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The 10 Rules for Mastering Management of Cloud Databases

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Systems and DB Manageability
Oracle Management Cloud
Oracle Corporation
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1. Introduction
2. OMC for Autonomous DB Management
3. The 10 Rules for Mastering Management of Cloud Databases
4. Demo
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Traditional DB Admin Responsibility

• Maintenance Tasks
  – Configuration and tuning of systems, network, storage
  – Database provisioning, patching
  – Database backups, H/A, disaster recovery
  – Maintain indexes, baselines, etc.

• Tasks Specific to Business and Innovation
  – Application related tuning
  – Cross-tier application diagnostics
  – Data movement
  – Data lifecycle management
Autonomous DB Admin Responsibility

• Maintenance Tasks
  – Configuration and tuning of systems, network, storage
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• Tasks Specific to Business and Innovation
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Management tool requirements for Autonomous Database

Aware that administration and tuning of Systems, OS, Storage, and Networks done by service provider
Understand deployment model/blueprint

Tasks related to all infrastructure and database maintenance tasks like backup, restore – OCI are automated

Highly secure: Automatically patch to avoid human errors that cause downtime or security vulnerabilities

Use REST-API based monitoring and management. No agent based monitoring of the host and database.
Management tools for Oracle databases

• Oracle Enterprise Manager Cloud Control
  – On-premise product; installed, managed and maintained by customer
  – Provides administration, performance management, and lifecycle management capabilities for databases running on-premises, on the cloud, or Exadata platform

• Tip
  – Existing customers use EMCC for managing cloud databases
  – Use OMC for advanced log search and IT analytics capabilities

• Oracle Management Cloud (OMC)
  – Cloud service; fully managed and maintained by Oracle
  – Provides monitoring, log search and analysis, performance analytics, and advanced security analytics for on-premise and cloud databases
  – Complements EMCC capabilities
  – Will support management of Autonomous Databases

• Tip
  • Use OMC for Autonomous Databases
    – EMCC does not support management of Autonomous Databases
  • If not existing EM customer, use OMC for monitoring and managing cloud databases
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OMC for Autonomous Databases
ADW, ATP Serverless, ATP Dedicated

- Autonomous DB will automate most tasks for the infrastructure DBA
- App DBA still needs to monitor, diagnose and perform basic app-level administrative operations
- OMC will provide management capabilities for these operations
  - Database movement and cloning
  - Monitoring and alerting
  - Deep performance diagnostics and troubleshooting
  - Performance trending and utilization analytics based on historical data
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The 10 Rules for Mastering Management of Cloud Databases

1. Use Managed Workflows for Data Movement to Autonomous DB
2. Use Fleet Monitoring to identify services/issues that need attention
3. Detect abnormal application behavior by using OMC’s ML-based monitoring and alerting
4. Monitor Audit Logs to identify anomalous database SQL access
5. Monitor and maintain DB Service SLAs
6. Diagnose and tune application related issues in the data tier
7. Diagnose complex run-time SQL performance analysis
8. Ensure end-to-end service level management
9. Identify poorly performing and inefficient databases and their root cause
10. Understand current capacity utilization and predict needed future compute capacity
1. Use Managed Workflows for Data Movement to Autonomous DB

**Workflows for accelerating Autonomous Database adoption**

- Automated data migration from on-premise to ADW and ATP Serverless, ATP Dedicated
  - Leverages service supported migration methods
  - Uses logical data migration through Oracle Data Pump for ADW
- Supports TDE, compression for production database migrations
- Supports test/dev creation use cases with data masking or redaction of sensitive data to comply with data privacy requirements
- Creates instance from existing source or load data into existing target instance
- Periodic and scheduled data refresh from source databases for test /dev scenarios
- Out-of-the-box SPA performance validation report comparing SQL response time before and after cloud migration
Data migration from on-premise to Autonomous DB

Workflow for accelerating Autonomous Database adoption

- Uses Oracle recommended best practices for Oracle Data Pump
- Integrates with database TDE, Data Masking and Data Redaction functionality for secure migration
- Exhaustive pre-requisite checks at source and destination databases
- Validation or “dry run” (schema only migrations) mode to ensure migration progresses smoothly with no run-time issues
- Uses OMC Orchestration Service for job control schedule and handle errors (retry, restore to initial state, etc.)
- Summary report assessing success of cloud migration and insight on how to proceed
  - Differences in schemas, their content (tables, indexes, etc.), #rows between source and destination databases
  - ML-based alerts and corrective actions (for automatic fixups on space, etc.)
  - Analysis of failures at each integration point – on premise database, OCI Storage, ADW instance
  - Performance validation report with ability to remediate regressions
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2. Use Fleet Monitoring to identify services/issues that need attention

• Automated discovery and monitoring of databases – No user input required

• Fleet monitoring with single pane-of-glass view of all Autonomous DB
  – Highlight active services, services with problems (alerts, failed backups), workload spikes, workflow status, etc.
  – Fleet HA Summary and roll up by SLAs - meeting recovery window and unprotected data window goals
  – Identify needle in the haystack - outliers based on CPU, I/O, and other statistics
  – Support for fleet-level operations (for e.g., change init.ora parameter for tagged databases, backups, etc.)
  – Drill-downs provided for active management operations and diagnostics
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• Baselines automatically calculated to determine
  – Tracks and adjusts for daily and weekly seasonality
    • For example, daily seasonality: Load from 9-10 am is expected to be higher than 6 pm – 7 pm
    • Weekly seasonality: Load on Mondays 9 am – 10 am is expected to be higher than Fridays 9 am – 10 am

• Auto-detection of performance anomalies
  – Anomaly = value outside expected baseline
  – Alert when performance is abnormal
  – Metrics from related entities
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Identify top failed audit actions, schema changes and objects impacted
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5. Monitor and Maintain DB Service SLAs

• High Availability
  – HA DB summary: SLAs by recovery window/unprotected data window goals
  – Fleet level rollups
  – Active operations at fleet and single DB level
  – Fast Recovery Area (FRA) utilization for ATP Dedicated
  – Backup job history configurations

• Comply to a backup and recovery management plan as per Oracle best practice standards for autonomous databases
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6. Diagnose and tune application related issues in the data tier

Database performance matters even in the cloud

- Define good data model and good SQL
- Avoid row at a time processing, and repeated logins/parsing
- Understand tradeoffs in parallelism, plans, indexes, partitions etc.
- Understand where time is spent in the database

Automated, E2E and scalable solution
End-user Expertise
Rapidly identify application performance issues

ASH Analytics

– Filter and drill-down DB activity interactively along various dimensions on the same page
– Identify Top PDBs being throttled due to CPU contention, and corresponding sessions and SQL
– Diagnose top offending sessions and SQL based on their activity
– Hot objects (tables, indexes) and files or even blocks within files
– Save report to Oracle Storage Cloud

Analyze transient performance problems
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7. Diagnose complex run-time SQL performance analysis

Real-Time SQL Monitoring

– Identify run-time performance problems with resource intensive long-running and parallel SQL statements

– Automatically started when a SQL statement either runs in parallel or has consumed at least 5 seconds of combined CPU and I/O time in a single execution

– Exposes monitoring statistics
  • Global execution level
  • Plan operation level
  • Parallel Execution level

– Developers tool of choice
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8. Ensure end-to-end service level management

What’s Really Happening in the Application?

**Challenge**

- DBAs have no visibility on how the applications have been written
- Need for a common source of information and context that can be used by both application support and DBA teams (Devops)

**Solution**

- Complete visibility of application performance, from the app to the database
- Rapidly identify the root cause of slowdowns for both application and database tiers
- Deep visibility into SQL execution, resource consumption and DB Time to help devops rapidly identify the root cause of application bottlenecks
Cross-tier Application Diagnostics: APM Integration
Cross-tier Application Diagnostics: App to SQL drill-down
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— Performance Analytics: Autonomous DB Performance Insights

• Analyze Autonomous Database workloads to identify inefficiencies caused by SQL performance variability and high wait trends

• Pinpoint databases
  – Those that can gain in performance by migration to autonomous DB vs. those that require application improvements due to high waits
  – With unpredictable performance due to slow degradation in performance or unexpected plan changes due to data profile changes or new access structures
Identify poorly performing and inefficient databases and their root cause

**SQL Warehouse**

- Collect SQL, execution plan and session data into a long term SQL Warehouse
- Analyze SQL performance to find systemic root cause of SQL performance issues
  - High resource (CPU or I/O) consuming SQLs
  - Compare performance trends across databases, drill-down to execution plans for analysis
  - Compare current SQL response time vs. automatic baselines
  - Trends and forecast on SQL Response Time and other key SQL performance metrics
  - Was there a plan change of the SQL and compare plan to identify causes of SQL regression

<table>
<thead>
<tr>
<th></th>
<th>Degraded SQLs</th>
<th>Variant SQLs</th>
<th>Inefficient SQLs</th>
<th>SQLs with Plan Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Count</td>
<td>50 of 893</td>
<td>28 of 893</td>
<td>7 of 893</td>
<td>27 of 893</td>
</tr>
<tr>
<td>Top SQLs By CPU</td>
<td>29 of the 50 degrading SQLs have increasing I/O Time</td>
<td>26 of the 50 degrading SQLs are variant above 50%</td>
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<td>Top SQLs By I/O</td>
<td>15 of the 28 variant SQLs have plan changes</td>
<td>5 of the 7 inefficient SQLs have plan changes</td>
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- **Analyze: Utilization Analytics**
  - Trend resource utilization vs. configured capacity to estimate cost of elasticity
  - **Solution: Database Resource Analytics**
    - Compare DB CPU growth vs. OCPU capacity to trend the lead time to capacity expansion
    - Identify outlier autonomous databases in a fleet by resource consumption
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