Tips for Maximizing DB Performance

Theory and Practice

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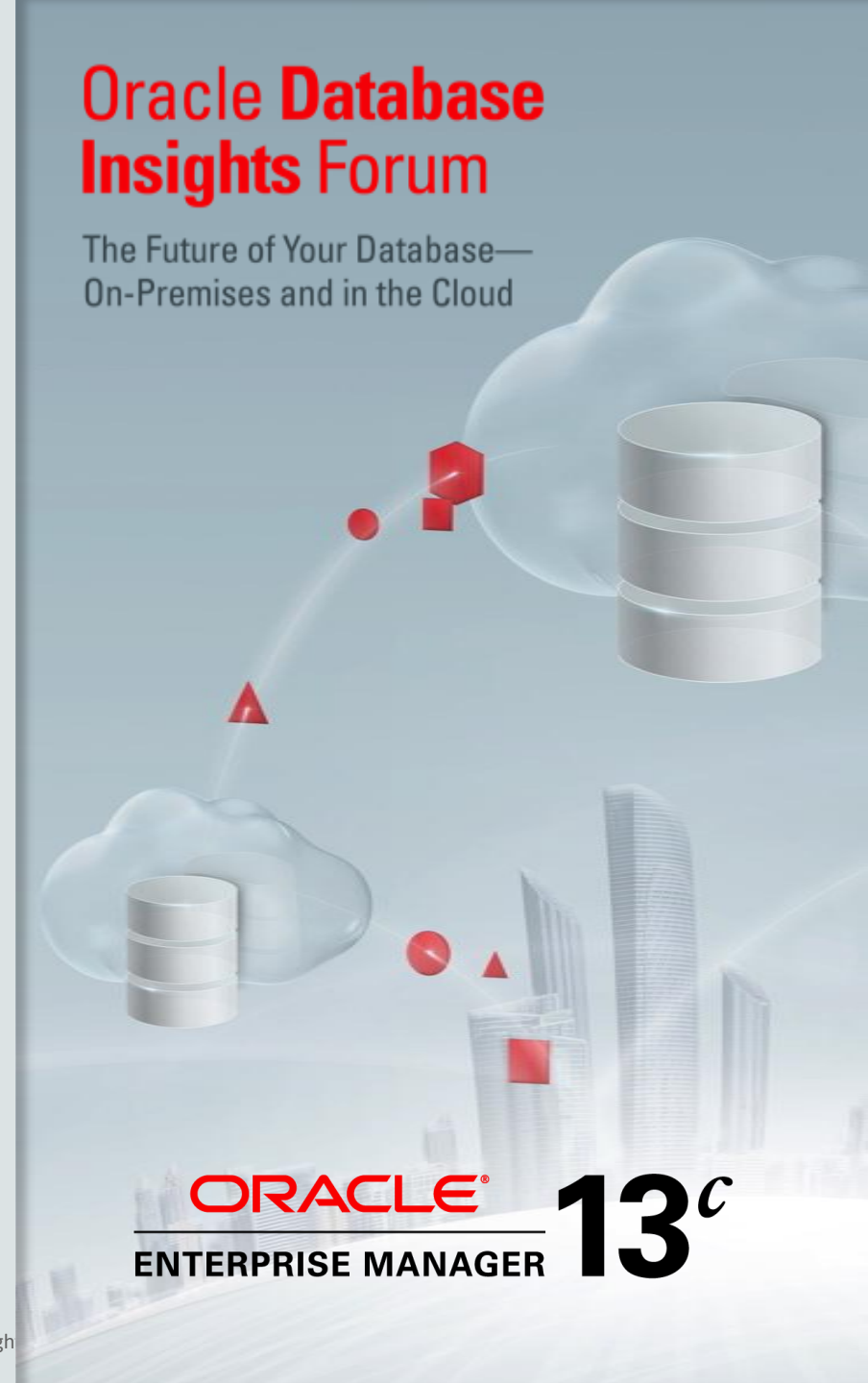
Oracle



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Safe Harbor Statement

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Program Agenda

1. Introduction
2. Oracle Database Performance Tuning Fundamentals
3. Performance Tuning Methodology
4. New Features

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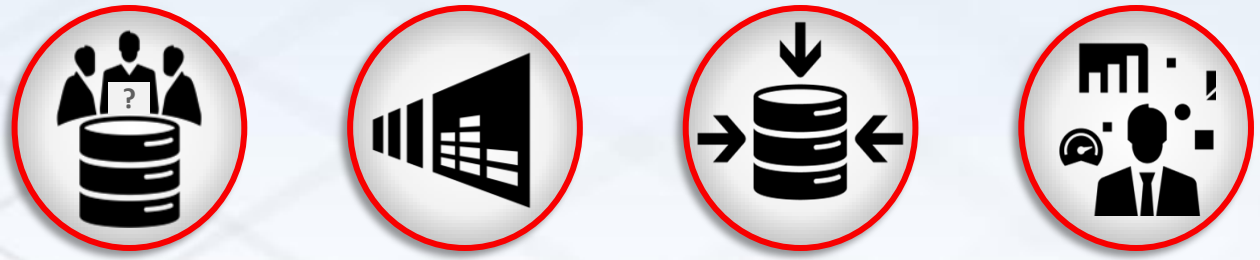
IOUG
independent oracle users group
For the Complete Technology & Database Professional

Top Challenges: **Database Management**



52% **Rapid diagnoses of database performance problems**

45% **Identifying application (SQL) issues**

37% **Validating and applying SQL tuning solutions**

Key Takeaway: Improve & Ensure Higher Quality of Service

Source: THE RAPIDLY ACCELERATING CLOUD-ENABLED ENTERPRISE: 2015 IOUG Survey On Database Manageability

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CONTINUOUS INNOVATION

Dark Ages (V5-V7)

Debug Code, Counters/Ratios, BSTAT/ESTAT
Renaissance (v7): Introduction of WAIT events, Moving from Counters to Timers

Modernity (V10)

DB Time Tuning, ASH, AWR, ADDM, EM

Grid Computing (V11)

ASH Analytics, RAC Aware ADDM, Real-Time ADDM, Real-Time SQL Monitoring, Active Reports, SQL Performance Analyzer, Exadata support

Cloud (V12)

Multitenant-aware, In-memory support, DB Operations Monitoring, EM Express, Performance Hub

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Database Time (DB Time)

- Total time in database calls by foreground sessions
- Includes CPU time, IO time and non-idle wait time
- DB Time <> response time
- New metric for Oracle performance analysis

Database time is total time spent by user processes either actively working or actively waiting in a database call.

Fundamental Concepts

Active Session =

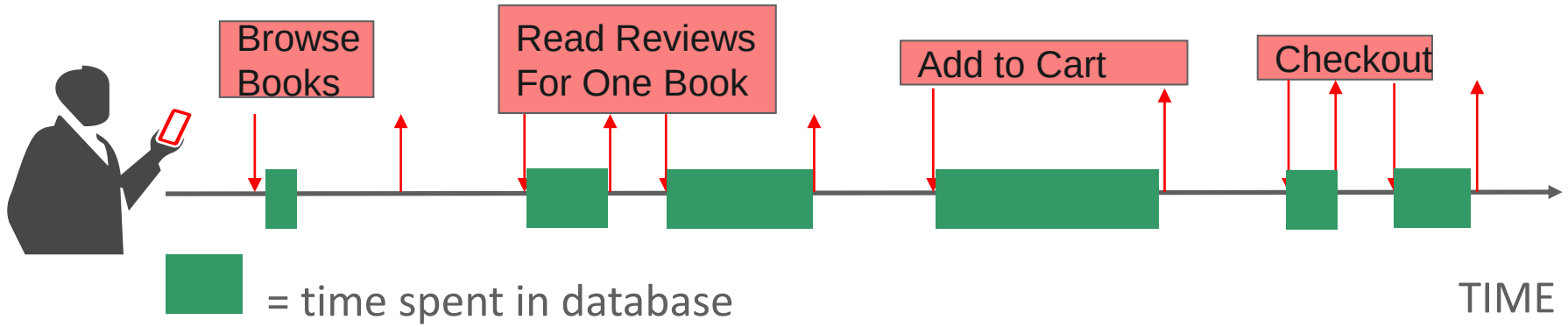
Session currently spending time in a database call

Database Time (DB Time) =

Total time session spent in all database calls

Average Activity of the Session (% Activity) =

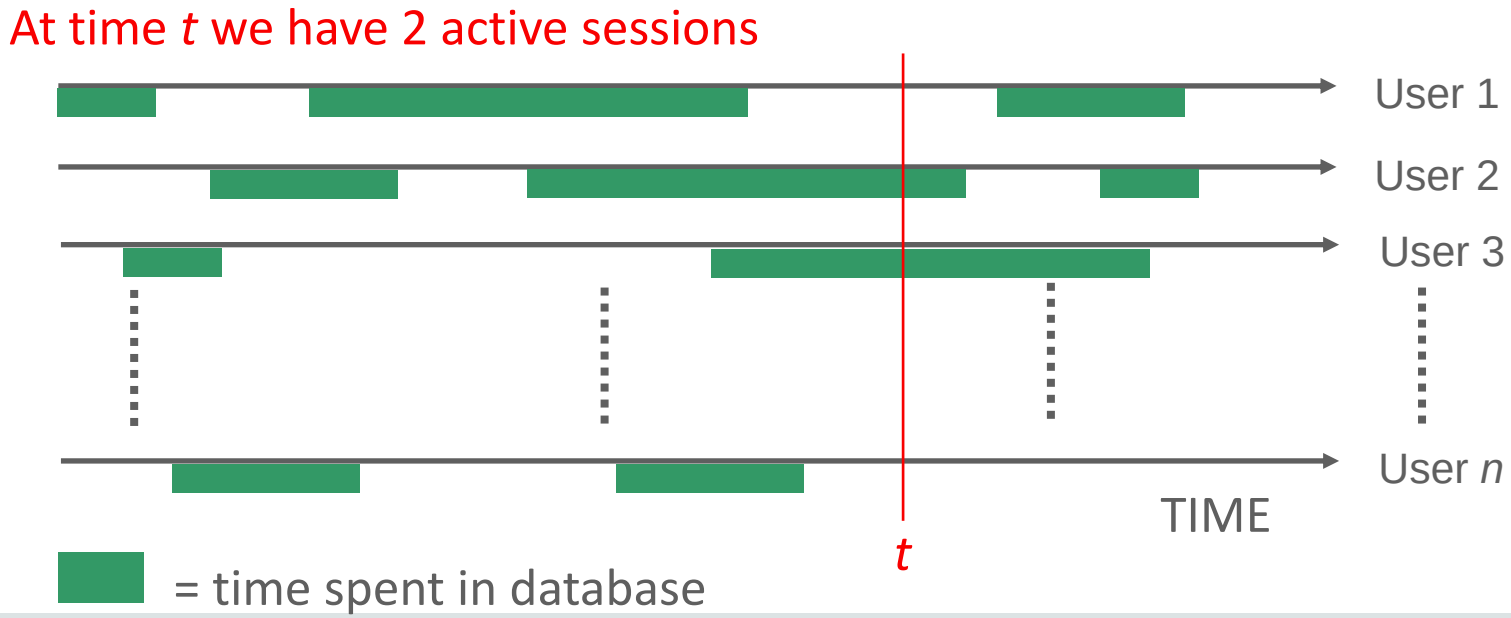
The ratio of time active to total wall-clock time



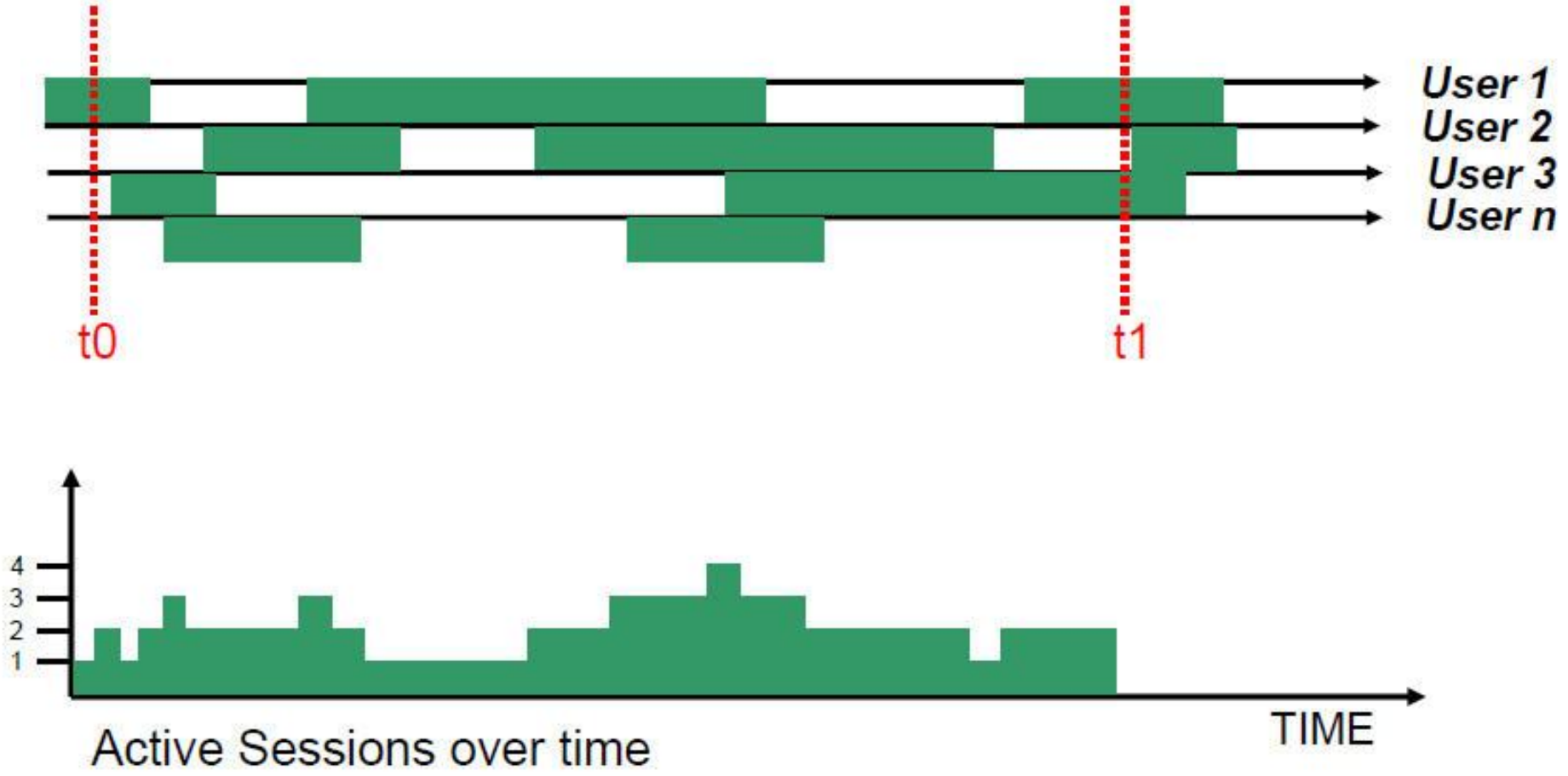
Multiple Sessions

- DB Time = Sum of DB Time Over All Sessions
- Avg. Active Sessions = Sum of Avg. Activity Over All Sessions

  = Sum(DB Time) / Elapsed Time



Visualizing DB Time

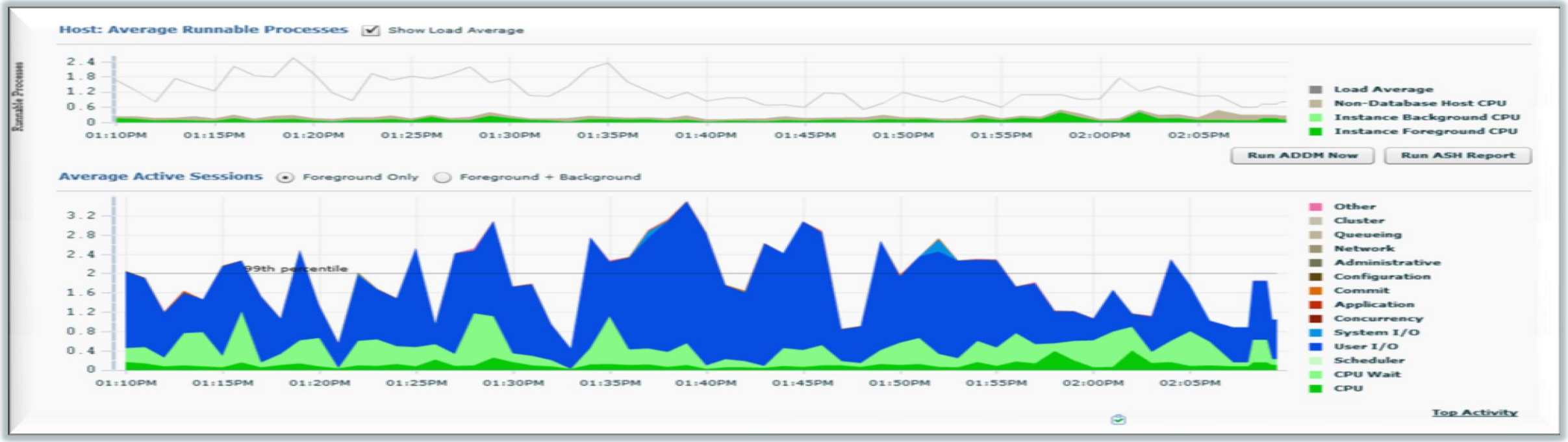


Quiz

An AWR report of snapshots taken between 15 minutes shows DB Time greater than 15 minutes. How is this possible?

- DB Time is the time spent in the database: Includes CPU time, IO time and non-idle wait time
- You have more than one session contributing to the "time" of the database.
- If you have 2 cpus, you have 2 cpu seconds per every 'real second’
- How can you have 30 minutes of enqueue wait in 15 minutes?
- Easy - 30 sessions waited one minute apiece, or two sessions waited 15 minutes or ……

Where to find DB time: EM Performance page



- Active Sessions by wait class over time
- Colored area = Amount of DB time, More the DB time, More the Problem
- DB time increases as system load increases , DB time increases as system performance degrades.

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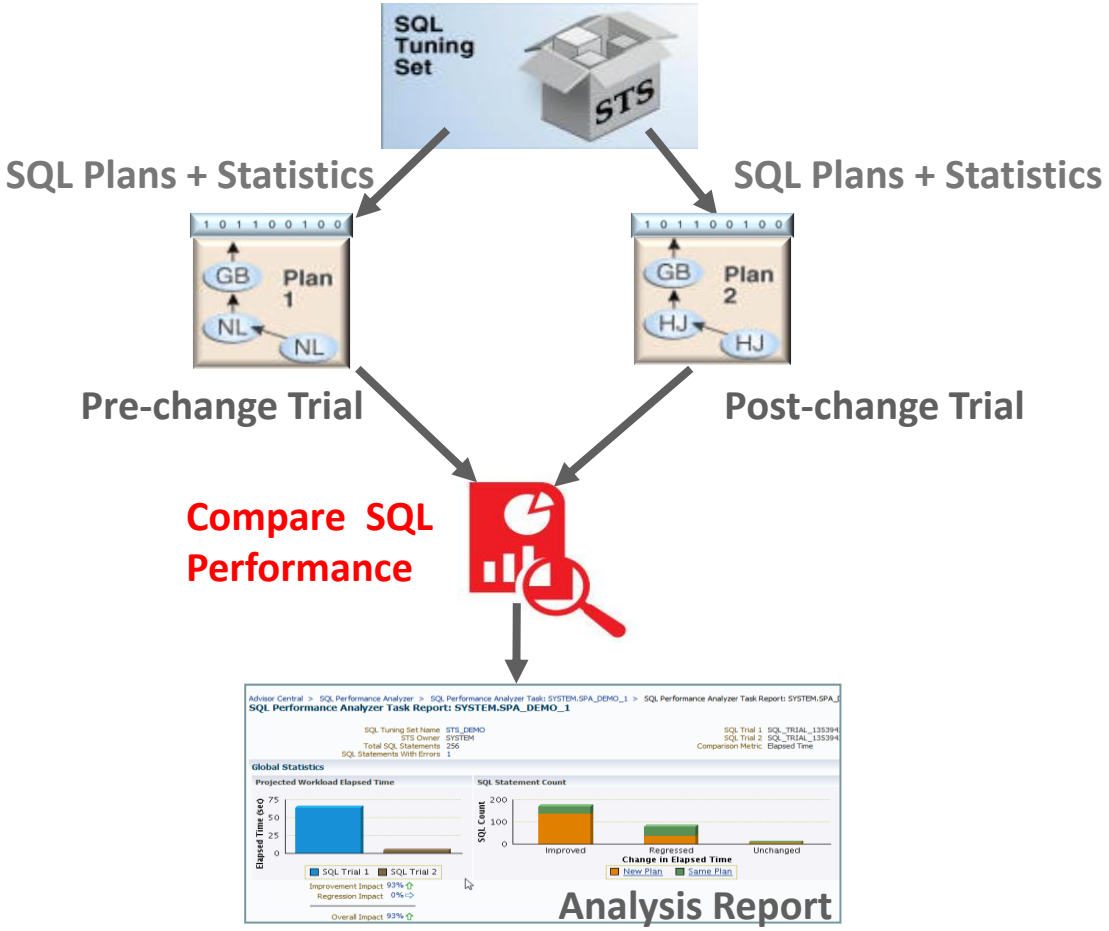
Performance Tuning Methodology

Proactive Performance Management

Reactive Performance Management

Proactive Performance Management: SPA Quick Check

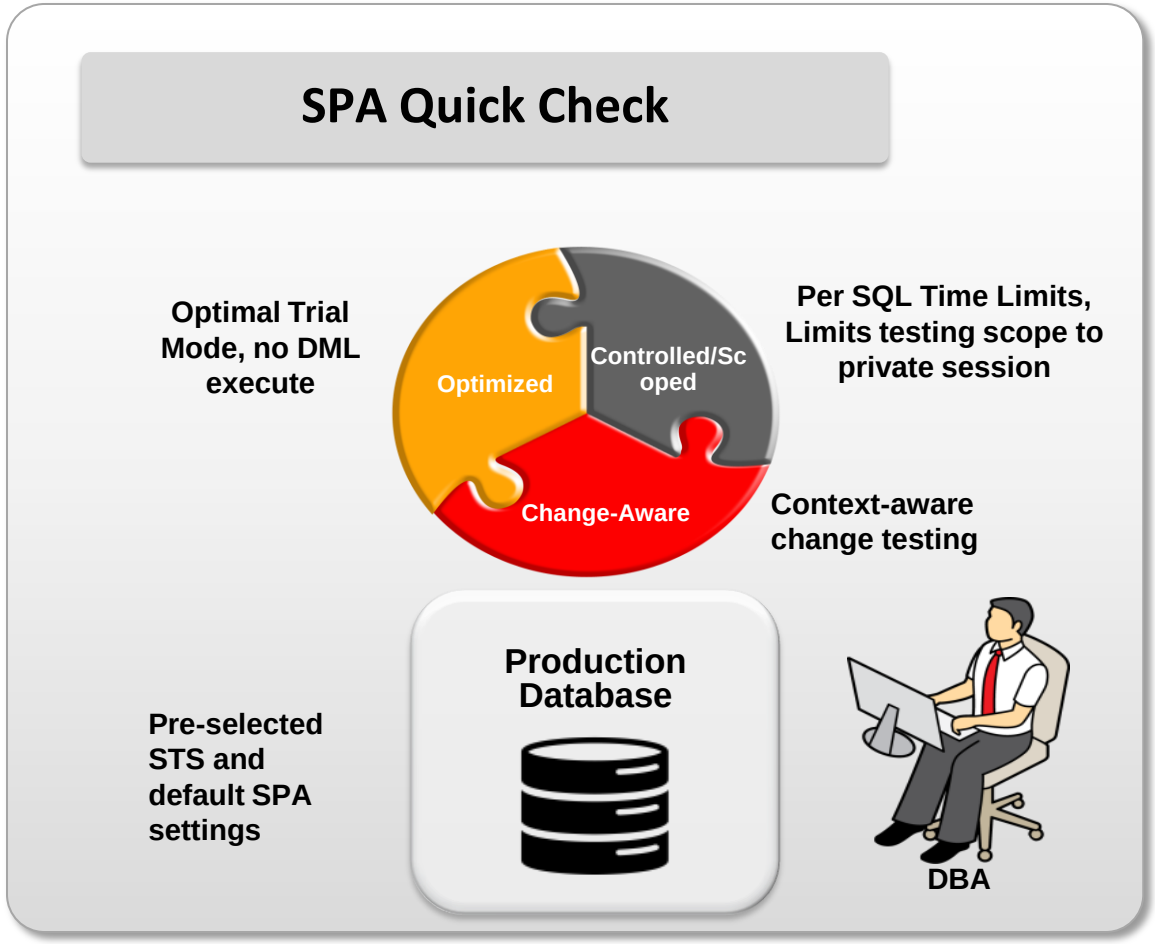
- Helps users predict the impact of routine system changes on production SQL workload
- Low overhead capture of SQL workload to SQL Tuning Set (STS)
- Build different SQL trials (experiments) of SQL statements performance by test execution or explain plan
- Day to day use cases integrated with SPA Quick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



Proactive Performance Management

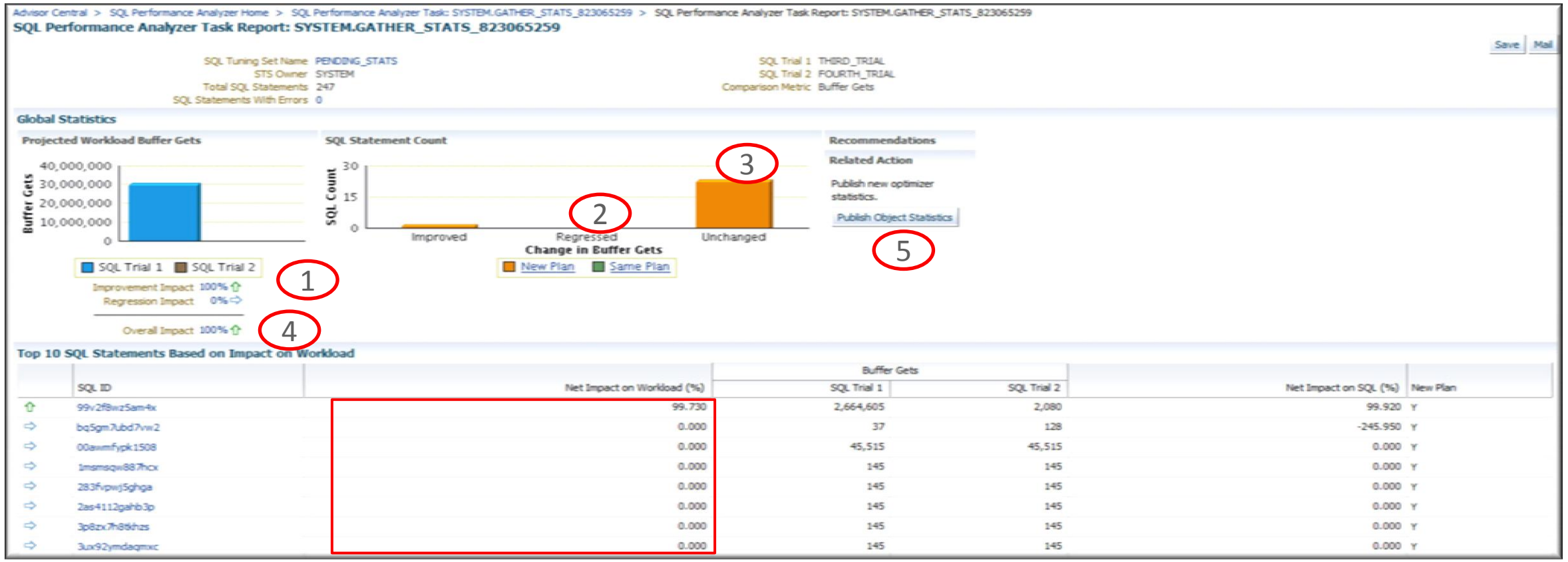
Predict the impact of routine system changes on SQL workload response time

- Optimized
  - Optimized for use on prod systems
  - Optimal Trial or Explain Plan mode
  - Disable multi-executions, full DML execute disabled
- Controlled
  - Per SQL time limits
  - Testing scoped to private session
  - Associate with Resource Consumer Group
- Change-Aware
  - Context-aware change testing workflows, such as,
  - Optimizer gather statistics
  - Init.ora parameter changes



Proactive Performance Management

Predict the impact of system changes on SQL workload response time



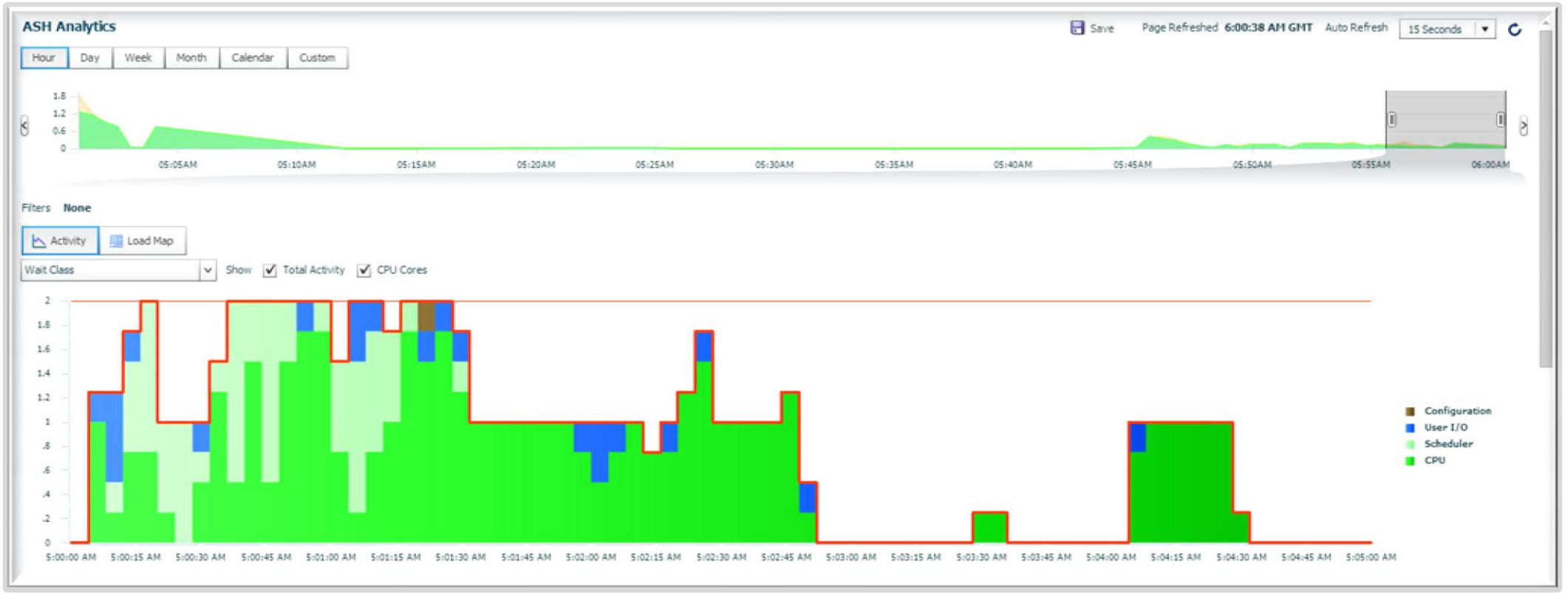
Performance Tuning Methodology

Reactive Performance Management

- Analyzing transient performance problems
  - ASH Analytics
- Diagnose persistent performance issues
  - ADDM
- In-depth SQL performance analysis
  - Real-Time SQL Monitoring
- Optimizing top SQL's with sub-optimal plans
  - SQL Tuning Advisor

Reactive Performance Management

Identify performance issues using ASH Analytics



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

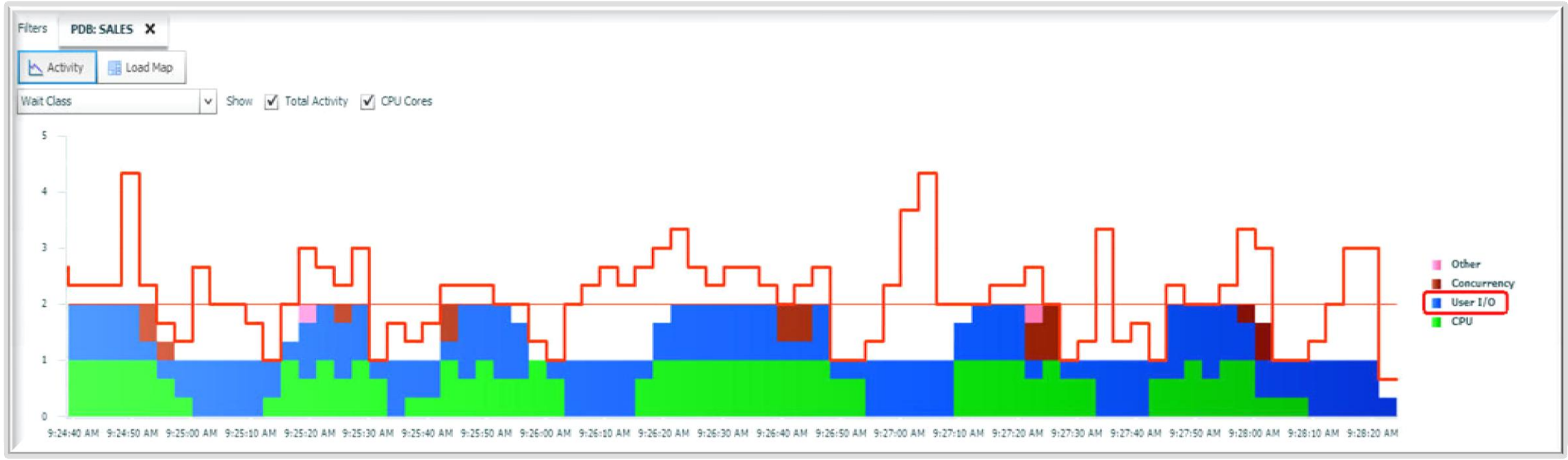
Reactive Performance Management

- I am a CDBA and asked to investigate transient performance issues reported by one application owner. I need to diagnose the cause of these issues and address them

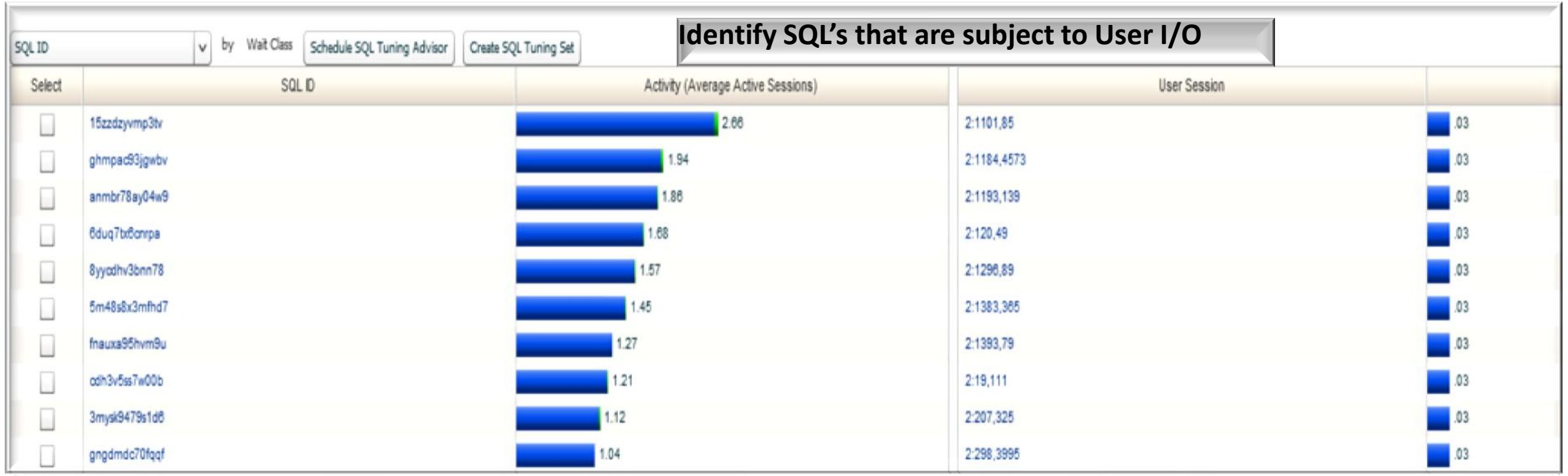
- AWR report indicates some unusual issues on the system
  - But I don’t get a PDB specific report…
  - What to do next?

Reactive Performance Management

Analyzing transient performance problems using ASH Analytics



ASH Analytics identifies User I/O as the problem



Which Database Performance Diagnostics Tool to Use?

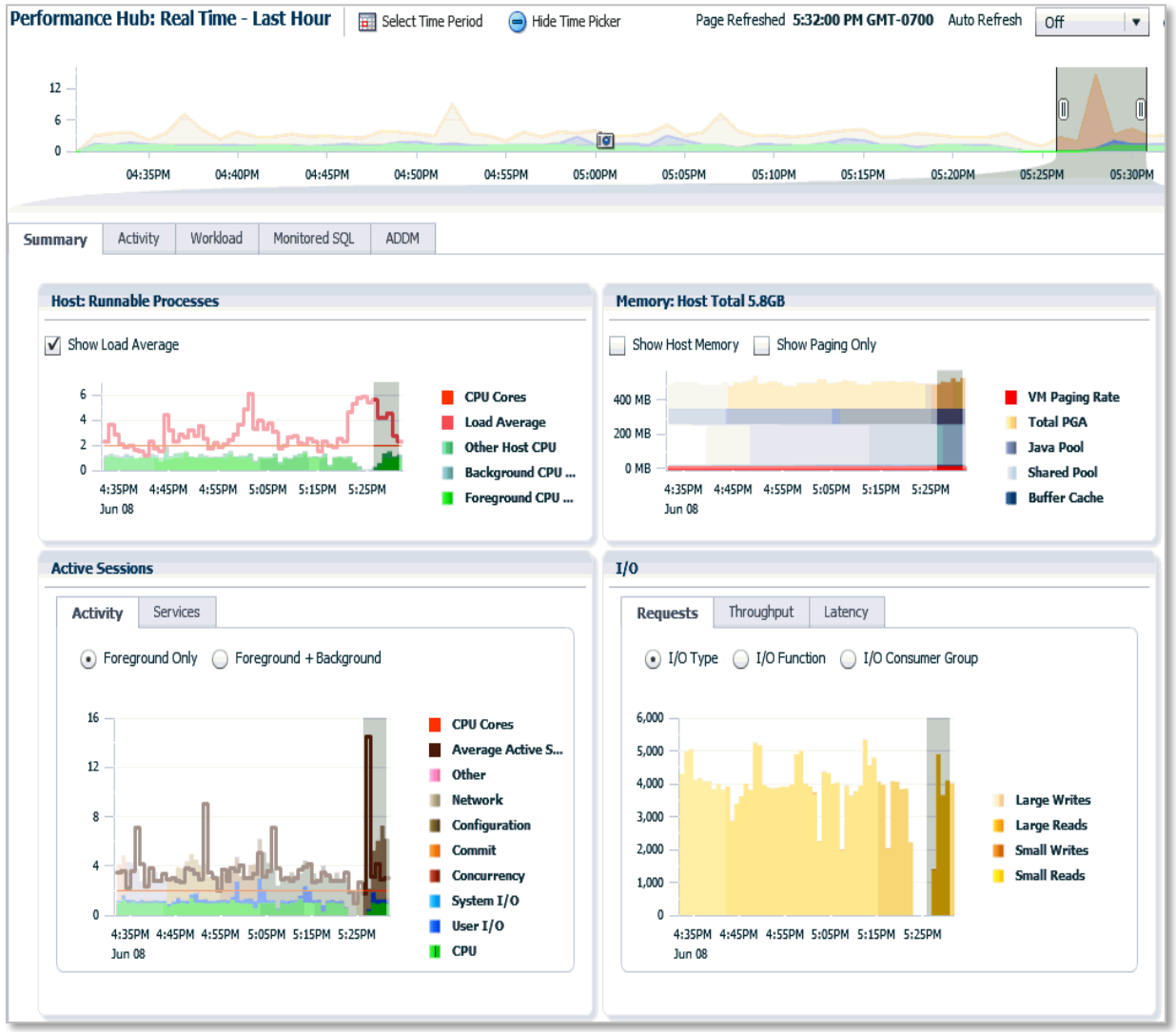
- Automatic Workload Repository – AWR Reports
  - Reports about performance and workload data from AWR
- Active Session History – ASH
  - Gathers fine-grain data about every active database session every second
- Automatic Database Diagnostics Monitor - ADDM
  - Data Analysis and Problem Identification
  - Findings and Advise on how best to resolve bottlenecks
- Real-time SQL and Database Operations Monitoring
  - Provides in-depth diagnostics about SQL execution at row source level

Database Performance Hub provides holistic performance management

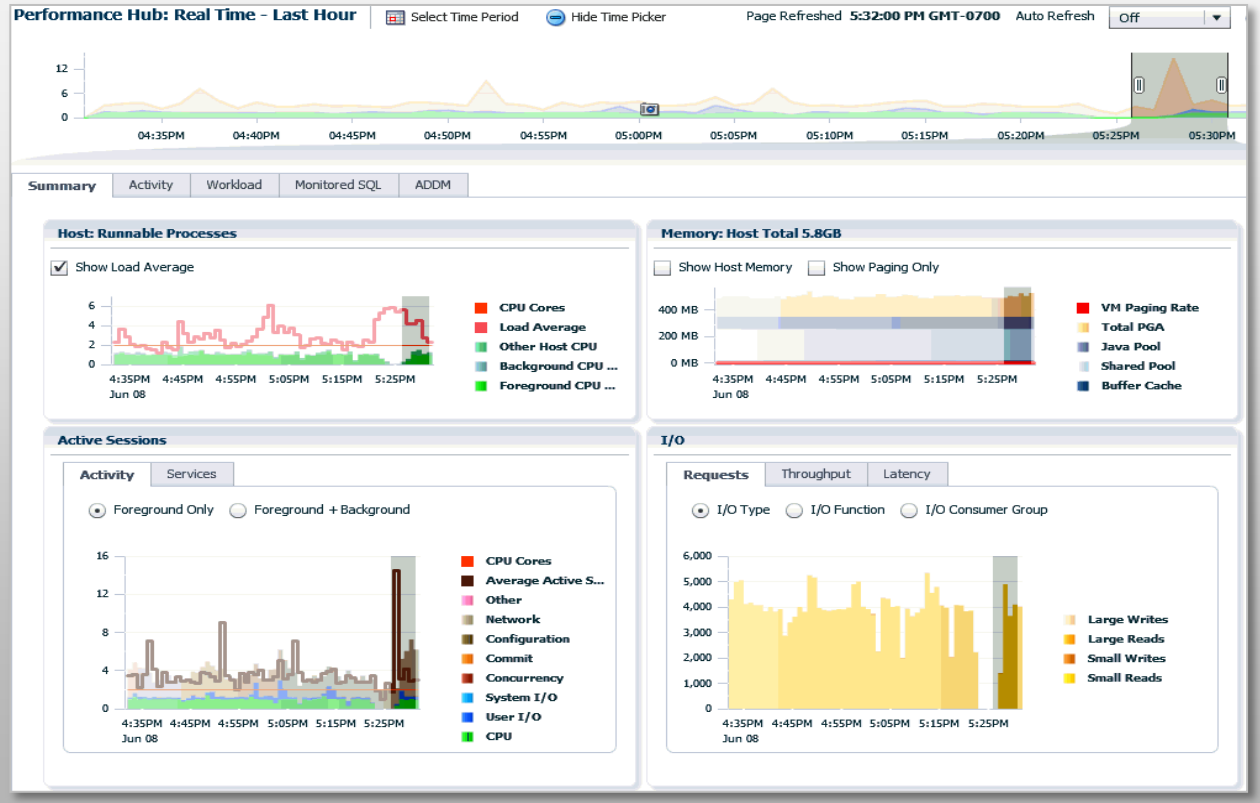
Database Performance Hub

Holistic Performance Management

- Single view of DB performance
  - ADDM, SQL Tuning, Real-Time SQL Monitoring, ASH Analytics
- Switch between ASH analytics, workload view, ADDM findings and SQL monitoring seamlessly
- Supports both real-time & historical mode
- Historical view of SQL Monitoring reports



Performance Hub Report



- New interactive report for analyzing AWR data
- Performance Hub report generated from SQL*Plus
  - @$ORACLE_HOME/rdbms/admin/perfhubrpt.sql

    OR calling dbms_perf.report_perfhub(….) function
  - Single view of DB performance
  - ADDM, SQL Tuning, Real-Time SQL Monitoring, ASH Analytics
- Switch between ASH analytics, workload view, ADDM findings and SQL monitoring seamlessly
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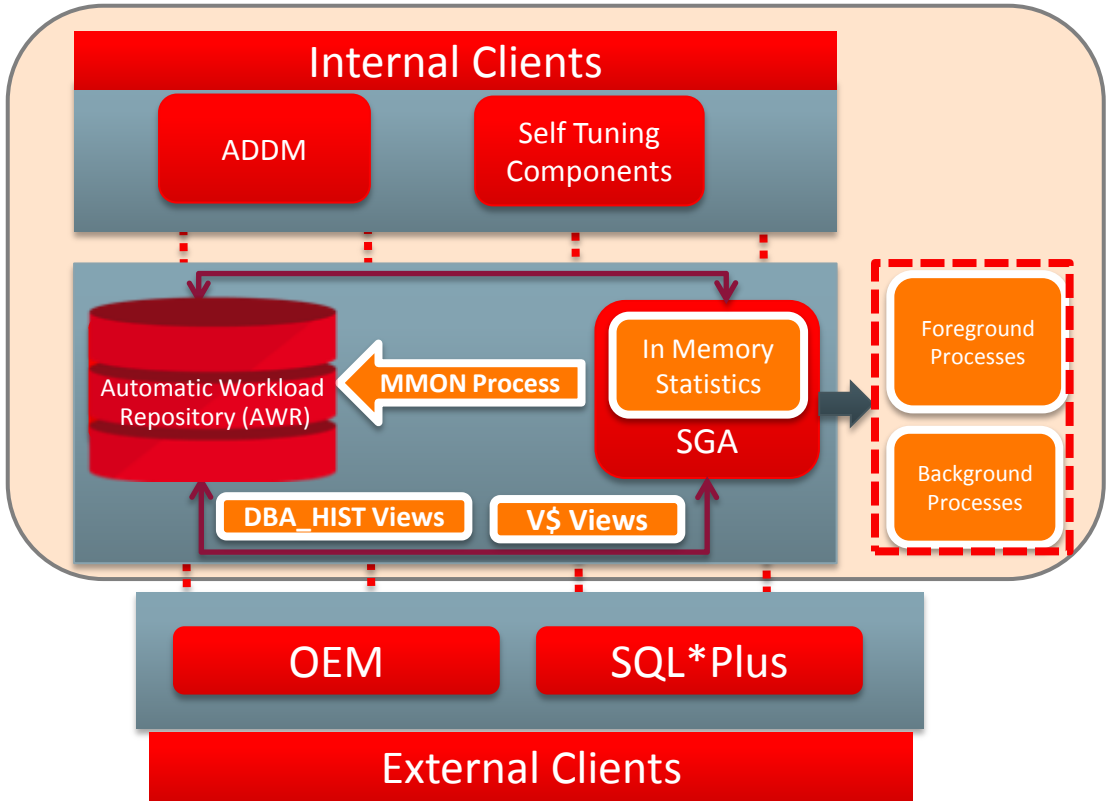
AWR and Multitenant: Background and Challenges

- Single AWR repository per database
  - For non-CDB resides in SYSAUX
  - For CDB resides in Root's SYSAUX (12.1)
- AWR does not have notion of AWR data for a PDB (no Top N per PDB)
- Partial AWR statistics
  - Missing Time-Wait model, sysmetrics statistics per PDB
  - No break down per PDB level at root
- AWR data not transportable along with PDB

AWR Architecture (pre-DB12.2)



AWR Enhancements for Multitenant

NEW IN 12.2

• CDB Level Snapshot Support

- Same functionality as in Oracle Database 12.1
  - CDB snapshots will be taken at the Root and stored at the Root's SYSAUX
  - Same default settings – automatic snapshots at every hour, retention period of 8 days
  - Automatic snapshots ON by default
- Enhanced content
  - More PDB-specific stats are collected and exposed via v$con_sysstats, v$con_sysmetric, v$con_sys_time_model

• PDB Level Snapshot Support

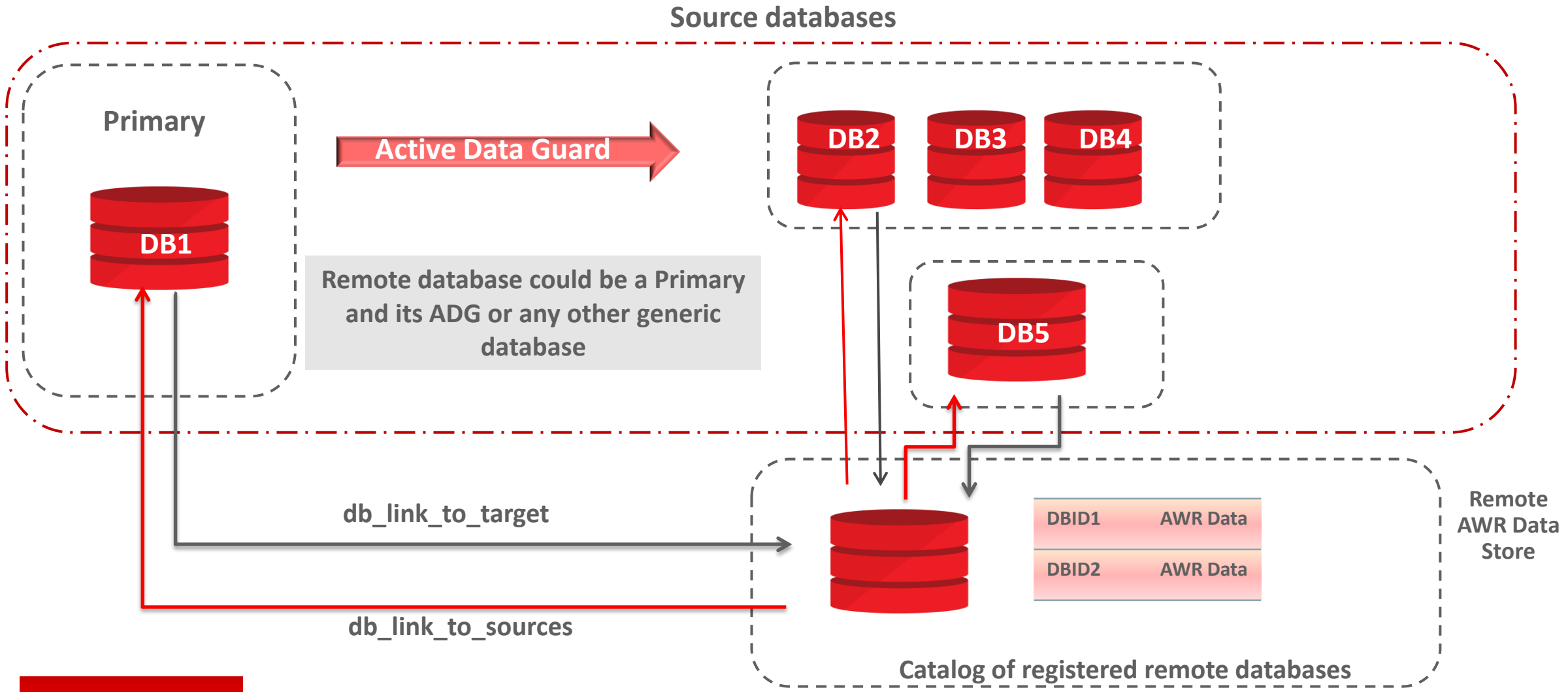
- Per PDB AWR with autonomous retention and snapshot settings
- Performance data for PDB stored in local SYSAUX
  - Snapshots contains data from PDB level v$ views
- Both manual and automatic snapshots supported
  - Automatic snapshots disabled by default, enable selectively

AWR Support for Remote Snapshots and ADG

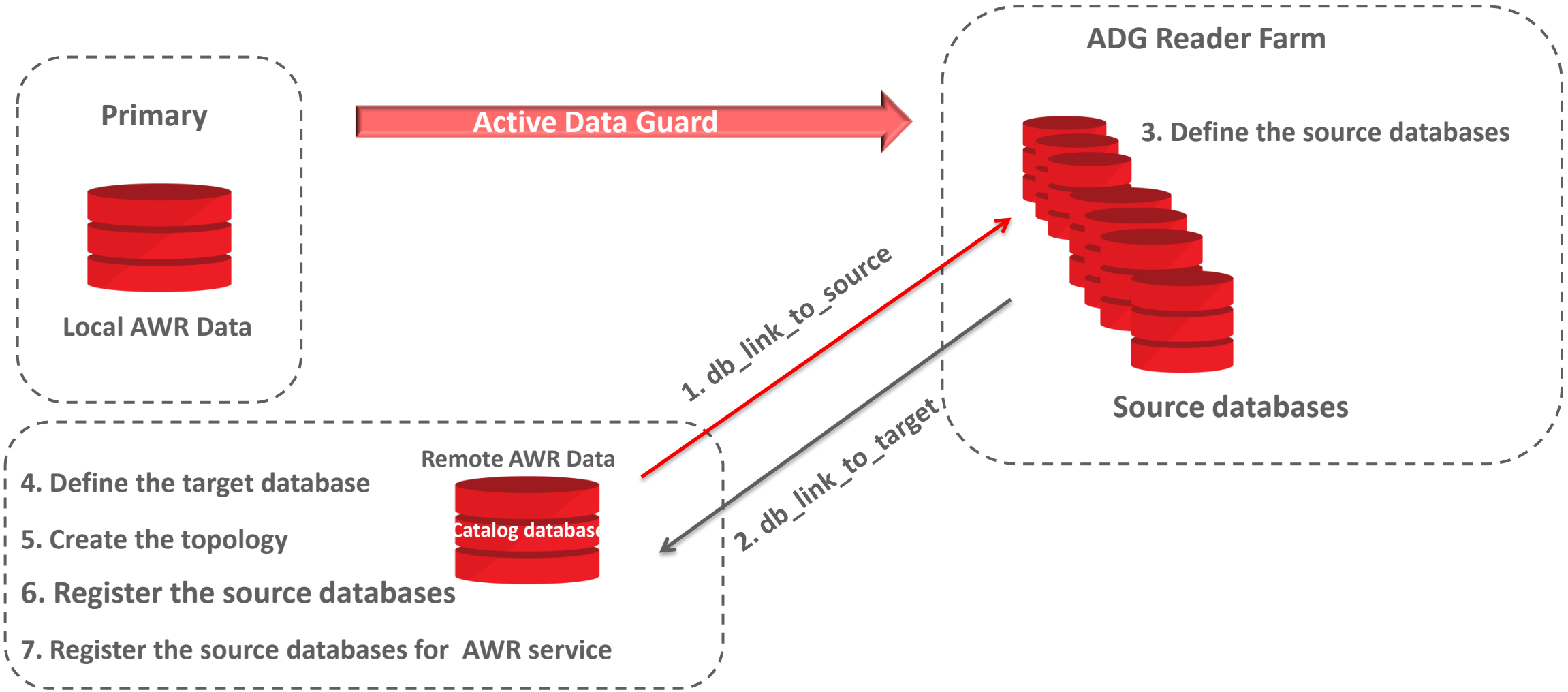
NEW IN 12.2

- Problem
  - AWR snapshots cannot be taken in a read-only standby environment
  - Performance monitoring and analysis is limited to basic STATSPACK functionality
- Solution
  - In Oracle Database 12.2, AWR framework enhanced to support capture of remote snapshots from any generic database including Active Data Guard (ADG) databases.
    - A target catalog database collects snapshots from the remote databases (sources)
    - Snapshots can be collected automatically or manually
    - AWR tables on the catalog database accumulate snapshot data from all sources via database links
    - Source databases must be registered on the catalog via new DBMS_WORKLOAD_REPOSITORY.REGISTER_REMOTE_DATABASE API

AWR Unified Manageability Framework topology



Remote Snapshot Configuration for ADG Database



SQL Tuning Advisor Support for Active Data Guard

NEW IN 12.2

- Problem
  - ADG databases are widely used to offload reporting or ad hoc query-only jobs from primary
  - Reporting workload profile is different from primary and often requires tuning
- Solution
  - Oracle Database 12.2 introduces the ability to tune SQLs workloads running on ADG database
  - All SQL Tuning Advisor tasks issued at the standby
    - Create tuning task, execute tuning task and implement SQL Profile recommendations can be run on standby
    - Test execution (heavy lifting) happens on standby, only minimal write related activity on primary
  - The required data for the above tasks are fetched from primary over a database link from standby
  - Task details and tuning results are stored at primary and the essential data required to construct the report is accessed remotely from primary
  - The report is constructed locally at the standby, with no CPU overhead in primary

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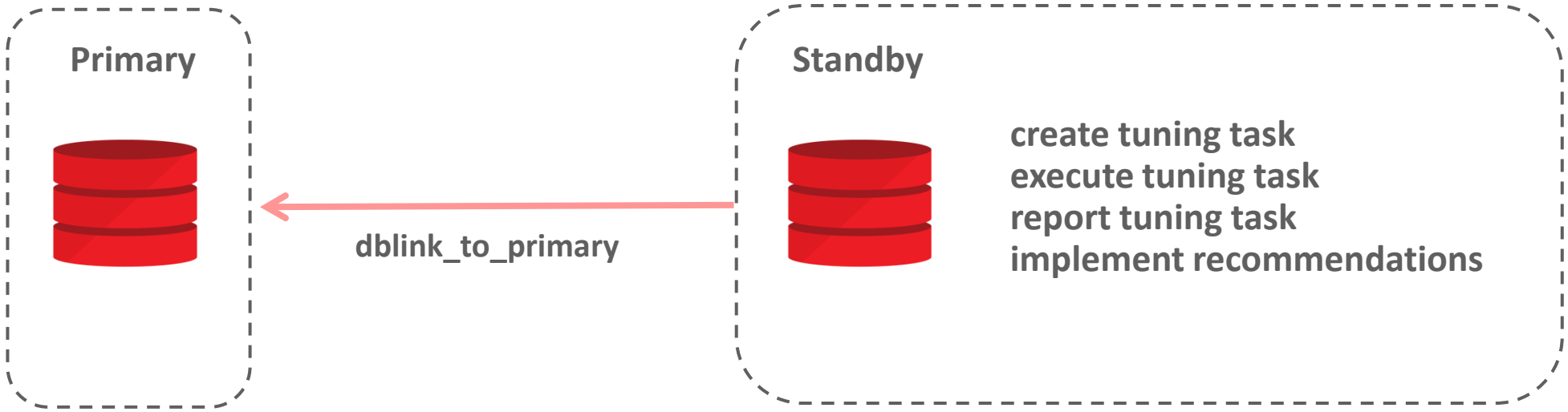
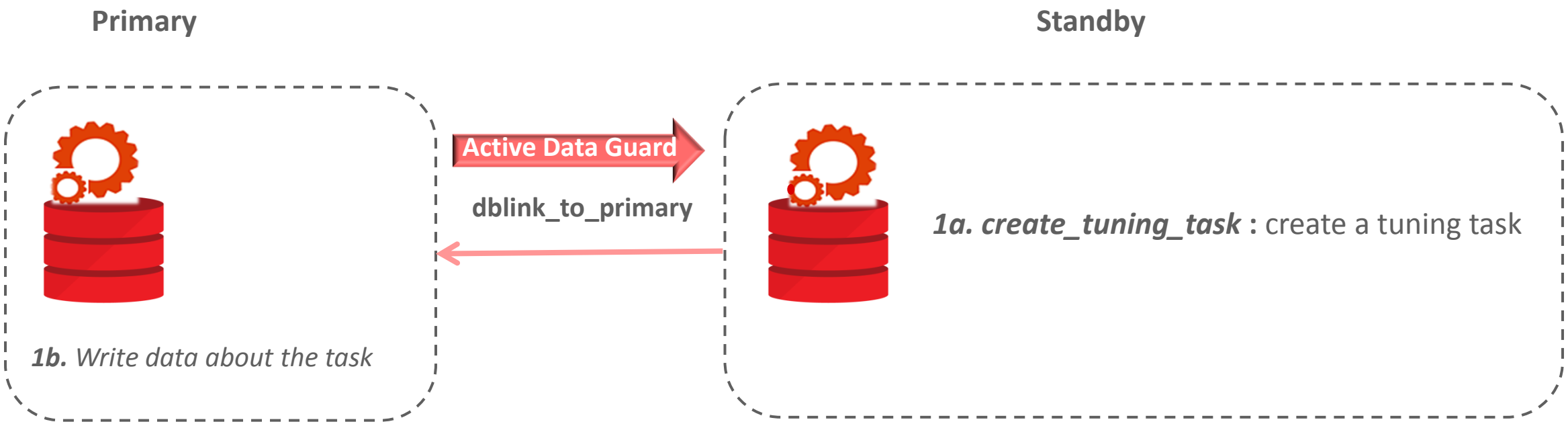
SQL Tuning Advisor Support for Active Data Guard



- All changes are done on primary and propagated from primary to standby by redo apply
- Support for PDB level tuning
- The tuning task is executed at the standby, with no CPU overhead in primary

SQL Tuning Advisor Support for Active Data Guard



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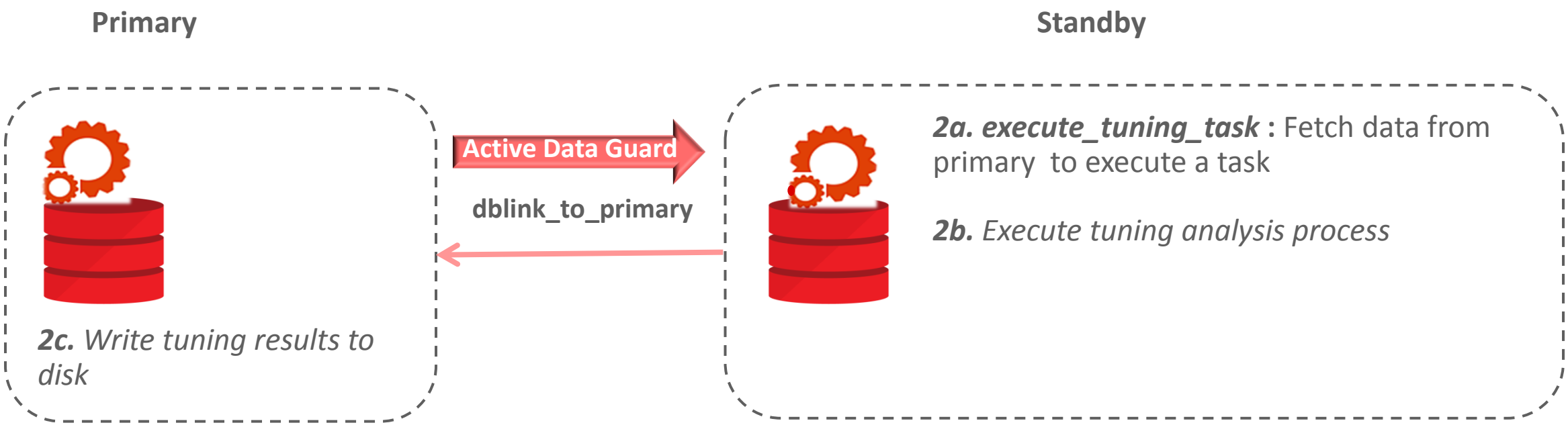

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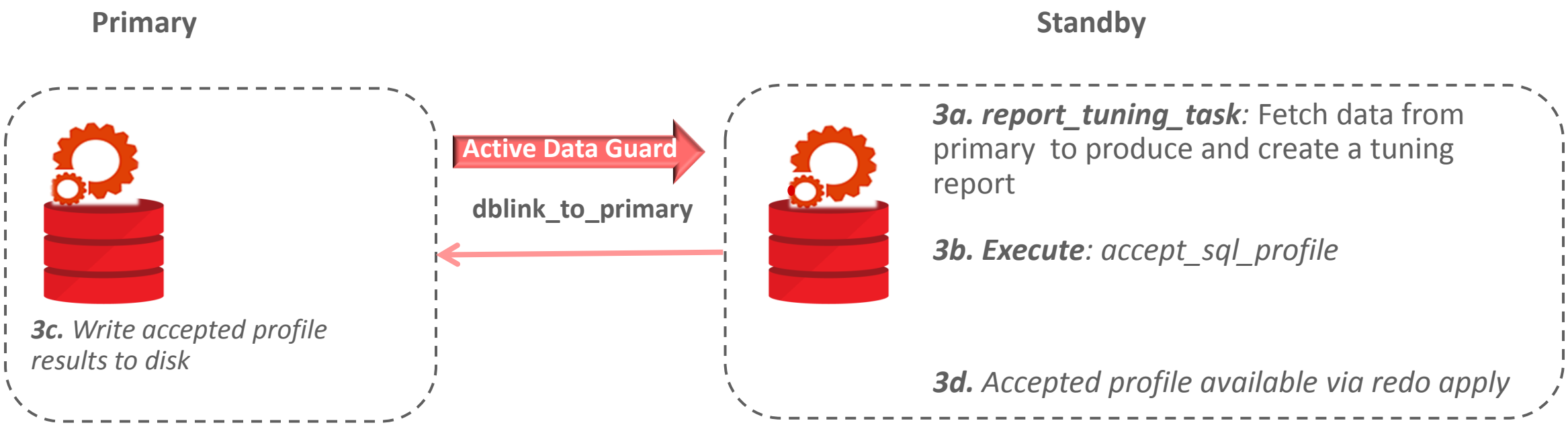

Performance Tuning Methodology: Summary

Proactive Performance Management

- SQL Performance Analyzer Quick Check

Reactive Performance Management

- ASH Analytics
- ADDM
- Real- Time ADDM
- Real-Time SQL Monitoring
- SQL Tuning Advisor
- Performance Hub for holistic management

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