Moving Databases to Oracle Cloud: Performance Best Practices

September 18–22, 2016
San Francisco

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Agenda

Oracle Database Cloud Migration:

1. Which Oracle Cloud Service
2. How to Migrate
3. How to Validate Performance

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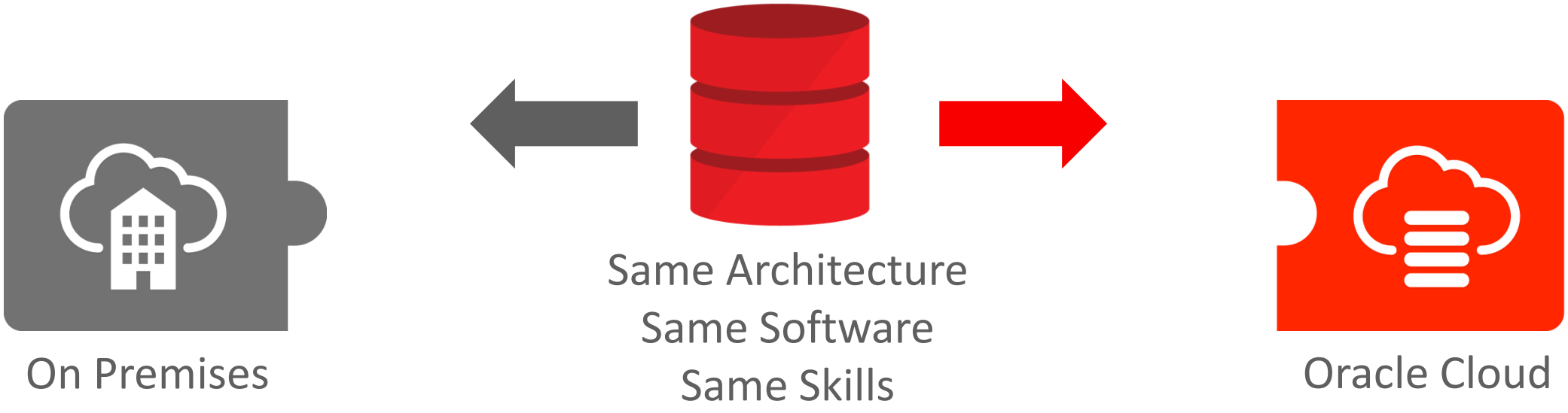
Oracle Database Cloud Service

Full portability

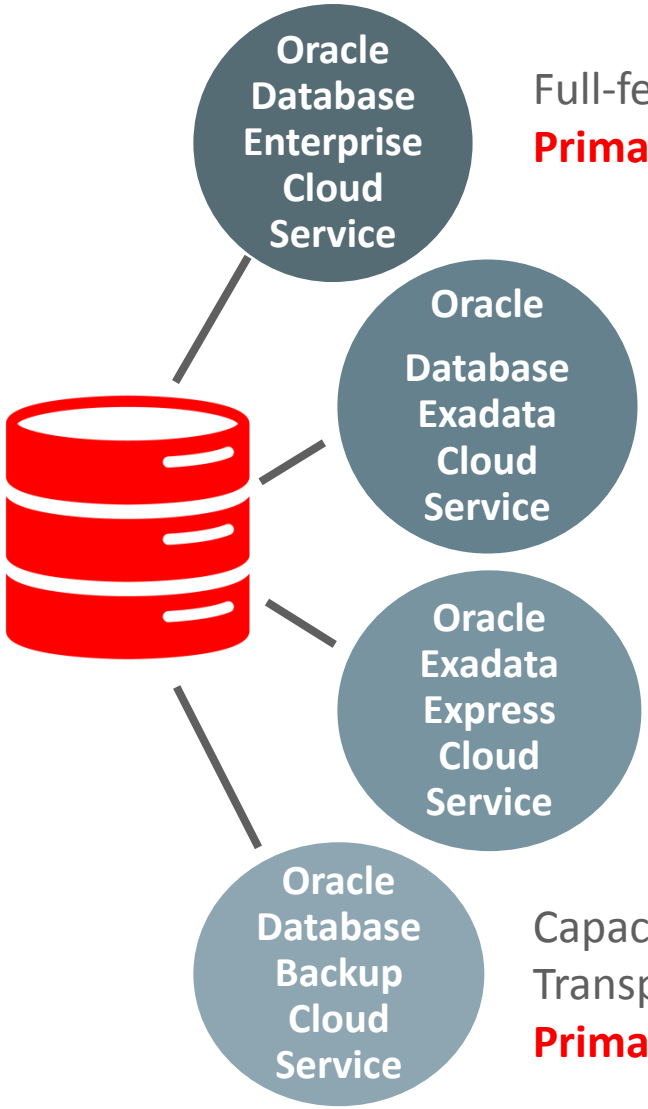


ORACLE ENTERPRISE MANAGER 13c

Enterprise Manager manages both On Premises and Cloud

Oracle Database Cloud – Overview of Services

- 100% compatibility with on-premises
- Fully automated or managed backups, patching and tooling
- Simple to move locations or create a hybrid cloud
- Simple provisioning in a few clicks



Full-featured dedicated single-node/RAC database
Primary Use Case: Dev, test and deployment of existing apps

Highest-performing and most-available database platform
Primary Use Case: Mission-critical applications and high density database consolidation

Fully managed Pluggable Database for app dev with APEX, SQL Developer, Java Cloud and RESTful Web Services
Primary Use Case: Development and deployment of departmental applications

Capacity on demand eliminates storage hardware planning
Transparent management, redundancy and highly available
Primary Use Case: Enterprise data security protection and privacy

Oracle Database Cloud – Software Editions

Standard Edition(2)

- Full database instance
- Up to 16 OCPUs and 240GB of memory

Enterprise Edition

Adds all 11g or 12c Enterprise Edition features

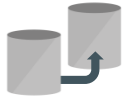
- All standard EE features

All new tablespace datafiles are encrypted by default across all versions

EE High Performance

Adds most 12c EE options


Multitenant


Data Guard


Partitioning


Advanced Compression


Advanced Security, Label Security, Database Vault

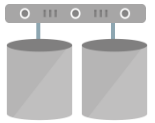

Real Application Testing


OLAP, Analytics, Spatial and Graph

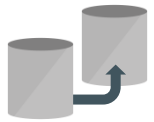

Management Packs

EE Extreme Performance

Adds all 12c EE options


RAC


In Memory


Active Data Guard

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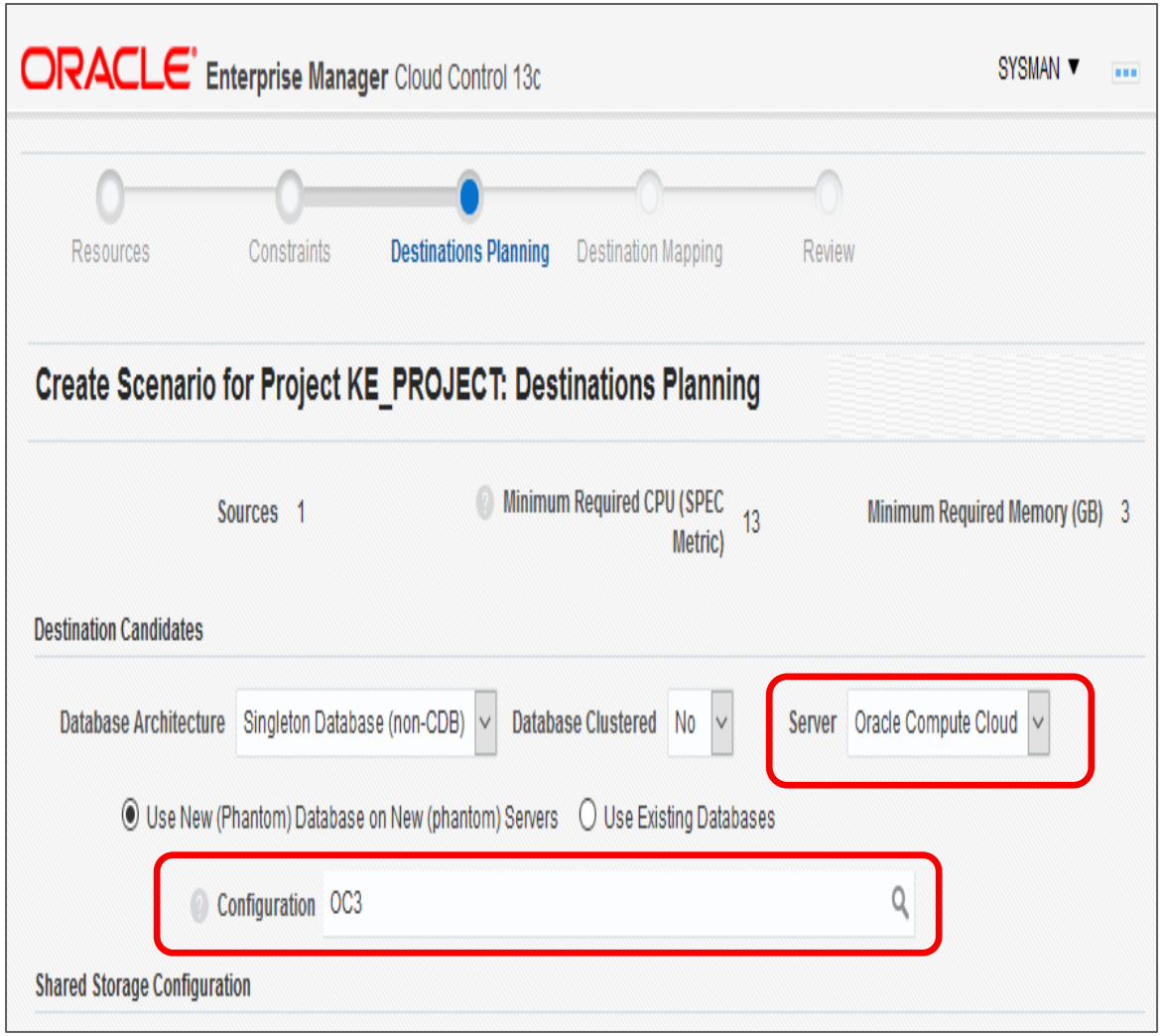
Use Database Consolidation Workbench to Determine Compute Shape

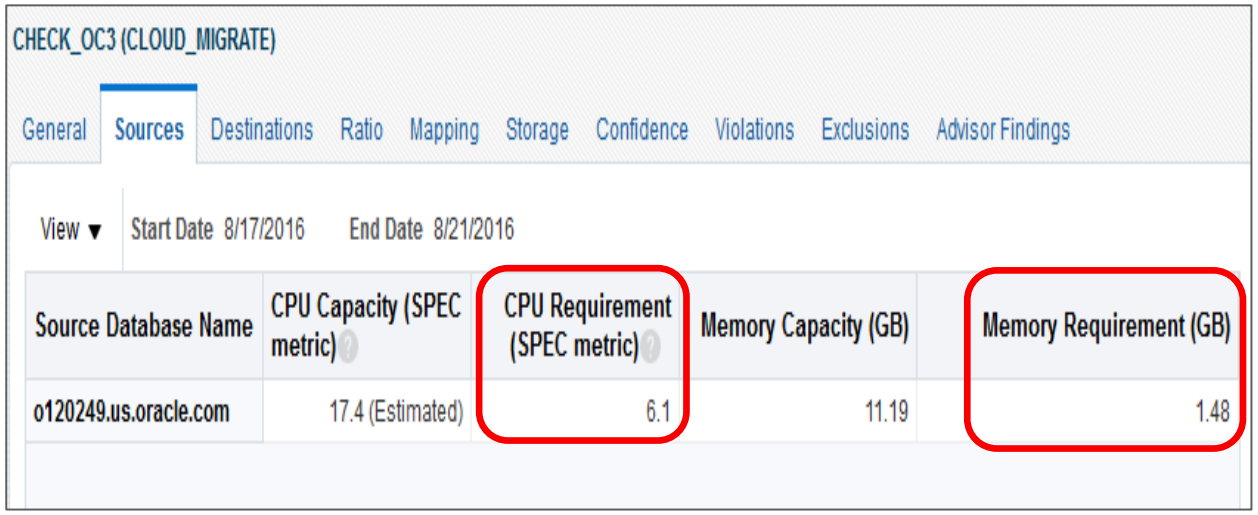
- Use Database Consolidation Workbench (EM13c) to determine target environment has sufficient resources for your databases
  - Evaluates source databases and validates that target cloud environment has sufficient resources to handle the workload
  - Analysis based on historical workload
    - AWR
    - Enterprise Manager database and host metrics
  - Gives target platform advice, including storage, I/O, compression

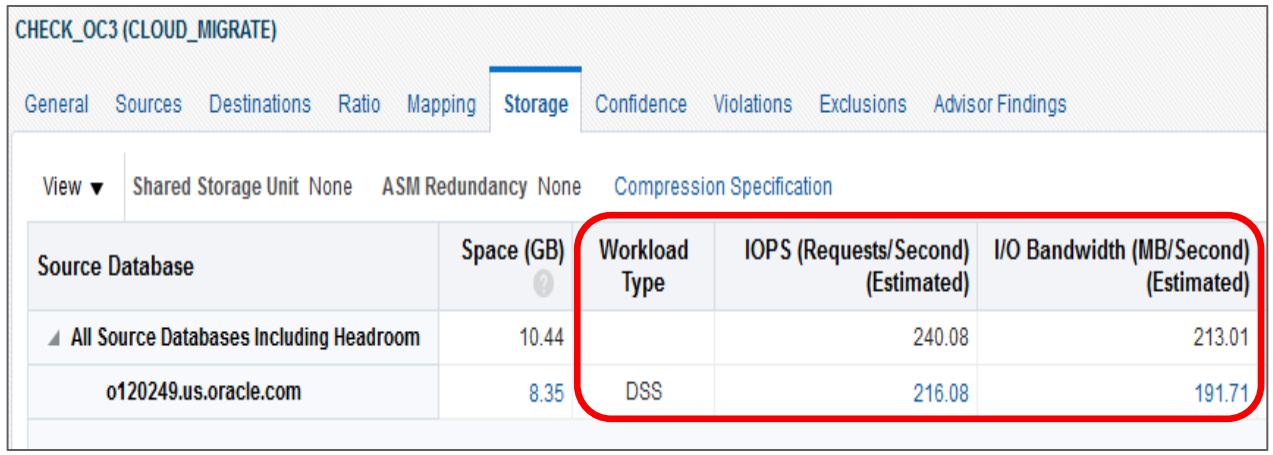


Database Consolidation Workbench

Evaluates Requirements

- Database Consolidation Workbench evaluates source database usage to determine cloud requirements
  - CPU
  - Memory
  - I/O workload
    - Workload type – DSS or OLTP
    - IOPS
    - I/O Bandwidth

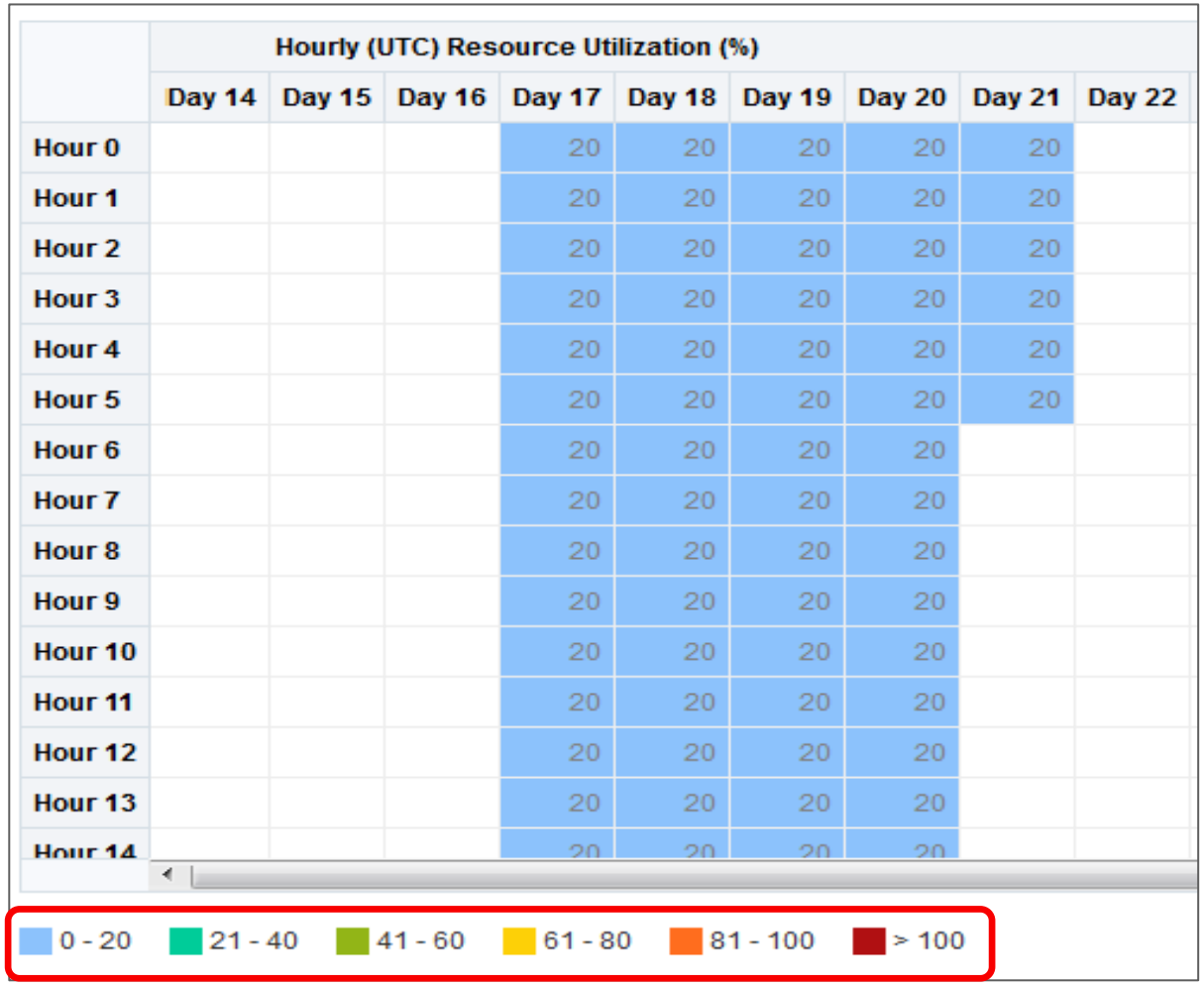




Database Consolidation Workbench

Predicts Cloud Target Utilization

- Using metrics from source database, Database Consolidation Workbench creates a heatmap showing expected hourly utilization of target cloud database
- SLA violations will be flagged



Oracle Database Cloud Service

Data Loading into a Database as a Service

- Oracle Data Pump Export/Import Utility (10.2+)
- Transportable Tablespaces (8i+)
- Pluggable Databases (PDBs) (12c)
  - Remote Cloning
  - Lift and Shift
- Dataguard
- GoldenGate Cloud Service
- SQL*Loader / External Tables
- Import/export (5+)

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How To Validate Performance

- Create a Performance Baseline
- Remove Unnecessary Parameters
- Preserve SQL Plan Baselines and SQL Profiles
- Validate SQL Response Time
- Validate Throughput

Create a Performance Baseline

Gather and Save Performance Data

- Gather accurate performance data from production
  - Use Automatic Workload Repository (AWR)
    - Minimum of 30 days of data
    - Snapshots interval 30-60 minutes
      - Extract and save AWR data

        ```
        SQL> @?/rdbms/admin/awrext.sql
        ```

      - Load data on target instance

        ```
        SQL> @?/rdbms/admin/awrload.sql
        ```

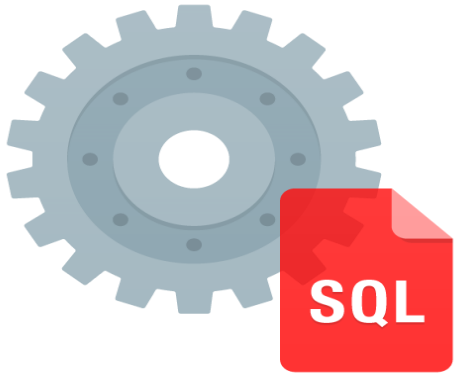
      - Use AWR diff report to compare performance of source and target system for specific time periods

        ```
        SQL> @?/rdbms/admin/awrddrpt.sql
        ```

Create Performance Baseline

Gather SQL Response Time Data

- Collect SQL performance data in a SQL Tuning Set (STS)
- An STS is a collection of SQL statements, execution plans and performance statistics (CPU_TIME, DISK_READS, BUFFER_GETS, etc.)
  - Create STS
    - By polling the cursor cache over time
    - Load from AWR data
- SQL Tuning Set usage
  - Input for SQL Performance Analyzer (SPA)
    - Can be converted to a SPA trial
  - Input to SQL Tuning Advisor

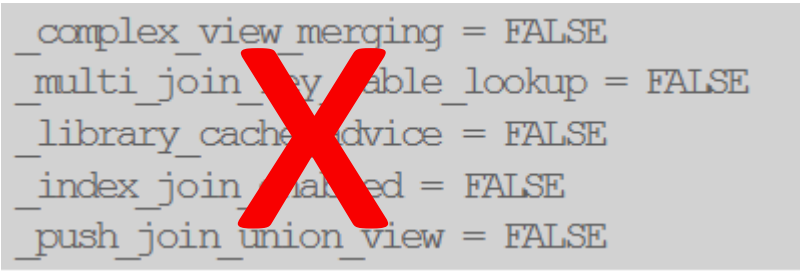


Preserve SQL Baselines and SQL Profiles

- Will need to migrate SQL Baselines and SQL Profiles along with database
  - Export from source database
  - Import to target database
- Use same methodology for SQL Baselines in the cloud as you used for on-premise database
- SQL Profiles – if testing time permits, use SQL Tuning Advisor to regenerate SQL Profiles for cloud environment – may be more optimized for target environment

Remove Unnecessary Parameters

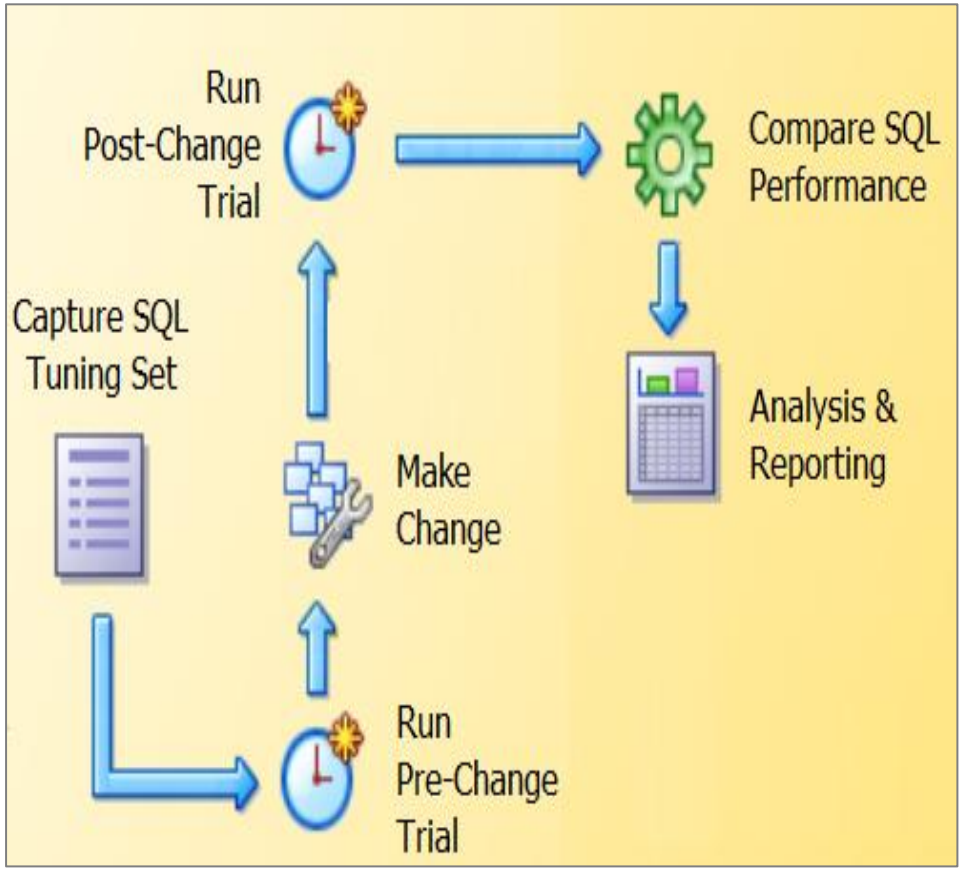
- Review and simplify spfile / init.ora
- Only have non-default parameter values set for clearly understood reasons
  - Minimizing non-default parameters means will execute most common code path – most optimized, fewest potential issues
- Underscore parameters particularly suspect
  - Frequently set to work around issues or behaviors no longer present in newer database versions
  - Unset as many as possible when migrating to cloud
- Exception: Follow packaged application vendor recommendations, e.g. EBS, SAP, Peoplesoft



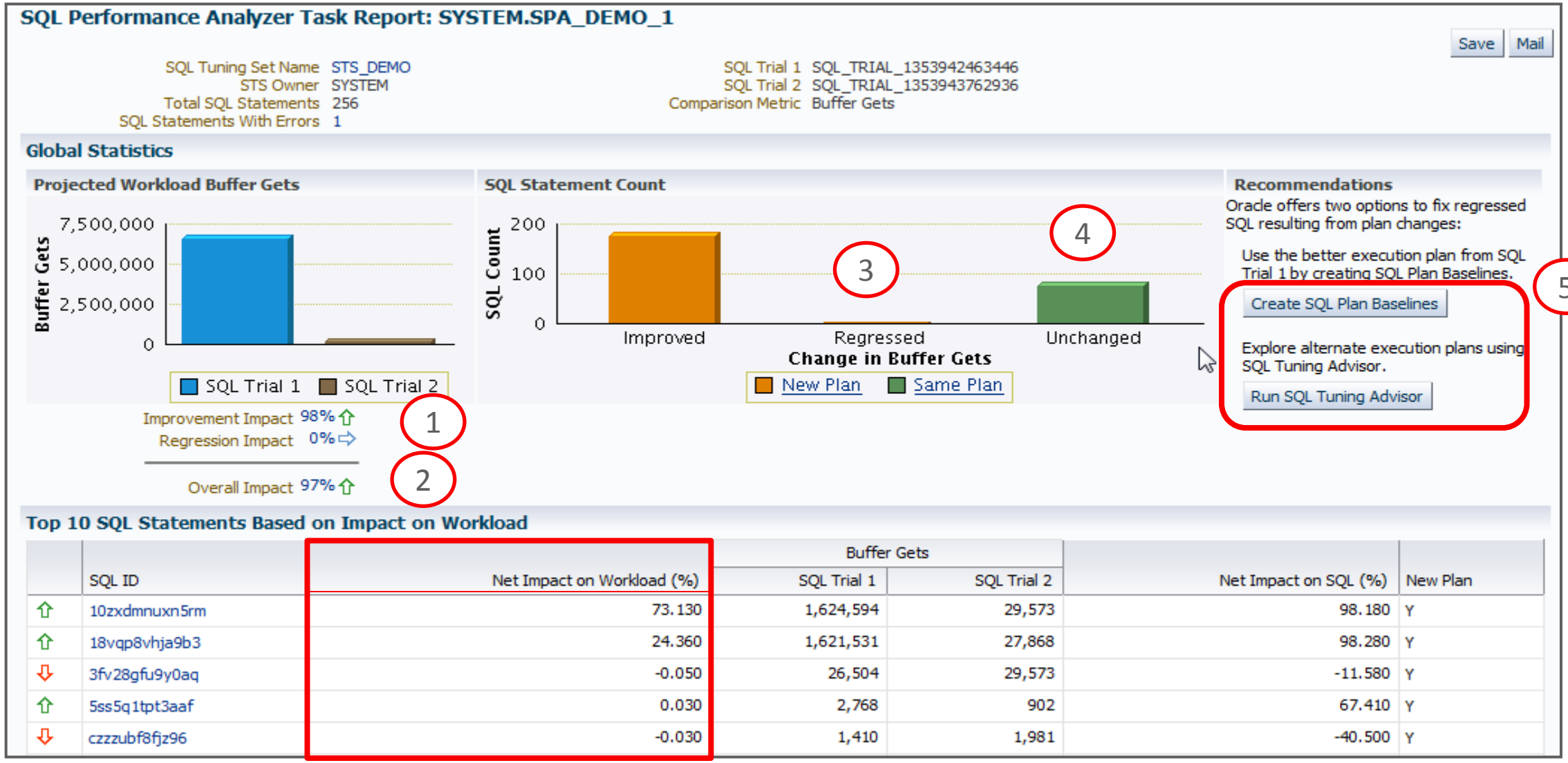
Validate SQL Response Time

SQL Performance Analyzer

- Helps users validate SQL response time in the target environment
- Low overhead capture of SQL Tuning Set (STS) on current production system
- Migrate STS to cloud, convert to SQL trial 1
- Execute SPA trial 2 on cloud
- Analyze performance difference between trial 1 and trial 2
- Offers fine-grained performance analysis on individual SQL
- Integrated with STS, SQL Plan Baselines, & SQL Tuning Advisor to remediate regressions



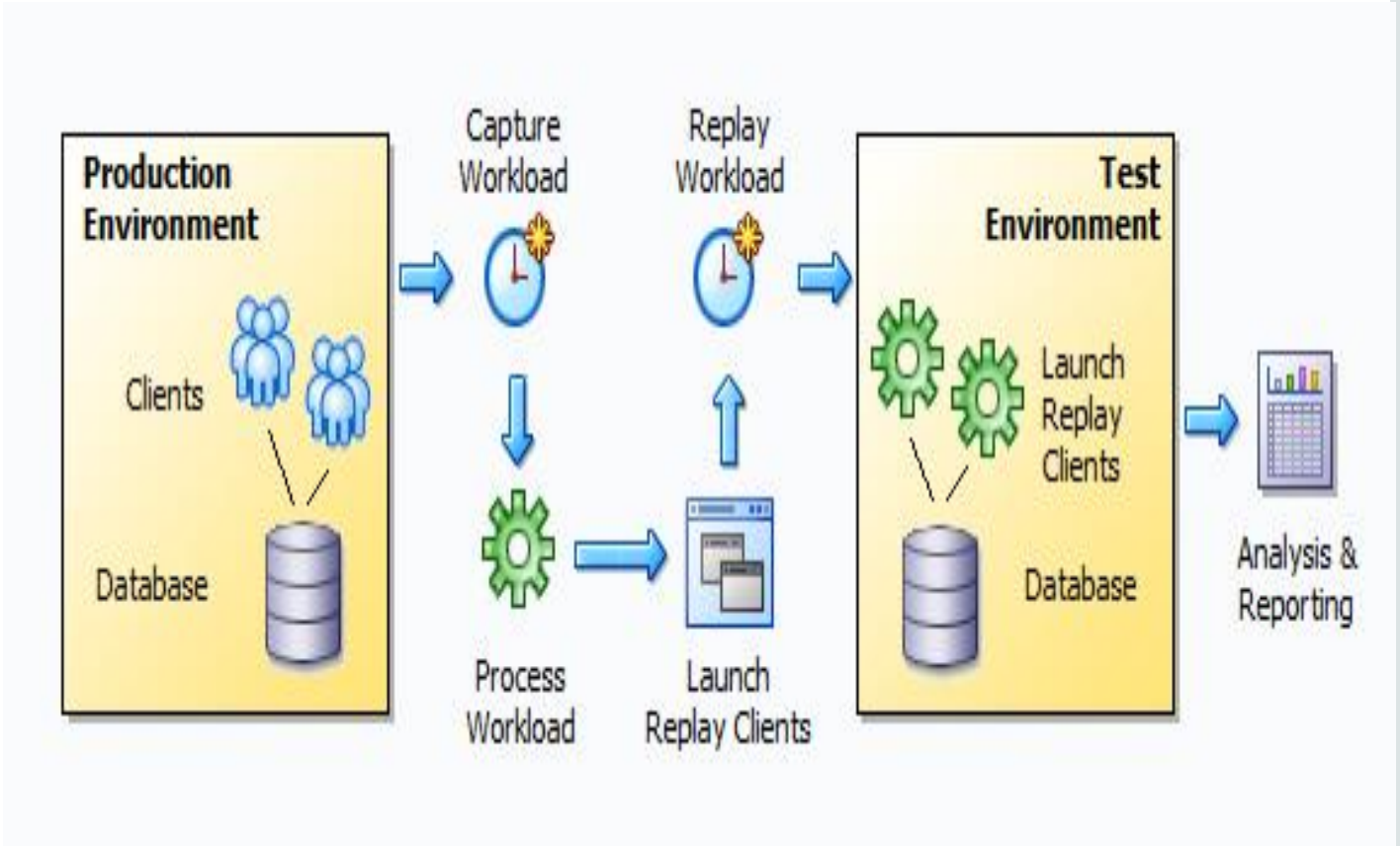
SPA Report



	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

Use Database Replay to Validate Throughput

- Database Replay validates target system's ability to handle required throughput
- Database Replay enables database load and performance testing with real production workloads
  - Fully maintains production workload characteristics such as timing, transaction dependency, think time, etc.
- Identify and remediate application scalability and concurrency problems in multitenant and non-CDB databases
- Capture workload from on premise database
- Replay workload on cloud



Database Cloud Testing: Validating Throughput Steps

Recommendation

- For throughput validation use Database Replay
  - Provision cloud database
  - Capture workload from production database
  - Use wrc/calibrate to estimate number of replay clients required
  - Provision cloud compute server to host replay clients
  - Migrate workload to either cloud database server or cloud client host
    - NFS cross mount the workload directory between database and client hosts
  - Execute replay
  - Analyze results
  - Remediate regressions

Database Cloud Validation Best Practices

- Validate SQL response time
  - Use SPA - unit test before load test
- Validate throughput
  - Use Database Replay
  - Capture and replay a manageable amount of time – e.g. 1 to 2 hours
  - Key metric for Database Replay is DB Time
  - Capture SQL Tuning Sets during capture and replay for additional validation
- Use Enterprise Manager 13c with the latest database plug-in
  - Implements best practices
  - Wizards guide you through the capture and replay process
  - Long term repository for storing and analyzing test results

Database Performance Management in the Cloud

Deliver Consistent Quality of Service across Private and Public Clouds

Use “Find > Fix > Validate” Methodology: Effective Accurate, and Automated

STEP 1: Find

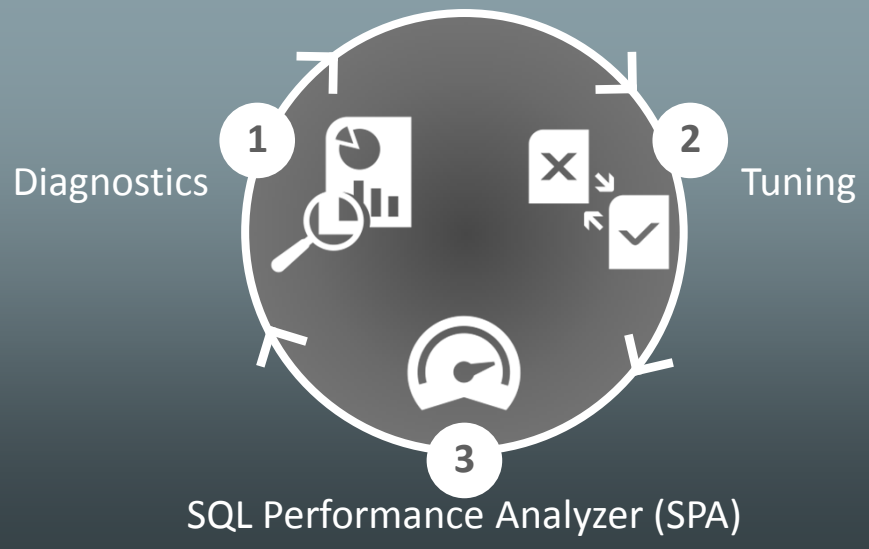
Built-in, self-diagnostics engine: Automatic Database Diagnostics Monitor (ADDM): Oracle Diagnostics Pack

STEP 2: Fix

Automates complex and time consuming task of application tuning: Oracle Tuning Pack

STEP 3: Validate:

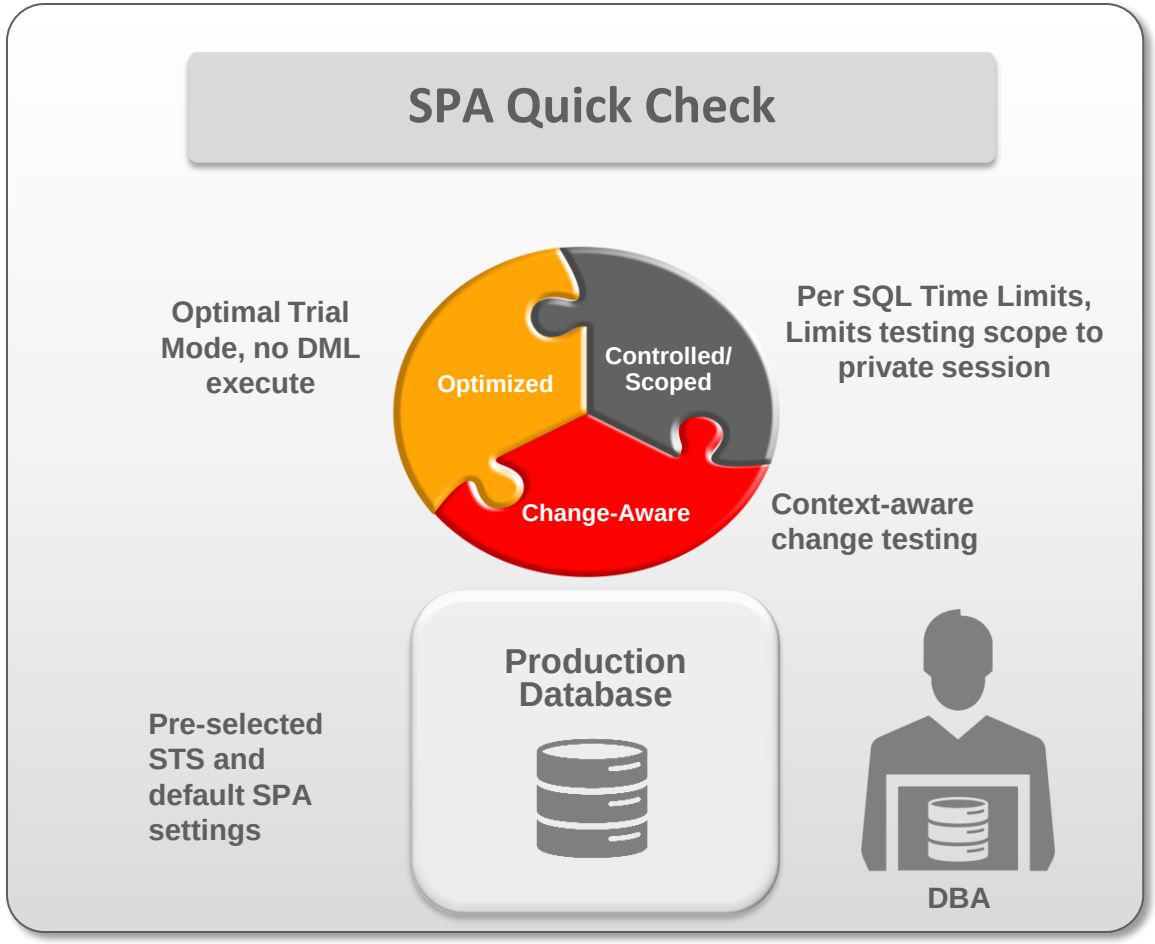
Routine tuning activities: Oracle Real Application Testing SPA



The same “Find-Fix-Validate” methodology can be used to deliver consistent quality of service across Private and Public Clouds since the underlying DB software running is the same!

Deliver Consistent Quality of Service across Private and Public Clouds
Use SPA Quick Check to Assess Routine Performance Changes

- Helps users quickly predict the impact of routine system changes on SQL workload on production system
- Designed to be used in production without impacting end-users and with no overhead
  - Runs trials in optimal mode that consumes order of magnitude less system resources
- Context-aware workflows, controlled and scoped impact assessment
- Useful for routine DBA activities such as statistics gathering refresh, init.ora changes, SQL Profile validation

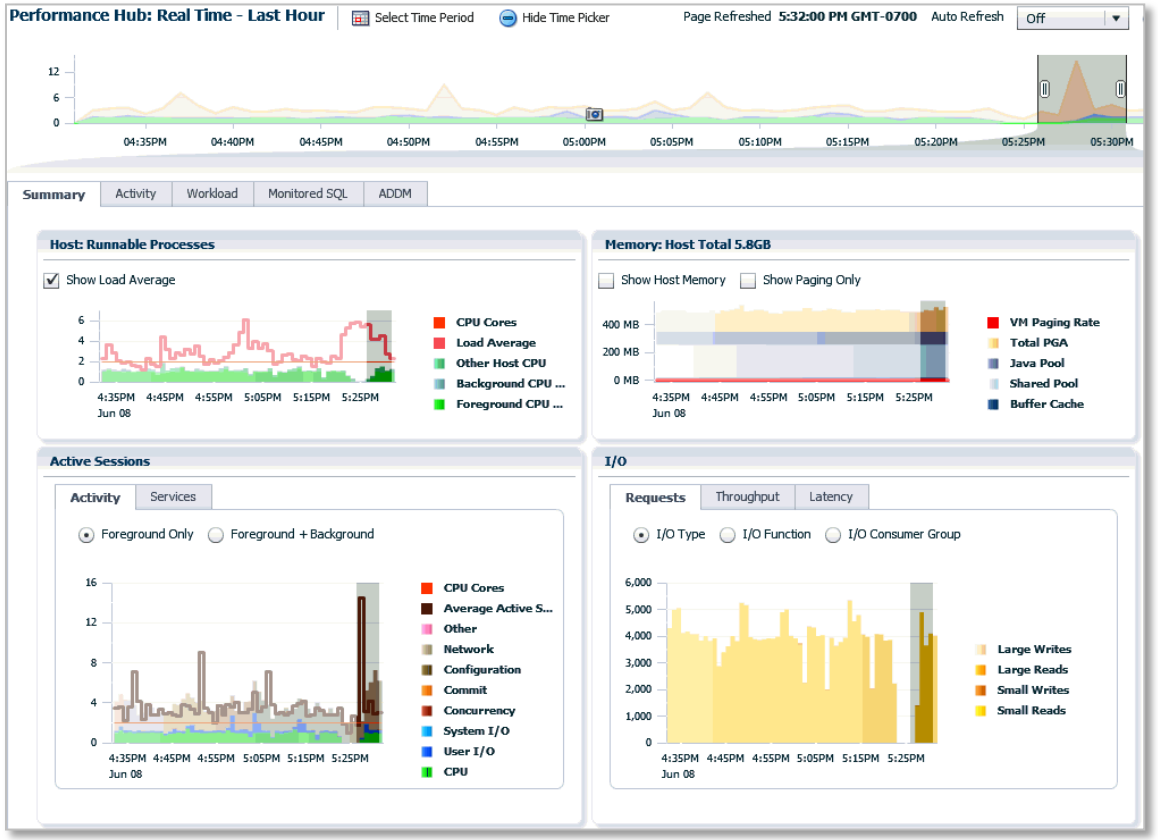


DEMO – SQL Response Time Validation

Deliver Consistent Quality of Service across Private and Public Clouds
Use Performance Hub: The Next Generation AWR Report

- Provides single unified view of DB performance
  - Works across Private and Public Clouds
  - Exadata and Multitenant-aware
- 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
  - 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



Resources

Oracle Cloud

Oracle Database Manageability and Real Application Testing

Oracle Database Upgrade

Integrated Cloud

Applications & Platform Services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