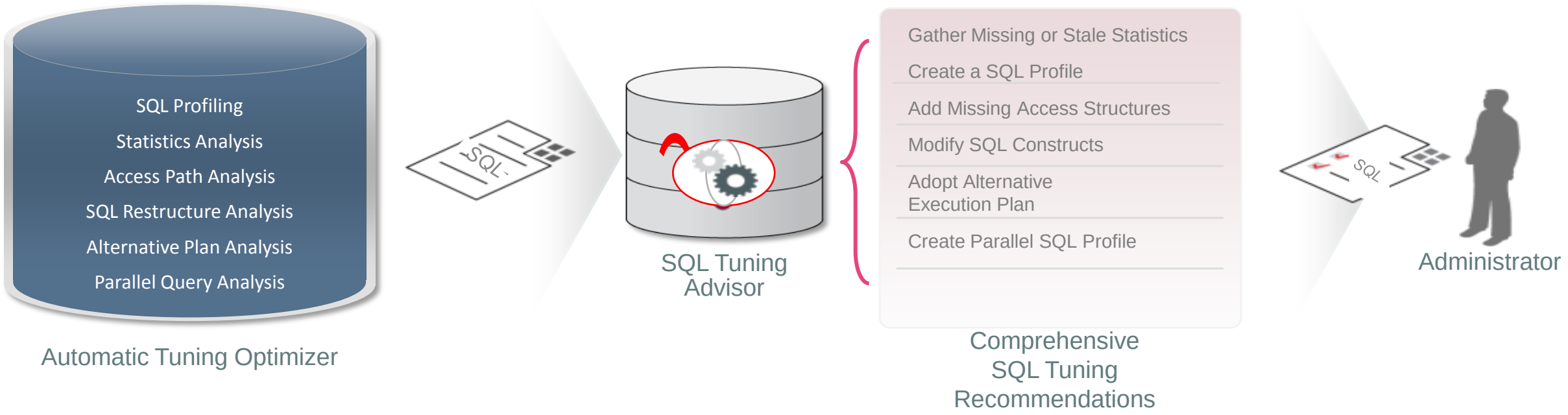
- Stale/Missing statistics
- Incomplete statistics
- Improper optimizer configuration
- Upgraded Database: new optimizer
- Changing statistics
- Rapidly changing data

- Hardware resource crunch
- Contention (row lock contention, block contention)
- Data fragmentation
- Not parallelized (no scaling to large data)
- Improperly parallelized (partially parallelized, skews)
- Rapidly changing data



- Missing access structures
- Poorly written SQL statements
- Bind-sensitive SQL with bind peeking (Cursor Sharing)
- Literal usage

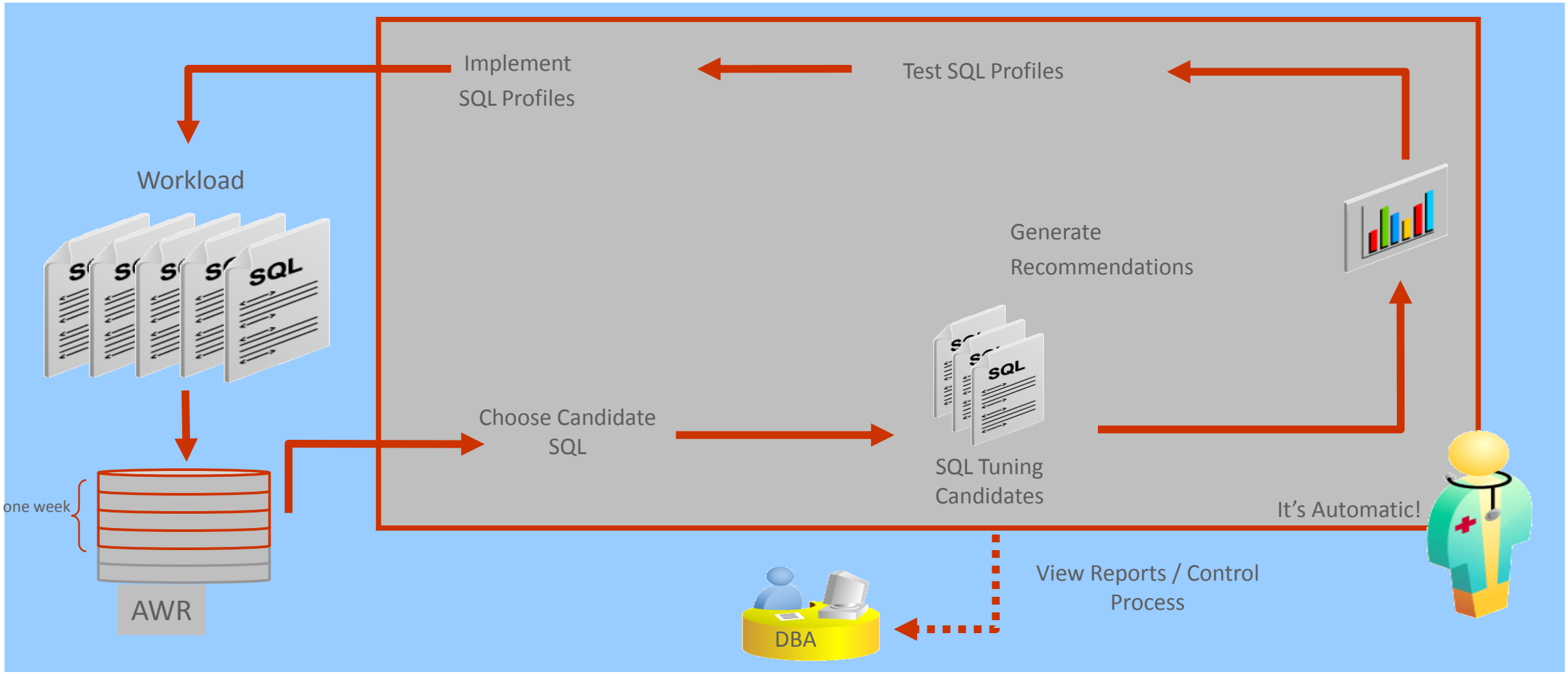
SQL Tuning



- SQL Tuning Advisor
  - Gives suggestions on the various problems identified during the diagnosis phase
  - Uses the same CBO but has more time budget to perform comprehensive analysis
  - Identifies alternate execution plans using real-time and historical performance data
  - Recommends parallel profile if it will improve SQL performance significantly (2x or more)

Automatic SQL Tuning in Oracle 11g/12c

End-to-End Workflow



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Setup | Help | DEMO | Log Out

Enterprise | Targets | Favorites | History | Search Target Name

emrep

Logged in as SYSTEM | dbrt3gc01.oracleads.com

Oracle Database | Performance | Availability | Schema | Administration

Advisor Central >

Logged in As SYSTEM

Automatic SQL Tuning Result Summary

The Automatic SQL Tuning runs during system maintenance windows as an automated maintenance task, searching for ways to improve the execution plans of high-load SQL statements.

Task Status

Automatic SQL Tuning (SYS_AUTO_SQL_TUNING_TASK) is currently Enabled Configure

Automatic Implementation of SQL Profiles is currently Disabled Configure

Key SQL Profiles 0

TIP Key SQL Profiles were verified to yield at least a 3X performance improvement and would have been implemented automatically had auto-implementation been enabled.

Summary Time Period

Choose a time period to focus the graphs and statistics below on a specific range of tuning results. Drill down to view focused results or see the results for all SQLs by clicking the "View Report" button.

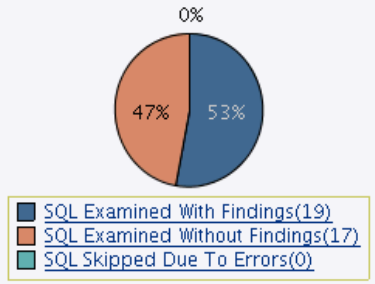
Time Period Last 31 Days Go View Report

Begin Date Jun 21, 2014 9:16:22 AM GMT+00:00 End Date Jul 22, 2014 9:16:22 AM GMT+00:00

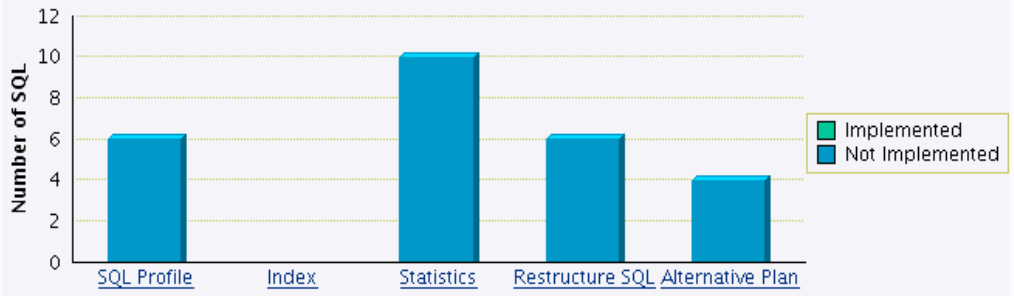
Overall Task Statistics

Executions 1 Candidate SQL 36 Distinct SQL Examined 36

SQL Examined Status



Breakdown by Finding Type



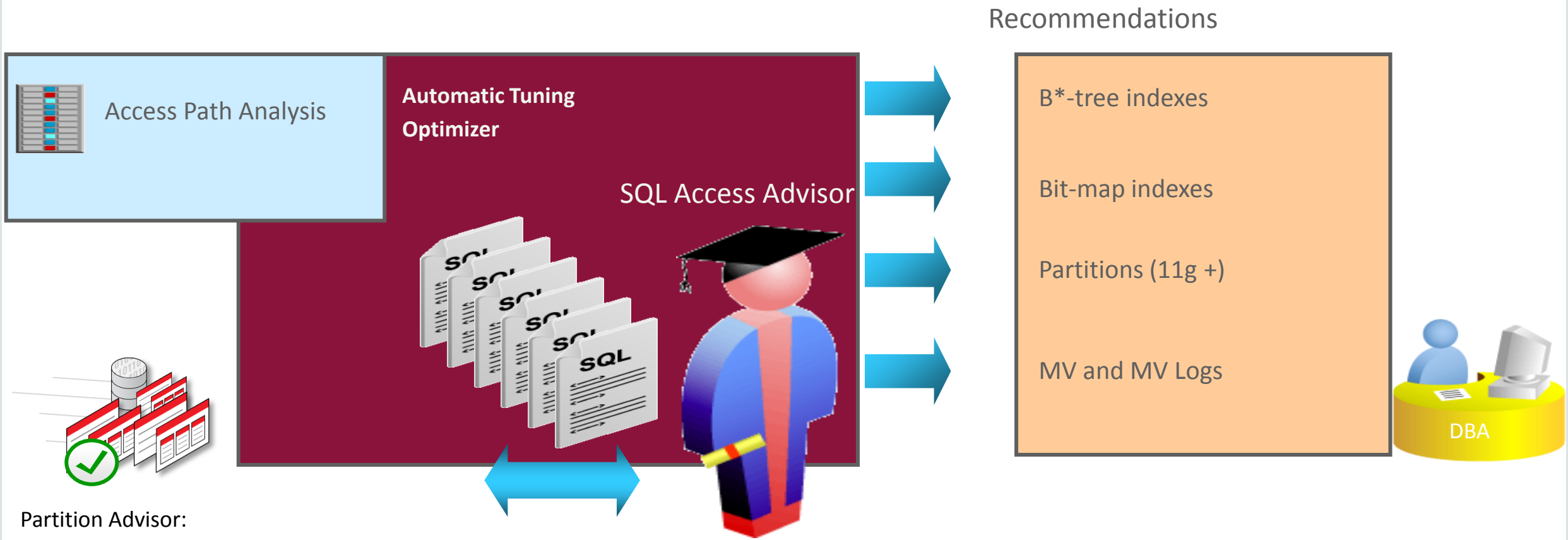
Profile Effect Statistics

Workload Potential DB Time Benefit (seconds per week)

Implemented (sec) 0 Potential Benefit(sec) 11

35

Workload Tuning: SQL Access Advisor



Partition Advisor:

- Range Partition
- Interval Partition
- Hash Partition
- List Partition

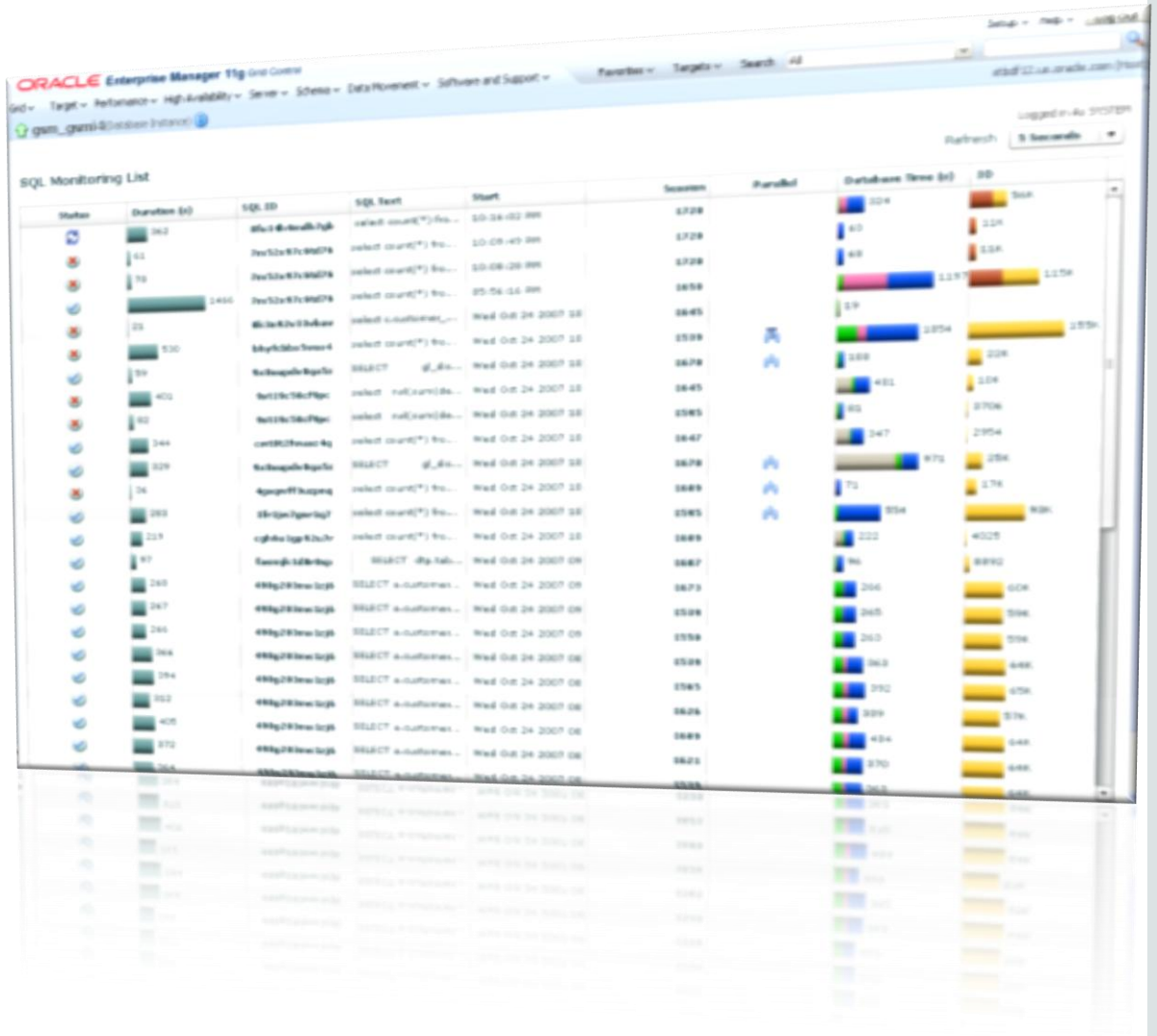
- Provides List Partition recommendations for 12c Database
- Analyzes already partitioned tables for further optimization

Significant reduction in analysis time for very large workloads (DB12c)

Real-Time SQL Monitoring

Looking Inside SQL Execution

- Automatically monitors long running SQL
- Enabled out-of-the-box with no performance impact
- Monitors each SQL execution
- Exposes monitoring statistics
  - Global execution level
  - Plan operation level
  - Parallel Execution level
- Guides tuning efforts
- Bind values shown
- SQL level metrics
  - CPU, I/O requests, throughput, PGA, temp space
- Graphical explain plan
- I/O statistics for each operation



Real-Time PL/SQL Monitoring

- PL/SQL execution no longer a “black box”
  - Answers questions like “why did my DBMS_STATS job take twice as long this time?”
- Shows global (PL/SQL) and SQL level statistics
- Each SQL called by PL/SQL recursively monitored
- Drill-down to slow SQL for diagnosing unexpected PL/SQL behavior

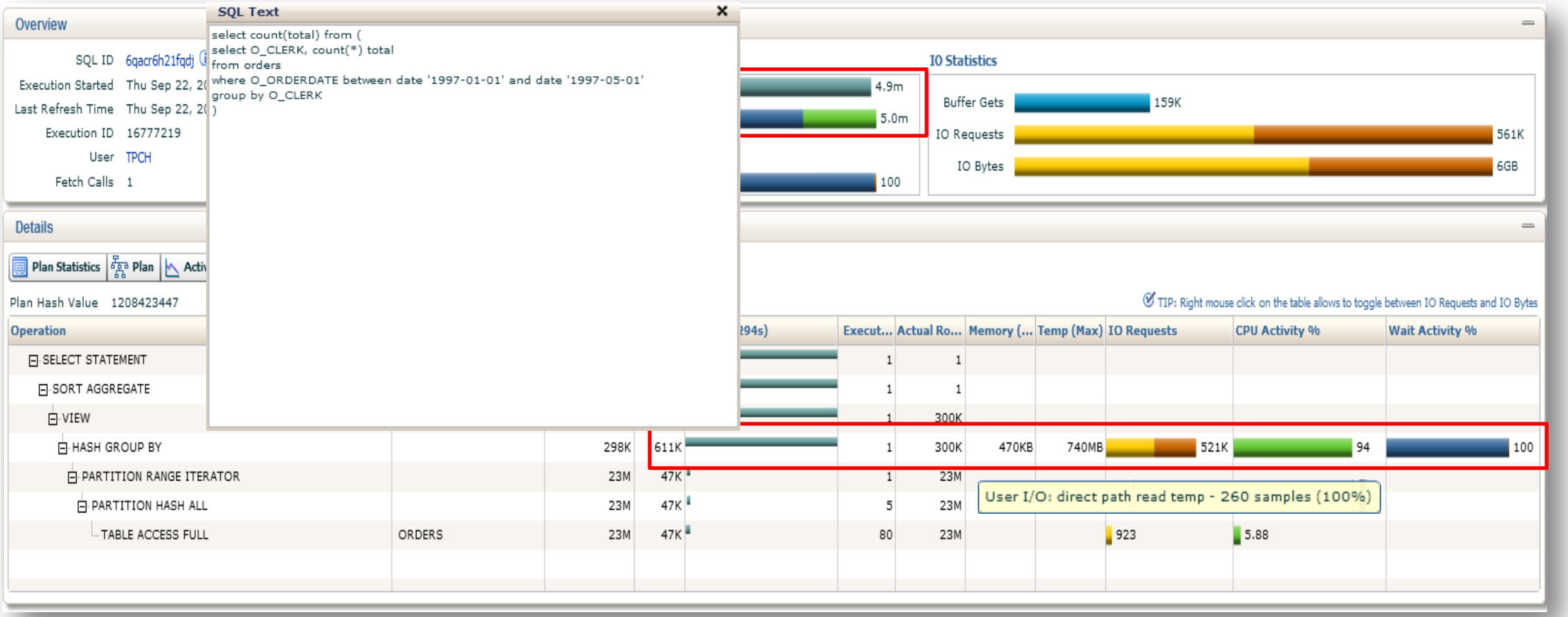
Real-Time SQL Monitoring: Case Study 1

My simple query is taking longer than before. What could have gone wrong?

- SQL Performance Problems
  - Statistics
  - Resources
  - Application issues
  - Parallelism
  - Initialization parameters

Real-Time SQL Monitoring

SQL with count and Group by



Real-Time SQL Monitoring

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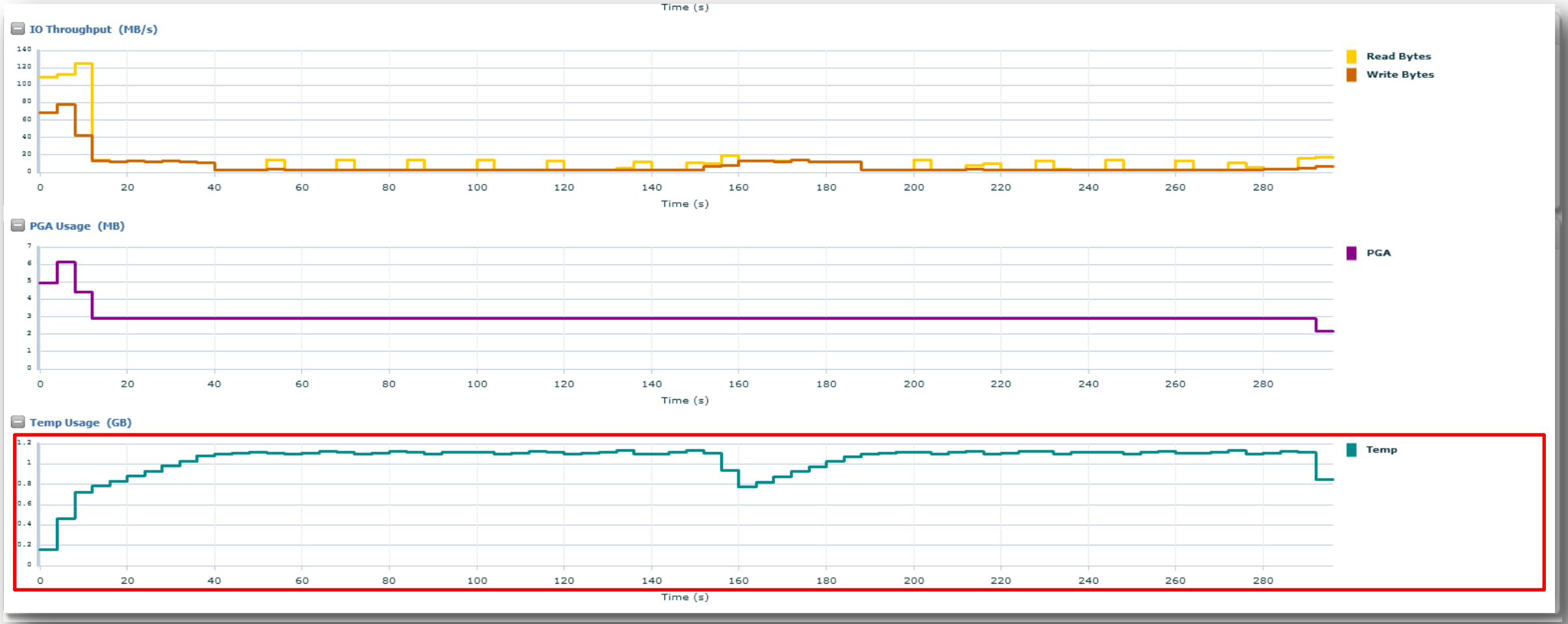
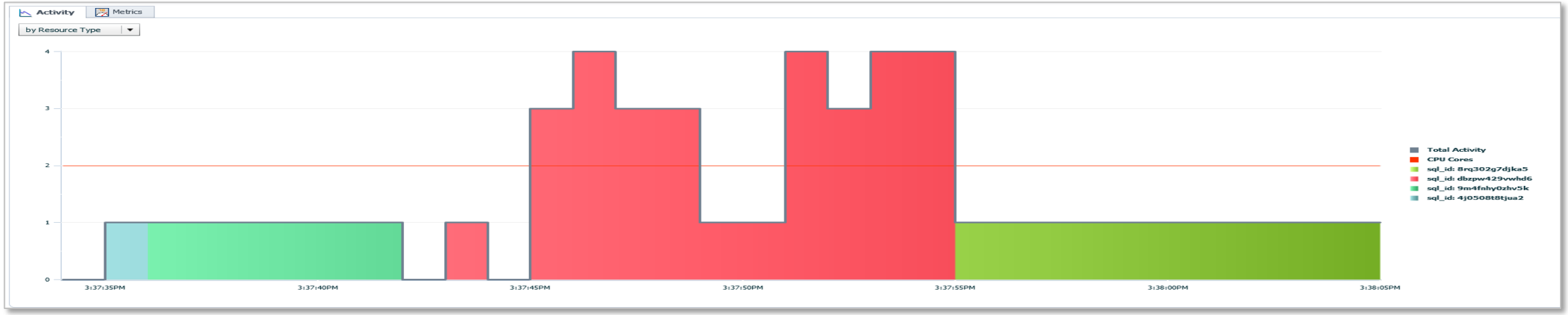


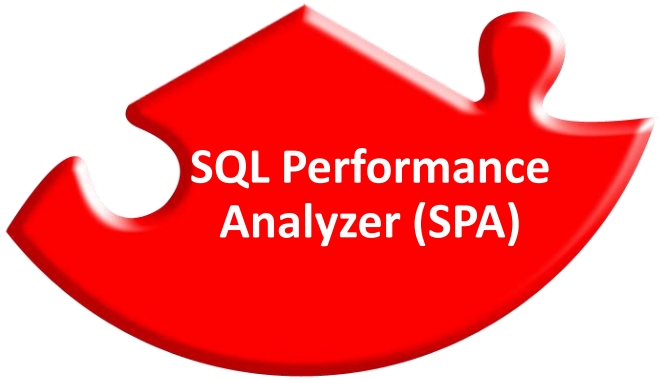
Real-Time SQL Monitoring

PGA Size increased

Monitor Complex Database Operations



- Oracle Database 11g: Support for simple DB operations
  - SQL statements (e.g., SQL for DSS, batch/report SQL, runaway SQL)
  - PL/SQL procedures/functions
- Oracle Database 12c: Support for composite operations
  - Session(s) activity between 2 points of time defined by application code / DBA
  - For example; SQL*Plus script, batch job, or ETL processing
  - At most one DBOP per DB session



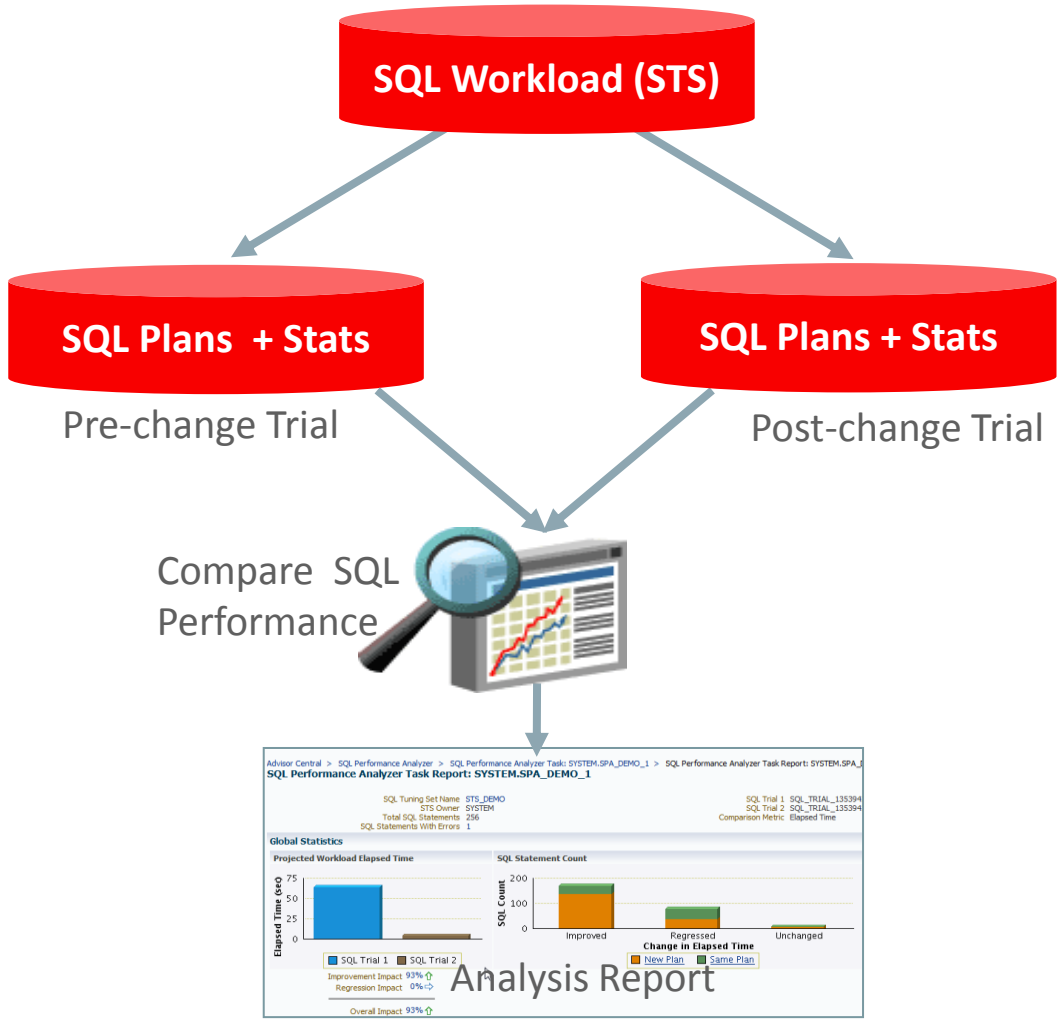
VALIDATE

SPA: Motivation

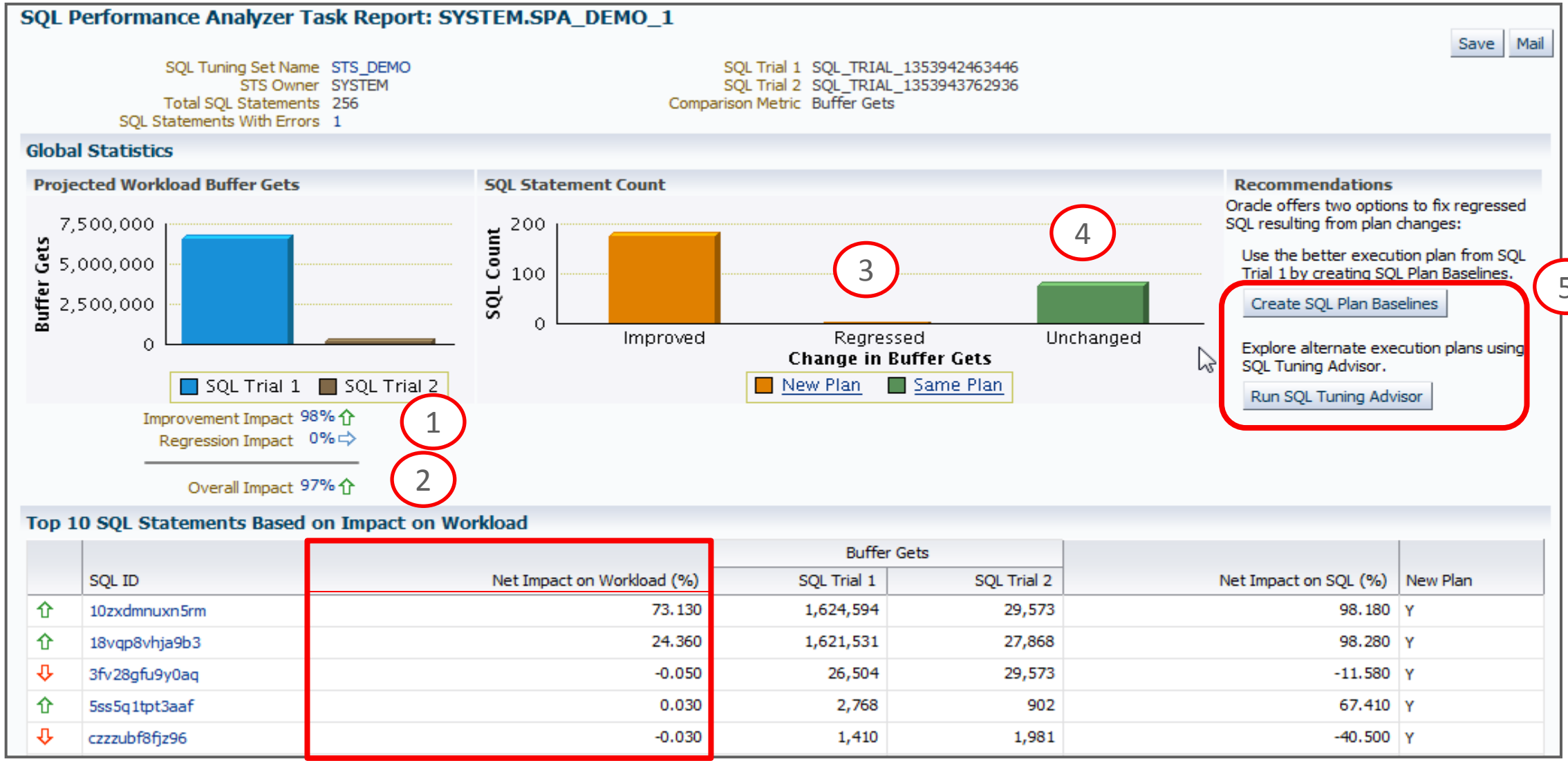
- Businesses need to adapt to changes to stay competitive, compliant and evolve
  - DB upgrades, schema, optimizer statistics refresh, validate tuning actions
  - SQL performance regressions: #1 cause for poor system performance
- Current testing landscape and limitations
  - Expensive capture, partial workload, non-production optimizer context, binds
  - Large workloads (100K SQL statements are common)
  - Manual and time consuming testing and regression tuning
  - No end-to-end testing solution
  - Test In Production is not too uncommon

SQL Performance Analyzer (SPA) Overview

- Helps users predict the impact of system changes on SQL workload
- Low overhead capture of SQL workload to SQL Tuning Set (STS) on production system
- Build different SQL trials (experiments) of SQL statements performance by test execution or explain plan
- Integrated with STS, SQL Plan Baselines, & SQL Tuning Advisor to form an end-to-end solution



SPA Report



	SQL ID	Net Impact on Workload (%)	Buffer Gets		Net Impact on SQL (%)	New Plan
			SQL Trial 1	SQL Trial 2		
⇧	10zxdmnuxn5rm	73.130	1,624,594	29,573	98.180	Y
⇧	18vqp8vhja9b3	24.360	1,621,531	27,868	98.280	Y
⇩	3fv28gfu9y0aq	-0.050	26,504	29,573	-11.580	Y
⇧	5ss5q1tpt3aaf	0.030	2,768	902	67.410	Y
⇩	czzzubf8fjz96	-0.030	1,410	1,981	-40.500	Y

When to use SPA?

Production and Non-production system use cases

Operational (Production)*

– Implement SQL Profiles

– Refresh statistics

– Change optimizer related init.ora parameters like OPTIMIZER_MODE…

– Change memory related init.ora like PGA_AGGREGATE_TARGET…

Non-operational (Test)

– Adding or dropping indexes, table partitioning...

– New features like Compression, In-Memory...

– Infra structure changes like server, storage, interconnect...

– Consolidation

– Upgrades and patching 11g -> 12c,12.1.0.1 -> 12.1.0.2, PSU 2

* SPA Quick Check the next generation of SPA, covers production scenarios better

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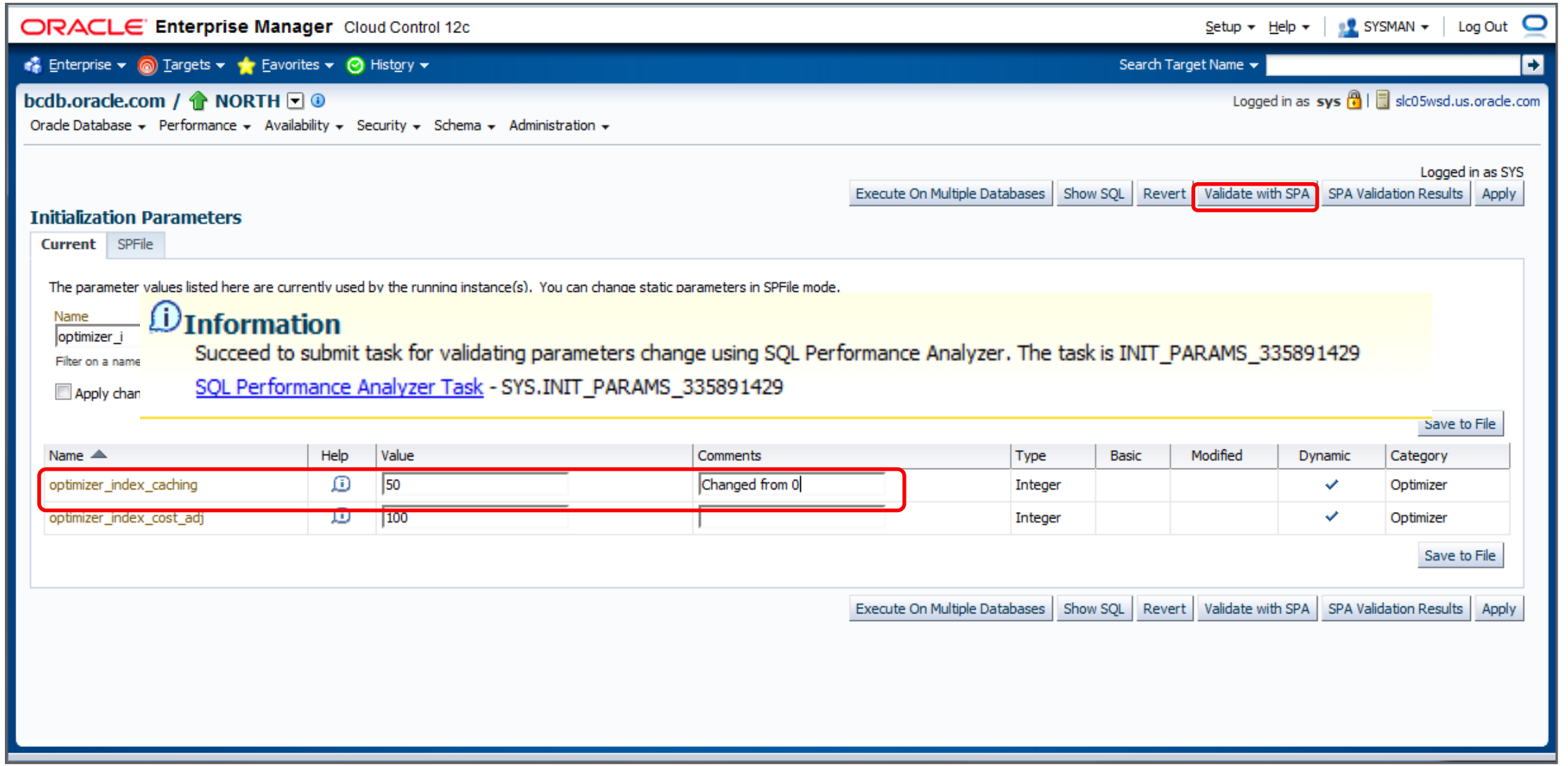
SPA Quick Check



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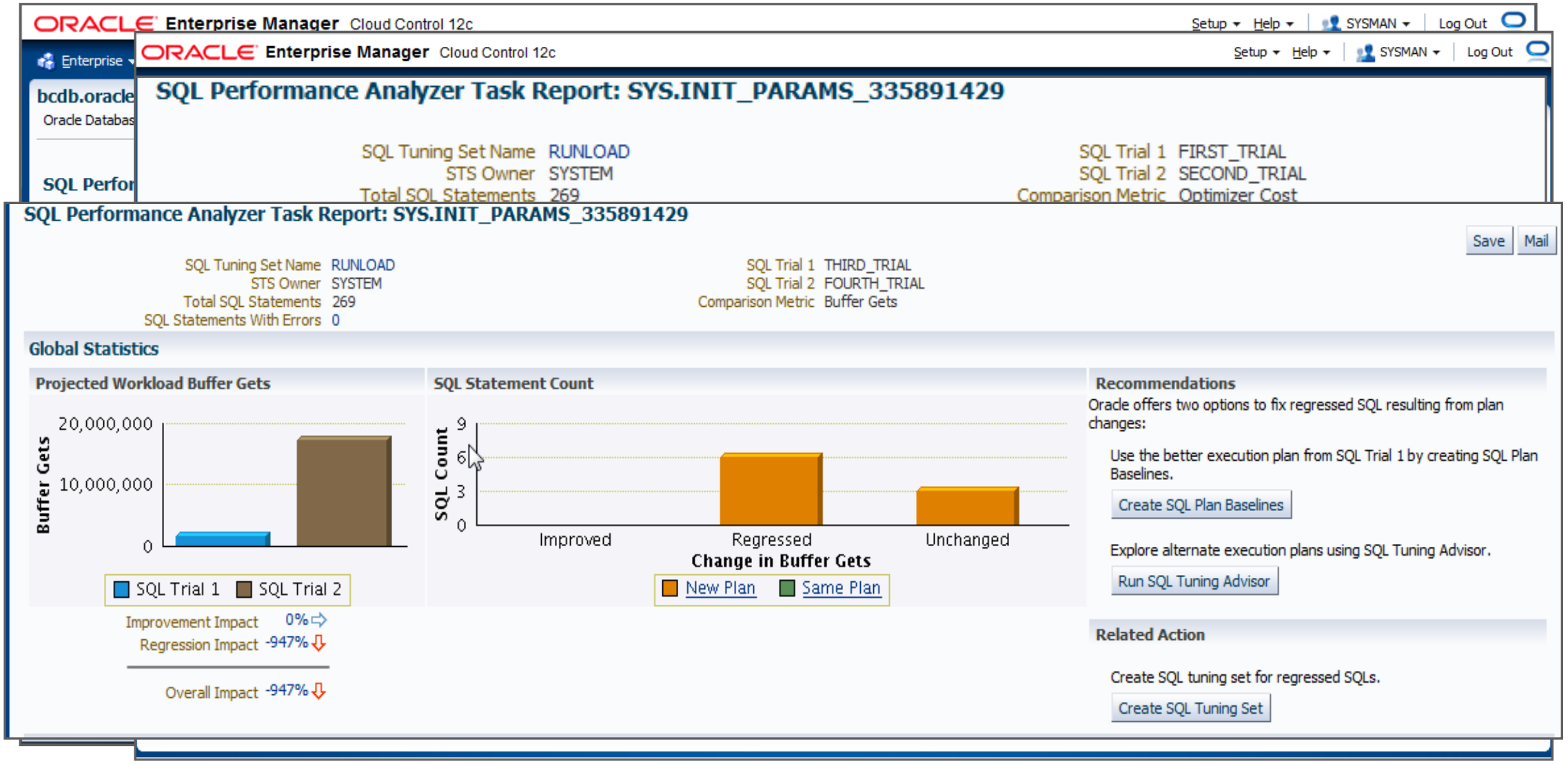

Program Agenda

- Introductions
- Oracle Database Performance Tuning Fundamentals
- Find, Fix and Validate: Methodology and Toolset


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