Managing Oracle Database 12c with Oracle Enterprise Manager 12c
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Oracle Database 12c Manageability
Deliver Highest Service Quality with Lowest Risk and Effort
Deliver Highest Service Quality with Lowest Risk & Effort
Oracle Enterprise Manager Database Express 12c
Integrated, GUI Management Tool for Database Administration

Integrated Install
- Pre-configured & installed with the database
- Runs inside database
- No extra MW components
- Leverages XDB server inside db for web services
- Supports SI, RAC, SE, EE

Small Footprint
- Disk: 20 MB
- Runtime: zero when idle
- Minimal CPU, memory overhead
- 100% of UI rendering performed in browser
- DB Server only runs SQL

Comprehensive Administration
- Basic admin support for:
  - Storage management
  - Security management
  - Configuration management
  - Advanced performance diagnostics and tuning
Architecture
Request Handling in EM Express

**EM Express Servlet**
- Authenticates and validates
- Serves the request by executing queries inside DB
- Writes the output to response stream
ORACLE DATABASE MANAGEMENT

Embedded Management

Proactive Performance Management

Latest Generation Consolidation

Comprehensive Cloud Services

Deliver Highest Service Quality with Lowest Risk & Effort
Automatic Performance Diagnostics
The ADDM Family:
A Continuous Evolution in Database Performance Management

ADDM
- Diagnose persistent performance issues
- Uses AWR snapshots
- Automatically runs every hour

Compare Period ADDM
- In-depth performance comparison across two periods
- Uses AWR data
- Manually triggered

Real-Time ADDM
- Hung or extremely slow databases
- Uses a normal and diagnostic mode connection
- Manually triggered

Enhanced Real-Time ADDM
- Proactively detect & diagnose transient performance spikes
- Uses in-memory data
- Automatically runs every 3 seconds
Enhanced Real-Time ADDM
Database Self-Monitors for Serious Performance Issues

- Proactive problem detection & analysis
  - Very light weight check (in memory, latchless) runs every 3 seconds
  - When detects bad performance trends, triggers further analysis
  - Analyzes High CPU, I/O spikes, memory, interconnect, hangs, deadlocks
  - Proactively identifies a problem before it threatens application performance

- For current spikes, Real-Time ADDM can be manually triggered
  - For short duration (5-min) performance spikes, i.e. transient, high impact problems
  - Provides actionable advice for critical issues
  - Collects rich data set for analysis

- Stores reports and data in AWR for historical analysis
## Triggers for Further Analysis

<table>
<thead>
<tr>
<th>#</th>
<th>Rule</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Load</td>
<td>Average active sessions greater than 3 times the number of CPU cores</td>
</tr>
<tr>
<td>2</td>
<td>I/O bound</td>
<td>Impact on active sessions based on single block read performance</td>
</tr>
<tr>
<td>3</td>
<td>CPU bound</td>
<td>Active sessions greater than 10% of total load and CPU utilization greater than 50%</td>
</tr>
<tr>
<td>4</td>
<td>Over-allocated memory</td>
<td>Allocation over 95% of physical memory</td>
</tr>
<tr>
<td>5</td>
<td>Interconnect bound</td>
<td>Single block interconnect transfer time based</td>
</tr>
<tr>
<td>6</td>
<td>Session Limit</td>
<td>Session limit close to 100%</td>
</tr>
<tr>
<td>7</td>
<td>Process Limit</td>
<td>Process limit close to 100%</td>
</tr>
<tr>
<td>8</td>
<td>Hung Session</td>
<td>Significant number of hung sessions. If this number is greater than 10% of total sessions</td>
</tr>
<tr>
<td>9</td>
<td>Deadlock Detected</td>
<td>Any deadlock detected by hang analyzer</td>
</tr>
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Monitoring Complex Database Operations
What’s Really Happening inside the Database

**Challenge**
- Real-Time SQL & PL/SQL Monitoring only monitors a single execution
- How does a DBA monitor a composite operation such as a batch job?

**Solution**
- Real-Time Database Operations Monitoring
- **Benefit:** Allows DBAs to analyze and tune complex composite DB operations
Real-Time Database Operations Monitoring
Know What’s Happening and Resolve Issues Faster

• Database monitoring of application jobs
  • Grouping of SQLs, sessions for the application jobs
  • Key scenarios: ETL operations, Quarter End Close jobs

• Real-time monitoring driven by application specified tagging
  • Oracle Data Pump jobs automatically monitored
  • Tagging ability in PL/SQL, OCI, JDBC

• Visibility of top SQL statements, system and session performance metrics

• Avoids the overhead of SQL*Trace
• Oracle Database 11g: Support for simple DB operations
  - PL/SQL procedures/functions
• Oracle Database 12c: NEW support for composite operations
  - Session(s) activity between 2 points of time defined by application code or DBA
  - For example; SQL*Plus script, batch job, or ETL processing
  - At most one DBOP per DB session
Automatic Report Persistence to Disk

- Automatically stores Real-Time SQL Monitoring and Real-Time ADDM reports in AWR
  - Every minute, reports of top 5 (elapsed time) SQL or DB-Ops from Real-Time SQL Monitoring
  - Automatic triggered reports from Real-Time ADDM drill-down analysis
- View persisted historical reports in EM Cloud Control or EM DB Express
- Reports are compressed to save space
- Reports are purged based on AWR retention policy

Persistent Reports:
- Top SQL/DB-ops
- Real-time ADDM

NEW

In DB12c
Unified Performance Monitoring

- 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 & ADDM reports
- Dedicated tab for RAC
Deliver Highest Service Quality with Lowest Risk & Effort
Database Consolidation
Full Support Across Entire Consolidation Lifecycle

Consolidation Planner/Advisor

PLAN

TEST

Real Consolidation Testing

Container DB & Pluggable DB Performance Tuning

TUNE

MIGRATE

Pluggable Database

Database Consolidation

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Pluggable Databases
Database Consolidation Using Oracle Database 12c

- Container Database
- Pluggable DBs
  - CRM
  - Seed
  - HR
- PDBAs
- Schemas
- Users, Roles & Services
- Data Dictionary
- Tablesspaces

Managed Globally by CDBA and Locally by PDBA
Upgrading to a Pluggable DB

How Do I Migrate My Standalone Database to a CDB?

**Plug-as-a-PDB Method**

- Non-CDBs of version DB 12.1 or later. Fast, file copy. An XML description is used to create the PDB.

**Data Pump Method**

- Non-CDBs of version 11.2.0.3 or later. Datafiles will be copied over as part of the migration.
Management of Pluggable Databases
Separation of Duties—CDBA vs. PDBA

CDB Management:
Holistic database and instance management

PDB Management:
Application centric management
Consolidated SQL Performance Analyzer (SPA)

Consolidation Testing using Real SQL Workload

- Validates SQL performance for consolidated database
- SQL workload captured for each database in STS
- SPA executes all workloads together in consolidated environment
- Identifies SQL regressions and helps remediate them
- Existing SPA capability in DB 11.1 works for schema consolidation
- Will support Pluggable DB consolidation in DB12
Consolidated Database Replay

Consolidation Testing using Real Application Workload

- Enables DB consolidation testing
- Allows workload captured on different databases to be replayed concurrently
- Works for schema consolidated databases or pluggable databases
- Available now as a patch to DB11.2.0.2, 11.2.03

Workload
Workload Scale Up for Capacity Planning

- Enables capacity planning by scaling up workload replay
- **Time-shifting**: Align workload peaks for maximum concurrency
Workload Scale Up for Capacity Planning

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  - **Workload folding**: Split single capture into multiple pieces and replay them concurrently
Workload Scale Up for Capacity Planning

- Enables capacity planning by scaling up workload replay
  - **Time-shifting:** Align workload peaks for maximum concurrency
  - **Workload folding:** Split single capture into multiple pieces and replay them concurrently
  - **Schema duplication:** Duplicate and replay workload in each schema concurrently
- Part of Database Replay feature under Real Application Testing Option
At-Source Data Masking

Secured Testing using Real Data

Before

Production data is copied to Test and then masked.

NEW

At-Source-Masking

Sensitive data is masked at the source before it leaves the production DB. Staging copy not required
Integrated Subsetting and Masking

Maximum Compliance with PCI

Before

Production

Data Subset

Clone and Mask

Test

Production data had to be subsetted first and then sensitive data masked separately.
High Performance Data Masking and Subsetting

Performance Benchmarks on Exadata X2-2 Full Rack

- Mask 600 billion row table in 33 minutes
- 1% subset of 100TB table in 6.5 hours
- 1% subset + masking of 110TB table in 5.8 hours
Deliver Highest Service Quality with Lowest Risk & Effort
Private Database Cloud

Greatest Consolidation, Maximum ROI
DBaaS Cloud Models

**Infrastructure Cloud**

- **DW**: Database-as-a-Service, Shared Servers
- **CRM**: Cloud Management
- **ERP**: Enterprise Resource Planning

**Database Cloud**

- **DW**: Database-as-a-Service, Shared Instance
- **ERP**: Enterprise Resource Planning
- **CRM**: Customer Relationship Management

**Increasing Consolidation**

- **DB**: Database
- **OS**: Operating System
- **Hypervisor**: Virtualization
- **Schema-as-a-Service**: Shared Database
**EM12c: Most Comprehensive DBaaS Solution**

- Enterprise Manager 12c supports for all three DBaaS deployment models
- Self service paradigm for database deployment and management
  - Pre-packaged, pre-configured database configurations
  - One-click provisioning and deployment of databases
  - On-demand scalability of underlying platform
- Metering and chargeback/showback for IT accountability
- Intelligent Auto-placement, Quota Management, Role based access, etc.
**EM12c: Most Comprehensive DBaaS solution**

**Requirement**
- Dedicated database instances for new projects
- Database copy for Functional Testing

**Solution**
- New database on shared infrastructure (ORACLE_HOME pools)
- Database Instant Cloning using Copy-on-Write technology
Database Instant Cloning Using Copy on Write
Database Provisioning in Minutes

- Fast clone with minimal space consumption
- Only consume more space as data is changed or added
- Users can create snapshots and ‘timetravel’ to an earlier snapshots
- Secured & fast production DB copies for functional testing
- Initial Support for Sun ZFS Storage & NetApp Storage
- Will be available in the next release of Self-Service-Application (SSA) Plug-In of EM12c
**EM12c: Most Comprehensive DBaaS solution**

**Requirement**
- Dedicated database instances for new projects
- Database copy for Functional Testing
- Database full copy for problem diagnosis or Load Testing

**Solution**
- New database on shared infrastructure (ORACLE_HOME pools)
- Database Instant Cloning using Copy-on-Write technology
- Cloning from RMAM Backups
**EM12c: Most Comprehensive DBaaS solution**

**Requirement**

- Dedicated database instances for new projects
- Database copy for Functional Testing
- Database full copy for problem diagnosis or Load Testing
- Small database for quick application development

**Solution**

- New database on shared infrastructure (ORACLE_HOME pools)
- Database Instant Cloning using Copy-on-Write technology
- Cloning from RMAM Backups
- Schema-as-a-Service on shared database
Schema-as-a-Service

Ultimate Consolidation of Databases

- Shared database deployment model enabled through self-service
- Each application user gets one or more database schema(s)
- Service level guarantee through Database Resource Manager
- Security isolation through Database Vault
- Will be available in the next release of SSA Plug-In of EM12c
- Will support Pluggable Databases
Plug into the Cloud.