Oracle Maximum Availability Architecture (MAA)

Blueprints for reduced planned and unplanned downtime for the On-Premises, Exadata-based or Cloud-base Oracle Database

May, 2020
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Program Agenda

1. Why Availability is Important
2. MAA Blueprint for Oracle On-Premise
3. Summary and Resources
Maximum Availability Architecture (MAA)

Why Availability is Important
MAA Solutions: On-Premises to Cloud

On-Premises Exadata and Recovery Appliance

MAA Reference Architectures and Best Practices

MAA integrated Engineered Systems (config practices, exachk, lowest brownouts, HA QoS, data protection)

Adding MAA Config and Life Cycle Operations, Shifting Admin Ownership to Oracle with MAA SLAs

Autonomous Database
DBCS/ExaCS/ExaCC
Downtime is Prevalent and Businesses are at Risk

40% of businesses fail to reopen after experiencing a disaster

91% of companies have experienced unplanned data center outages in the past 24 months

75% of small to medium sized business don’t have a disaster recovery plan in place

Source: https://informationprotected.com/study-40-percent-businesses-fail-reopen-disaster/
Source: http://gazette.com/7-shocking-disaster-recovery-stats-for-small-business-owners/article/1590436
Oracle Maximum Availability Architecture (MAA)
High Availability, Disaster Recovery and Data Protection

Applying **30+ years** of lessons learned in solving toughest HA problems around the world
Solutions to reduce downtime for **planned & unplanned outages** for Enterprise customers with most demanding workloads and requirements
Service level oriented MAA reference architectures
Books, white papers, blueprints
MAA integrated Engineered Systems
Continuous feedback into products

https://oracle.com/goto/maa
### MAA Reference Architectures

Meet Downtime (RTO) and Data Loss (RPO) SLAs

<table>
<thead>
<tr>
<th>MAA Reference Architectures</th>
<th>Topology</th>
<th>Suitable Databases</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRONZE</strong></td>
<td>Single Instance + Backup</td>
<td>Dev, Test, Prod</td>
</tr>
<tr>
<td><strong>SILVER</strong></td>
<td>HA Clustering + Backup</td>
<td>Prod/Departmental</td>
</tr>
<tr>
<td><strong>GOLD</strong></td>
<td>HA Clustering + Disaster Recovery + Backup</td>
<td>Mission Critical</td>
</tr>
<tr>
<td><strong>PLATINUM</strong></td>
<td>Zero Data Loss &amp; Zero Downtime</td>
<td>Extreme Critical</td>
</tr>
</tbody>
</table>

Addresses SLAs for Data Loss and Downtime during Planned & Unplanned Outages

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Oracle MAA – Proven at Thousands of Customers

[Map showing various company logos around the world, including AmersourceBergen, Thomson Reuters, WestJet, Loblaw, BT, JPMorgan Chase & Co., Deutsche Bank, Bank of America, GE, GE Imagination at Work, U.S. Cellular, Intel, Salesforce, ANIMA, and others.]

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Oracle Maximum Availability Architecture (MAA)

**Deployment Choices**
- Generic Systems
- Engineered Systems
- DBCS/ExaCS/ExaCC
- Autonomous DB

**Reference Architectures**
- Production Site
- Replicated Site

**Replication**

**HA Features, Configurations & Operational Practices**

**Continuous Availability**
- Application Continuity
- Global Data Services

**Data Protection**
- Flashback
- RMAN + ZDLRA

**Active Replication**
- Active Data Guard
- GoldenGate

**Scale Out**
- RAC
- ASM
- Sharding

Customer Insights & Expert Recommendations

Platinum
Gold
Silver
Bronze
Designed to Address the Complete Range of Business Requirements

Oracle MAA

On Premises

Oracle Database

On Cloud

Common Platform – On Premises, Cloud, and Hybrid Cloud

Big Differentiator
Oracle Enterprise Manager Cloud Control (OEM)
Configuration, Monitoring, Alerting and Management

- Data Guard / Active Data Guard
- Multitenant
- Zero Data Loss Recovery Appliance (ZDLRA)
- Recovery Manager (RMAN)
- Real Application Clusters (RAC)
- Edition Based Redefinition (EBR)
- Oracle Sharding
- Oracle GoldenGate (OGG) – Monitoring and Alerting Only
Maximum Availability Architecture (MAA)

MAA Blueprint for Oracle On-Premise
Reference Architectures – Level Set

- Blueprints developed and certified by Oracle
- Validated by 10,000s of Oracle Customers
- Capabilities carry forward as you progress from one tier to the next
- Achieving stated service levels requires:
  - Utilization of prescribed features and capabilities
  - Utilization of prescribed configuration and operational best practices
  - Due diligence during pre-production testing
  - Due diligence on all life cycle operations
  - Maintaining recommended patch levels and versions
Dev, Test, Prod - Single Instance or Multitenant Database with Backups

- Single Instance with Clusterware Restart
- Advanced backup/restore with RMAN
  - Optional ZDLRA with incremental forever and near zero RPO
- Storage redundancy and validation with ASM
- Multitenant Database/Resource Management with PDB features
- Online Maintenance
- Some corruption protection
- Flashback technologies

Outage Matrix

Primary Availability Domain

<table>
<thead>
<tr>
<th>Single Instance Database</th>
<th>Local Backup</th>
</tr>
</thead>
</table>

Secondary Availability Domain

| Replicated Backups |

Unplanned Outage | RTO / RPO Service Level Objectives (f1) |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Recoverable node or instance failure</td>
<td>Minutes (f2)</td>
</tr>
<tr>
<td>Disasters: corruptions and site failures</td>
<td>Hours to days. RPO since last backup or near zero with ZDLRA</td>
</tr>
</tbody>
</table>

Planned Maintenance

<table>
<thead>
<tr>
<th>Software/hardware updates</th>
<th>Minutes (f2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major database upgrade</td>
<td>Minutes to hour</td>
</tr>
</tbody>
</table>

f1: RPO=0 unless explicitly specified
f2: Exadata systems has RAC but Bronze Exadata configuration with Single Instance database running with Oracle Clusterware has highest consolidation density to reduce costs
Oracle Clusterware for Automatic Restart

1. Oracle Clusterware is available for all Oracle Databases
2. Enables HA capabilities and resource management:
   • **Automatic Restart** of database instances, listeners and other resources
   • Fleet patching
   • Service management including restarting service after failure
   • Automatic Storage Management (ASM) for HA, data protection and ease of use

• Trade off: additional software maintenance for Grid Infrastructure
Oracle Multitenant
Architecture for consolidating databases and simplifying operations

- Self-contained PDB for each application
  - Portability (via pluggability)
  - Rapid provisioning (via clones)
  - Applications run unchanged
  - PDB upgrades via plug/unplug

- Common operations performed at CDB level
  - Manage many as one (upgrade, backups, HA)
  - Granular control when appropriate
  - Simple DR

- Shared memory and background processes

- MAA and Multitenant
  - Solutions for planned / unplanned outages

MAA Best Practice Paper: Database Consolidation with Oracle Multitenant

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Pluggable Database Backup, Restore and Recovery

- Backup and restore pluggable database ...
- Create Restore Point ‘before_event’ for pluggable database...
  - Normal or Guaranteed Restore Point
  - Clean Restore Point

- Flashback Pluggable Database
- Complete ZDLRA support
Oracle Recovery Manager - RMAN
Database Integrated Backup and Recovery

- Unique knowledge of database file formats and recovery procedures
  - Oracle block validation
  - Online block-level recovery
  - Native encryption, compression
  - Table/partition-level recovery
  - Oracle Multitenant support
- Tape and cloud backups
- Unified Management
1) Check Auxiliary Instance Disk Space
   - Automated Table Recovery requires disk space for SYSTEM, SYSAUX, UNDO and User Tablespace(s)
   - Pre-check for space in the Auxiliary Instance disk space to avoid failures in the middle of the process

2) Recovery Across Schema
   - Enables Table level recovery under different schema
   - Provide **OLD: NEW Schema(s)** under REMAP TABLE

```
RECOVER TABLE hr.department, sales.product
UNTIL SCN 1234 AUXILIARY DESTINATION '/tmp/' REMAP TABLE
hr.department:dev.testdepartment, sales.product:mkt.newproduct;
```
Recovery Appliance Recommended

Databases

Transactional Block Changes

Oracle DB 12c-19c on Any Platform
No More Full Backups, Incremental Forever

End-to-End Oracle Recovery Validation Near Zero Data Loss for DR

Day 1 Full
Day 2 Changes
Day N Changes
Day N State

Virtual Full Backup

EM Real-Time Protection Status & Space Monitoring

Cloud Storage
Remote Replica
Tape

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Database and Exadata Health Checks

— Assessment Report
- Health Score, Summary, Findings

Findings & Recommendations
- How to Solve the problem?

MAA Score Card
- MAA architectural readiness and configuration

Note: Automated Orachk/Exachk Healthcheck MOS 107954.1 updated frequently
Online Operations

Online Redefinition Improvements

DBMS_REDEFINITION allows you to reorganize and redefine tables online
- Add/drop/rename/reorder columns
- Switch physical storage structures
- Reorganize & transform data while online

Additional Benefits of using DBMS_REDEFINITION
- Fault Tolerant (resume at point of failure) and track changes to enable fast rollback to prior definition
- Entire redefinition process runs without acquiring Exclusive DDL lock
- Monitor reorganization using V$online_redef
## Online Operations

### All Partition Maintenance Operations are now Online

| 11.2 & Prior | Create index online, **rebuild index** online, rebuild index partition online  
|             | **Add Column**, Add Constraint enable novalidate |
|             | |
| 12.1        | **Online move partition**  
|             | **Drop index** online  
|             | **Set unused** column online, **alter column visible/invisible**, alter index unusable online, alter index visible/invisible  
|             | alter index parallel/noparallel |
| 12.2        | **Alter table move online for non-partitioned tables**  
|             | **Alter table from non-partitioned to partitioned online**  
|             | **Alter table split partition online**  
|             | Create table for exchange (usable for online partition exchange)  
|             | Move/merge/split partition maintenance operations can now do data filtering |
| 18.1, 19c   | **Alter table modify partitioned table to a different partitioning method** (e.g., hash to range)  
|             | **Alter table** merge partition/sub-partition online |
Flashback Technologies

Rewind Button for Oracle Databases

- Fast point-in-time recovery (PITR) without expensive restore operation
- Error investigation
  - View data as of previous point in time
- Error correction
  - Back-out a transaction
  - Incorrect table updates
  - Rewind the entire database
Prod/Departmental

Bronze +
- Real Application Clustering (RAC)
- Application Continuity

**Outage Matrix**

<table>
<thead>
<tr>
<th>Unplanned Outage</th>
<th>RTO/RPO Service Level Objectives((f_1))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recoverable node or instance failure</td>
<td><strong>Single digit seconds</strong> ((f_2))</td>
</tr>
<tr>
<td>Disasters: corruptions and site failures</td>
<td>Hours to days. RPO since last backup or near zero with ZDLRA</td>
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</table>

**Planned Maintenance**

| Software/Hardware updates                          | **Zero** (\(f_2\))                       |
| Major database upgrade                              | Minutes to hour                           |

\(f_1\): RPO=0 unless explicitly specified
\(f_2\): To achieve zero downtime or lowest impact, apply application checklist best practices

Checklist found in MAA OTN
Oracle Real Application Clusters (Oracle RAC)

Utilizes two or more instances of an Oracle Database concurrently

Very Scalable
- All instances active; Add capacity online; Ideal for database consolidation

Highly Available
- Auto-failover of services to an already running instance; Outage is transparent to user, in-flight transactions succeed; Zero downtime rolling maintenance
Transparent Application Continuity (TAC)

Application does not see errors during outages

- Uses Application Continuity and Oracle Real Application Clusters
- Transparently tracks and records session information in case there is a failure
- Built inside of the database, so it works without any application changes
- Rebuilds session state and replays in-flight transactions upon unplanned failure
- Planned maintenance can be handled by TAC to drain sessions from one or more nodes
- Adapts as applications change: protected for the future

Errors/Timeouts hidden
Planned Maintenance

**Planned Maintenance (without Outages!):**
1. Database Service is relocated or stopped
2. Service starts on another RAC instance
3. Sessions connected to the service are drained
4. New sessions connect to Service on another instance
5. Results from Database Request returned to user
6. Maintenance activities can start on first node (rolling)
Unplanned Outages, without Impact

Outage or Interruption at Database:
1. Database Request interrupted by an Outage or timeout
2. Session reconnects to the RAC Cluster and
3. Database Request replays automatically
4. Result from Database Request returned to user
Checklist for Achieving Zero Application Downtime

1. Use Oracle Clusterware Service (never use default service)
2. Use Recommended Connection String
3. Configure FAN for Connection Pool
4. Drain your service
5. Use Application Continuity or Transparent Application Continuity

1) MAA Whitepaper: Application Checklist for Continuous Service for MAA Solutions
2) Using RHPhelper to Minimize Downtime During Planned Maintenance on Exadata (MOS 2385790.1)
3. Fleet Patch and Provisioning incorporates MAA practices
Mission Critical

Silver +
- Active Data Guard
- Comprehensive Data Protection

MAA Architecture:
- At least one standby required across AD or region.
- Primary in one data center(or AD) replicated to a Standby in another data center
- Active Data Guard Fast-Start Failover (FSFO)
- Local backups on both primary and standby

## Outage Matrix

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<th>Unplanned Outage</th>
<th>RTO/RPO Service Level Objectives <em>(f1)</em></th>
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<tr>
<td>Recoverable node or instance failure</td>
<td>Single digit seconds <em>(f2)</em></td>
</tr>
<tr>
<td>Disasters: corruptions and site failures</td>
<td>Seconds to 2 minutes. RPO zero or seconds</td>
</tr>
</tbody>
</table>

### Planned Maintenance

| Software/Hardware updates                  | Zero *(f2)*                              |
| Major database upgrade                    | Less than 30 seconds                     |

*(f1) RPO=0 unless explicitly specified
*(f2) To achieve zero downtime or lowest impact, apply application checklist best practices
Storage Remote Mirroring Architecture

Generic - Must Transmit Writes to All Files

... INCLUDING CORRUPTED BLOCKS OR BAD DATA

Primary Database

Oracle Instance (in memory)

Mirrored Volumes

- Zero Oracle validation
- 7x network volume
- 27x network i/o

SYNC or ASYNC block replication
Data Guard Addresses Shortcomings of Storage Replication

Inadequate isolation, zero application-level validation

“…when something happens in the I/O stack and a database write is malformed Symmetrix A happily replicates the faulty data to site B and the corruption goes undetected”

EMC BLOG with Integrity
# Oracle Data Protection

## Gold – Comprehensive Data Protection

<table>
<thead>
<tr>
<th>Capability</th>
<th>Physical Block Corruption</th>
<th>Logical Block Corruption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dbverify, Analyze</td>
<td>Physical block checks</td>
<td>Logical checks for intra-block and inter-object consistency</td>
</tr>
<tr>
<td>RMAN, ASM</td>
<td>Physical block checks</td>
<td>Intra-block logical checks</td>
</tr>
<tr>
<td>Active Data Guard</td>
<td>• Continuous physical block checking at standby</td>
<td>• Detect lost write corruption, auto shutdown and failover</td>
</tr>
<tr>
<td></td>
<td>• Strong isolation to prevent single point of failure</td>
<td>• Intra-block logical checks at standby</td>
</tr>
<tr>
<td></td>
<td>• Automatic repair of physical corruptions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Automatic database failover (option for lost writes)</td>
<td></td>
</tr>
<tr>
<td>Database</td>
<td>In-memory block and redo checksum</td>
<td>In-memory intra-block checks, shadow lost write protection</td>
</tr>
<tr>
<td>ASM</td>
<td>Automatic corruption detection and repair using extent pairs</td>
<td></td>
</tr>
<tr>
<td>Exadata</td>
<td>HARD checks on write, automatic disk scrub and repair</td>
<td>HARD checks on write</td>
</tr>
</tbody>
</table>

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Active Data Guard Overview

- Primary
  Open Read-Write

- Standby
  Open Read-Only

**DML Redirection**

**Zero Data Loss at any Distance**

- Automatic Block Repair
  - Synchronous zero data loss replication
  - Database rolling upgrade to reduce downtime for planned maintenance
  - Automatic failover for High Availability

**Offload read only or read mostly workloads to the standby database**

Multi-instance Redo Apply for RAC (In Memory supported)
Active Data Guard Far Sync

Zero Data Loss Protection at Any Distance

**SYNC**
- Limited distance

**ASYNC**
- Any distance

**Far Sync Instance**
- Oracle control file and log files
- No database files
- No media recovery
- Offload transport compression and/or encryption

**Active Standby Database**
- Zero data loss failover target
- Database open read-only
- Continuous Oracle validation
- Manual or automatic failover

---

Primary Database
- Production copy

Redo compressed over WAN
Unplanned Outages, without Impact expanded to the Standby

Outage or Interruption at Database:
1. Database Request interrupted by an Outage or timeout
2. Session reconnects to the RAC Cluster (or Standby) and
3. Database Request replays automatically
4. Result from Database Request returned to user
Extend Footprint of ADG Applications

Support for DML Re-direction

- DML Re-direction is automatically performed from an Active Data Guard standby to the primary (ACID uncompromised)
- New parameter `ADG_REDIRECT_DML` controls DML Redirection
- New `ADG_REDIRECT_DML` and `ADG_REDIRECT_PLSQL`

- “Read-Mostly, Occasional Updates” applications supported for Oracle Database 19c
Preserve Buffer Cache During Role Change

The database buffer cache state is preserved on an ADG standby during a role change.

Automatically enabled
- Configure services so that users can stay connected on a service that is valid in both PHYSICAL_STANDBY and PRIMARY roles.

Supported versions:
- Oracle Database 18c – Single Instance
- Oracle Database 19c – Oracle RAC Support
Multi-Instance Redo Apply Performance

Lower Latency Active Data Guard Standby Databases

- Utilizes all RAC nodes on the Standby database to parallelize recovery
- OLTP workloads on Exadata show great scalability
Database Rolling Upgrade to 19c

Database Rolling Upgrade with DBMS_ROLLING
• Pre-checks and early problem detection
• Fault tolerant, resumable and rollback capabilities
• Three Role Transition Steps: Start, Switchover, Finish
• Potential Maintenance Window: Hours
• Potential Database and Application Downtime: Seconds

Automated Database Upgrades using Oracle Active Data Guard and DBMS_ROLLING
Oracle Multitenant

Architecture for consolidating databases and simplifying operations

Self-contained PDB for each application
• Portability (via pluggability)
• Rapid provisioning (via clones)
• Applications run unchanged
• PDB upgrades via plug/unplug

Common operations performed at CDB level
• Manage many as one (upgrade, backups, HA)
• Granular control
• Simple DR

Shared memory and background processes
• More applications per server

MAA and Multitenant
• Solutions for planned / unplanned outages
PDB Failover: Normal Runtime

CDB 1 Read-Write

Data Guard

CDB 1 Standby Read-Only

CDB 2 Read-Write
PDB Failover after PDB 2 Outage

Unplug/plug PDB2 from CDB1 standby to CDB2 and failover application connections

CDB 1
Read-Write

PDB1
PDB2
PDB3

Data Guard

CDB 2
Read-Write

PDB4
PDB2
PDB3

CDB 1
Standby
Read- Only
## Multitenant “Gold” MAA Strategy

<table>
<thead>
<tr>
<th>Unplanned Outages</th>
<th>Key Features for Solution</th>
<th>RTO</th>
<th>RPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recoverable node or instance failure</td>
<td>Real Application Cluster (RAC) Application Continuity (AC/TAC)</td>
<td>Secs</td>
<td>Zero</td>
</tr>
<tr>
<td>Disasters: corruptions and site failures</td>
<td>Active Data Guard Fast-Start Failover</td>
<td>&lt; 2 mins</td>
<td>Zero or Secs</td>
</tr>
<tr>
<td>PDB unrecoverable failure or “sick” PDB</td>
<td>PDB Failover (unplug/plug) Another target CDB on the same cluster required (MOS 2088201.1)</td>
<td>&lt; 2 mins</td>
<td>Zero or Secs</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planned Maintenance</th>
<th>Solution</th>
<th>RTO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software and hardware updates</td>
<td>RAC, AC or TAC</td>
<td>Zero</td>
</tr>
<tr>
<td>Major database upgrade</td>
<td>Active Data Guard DBMS_ROLLING</td>
<td>Secs</td>
</tr>
<tr>
<td>Migration to remote CDB</td>
<td>PDB Relocate</td>
<td>Mins</td>
</tr>
<tr>
<td>Migration to remote CDB (logical migration)</td>
<td>Data Pump and GoldenGate</td>
<td>Potentially Zero</td>
</tr>
<tr>
<td>Migration plus upgrade</td>
<td>PDB Relocate + Upgrade</td>
<td>Mins</td>
</tr>
</tbody>
</table>
Refreshable PDB Switchover
Per-PDB replica with only two CDBs to manage!

1. create pluggable database Red;
4. create pluggable database Brown;
6. create pluggable database Grey
   from Grey@CDB2_Link
   refresh mode every 2 minutes;

2. create pluggable database Red
   from Red@CDB1_Link
   refresh mode every 2 minutes;
3. create pluggable database Gold;
5. create pluggable database Grey;
Refreshable PDB Switchover

Planned switchover

1. alter pluggable database Grey refresh mode every 2 minutes from Grey@dblink switchover;
Refreshable PDB Switchover

Unplanned switchover

Server1

CDB1

Server2

CDB2

Does not interoperate with Data Guard Fast-Start Failover, auto-block repair, DB rolling upgrade so NOT part of Gold MAA

1. alter pluggable database Grey refresh;
2. alter pluggable database Grey refresh mode none;
3. alter pluggable database Grey open read write;
RPO=0 unless explicitly specified
To achieve zero downtime or lowest impact, apply application checklist best practices
Application failover is custom or with Global Data Services

Gold +
- GoldenGate Active/Active Replication
- Optional Sharding & Editions Based Redefinition

MAA Architecture:
- Each GoldenGate “primary” replica protected by Exadata, RAC and Active Data Guard
- Primary in one data center (or AD) replicated to another Primary in remote data center (or AD)
- Oracle GG & Editions Based Redefinition for zero downtime application upgrade
- Sharding for scalability and fault isolation
- Local backups on both sites
- Achieve zero downtime through custom failover to GG replica

Outage Matrix

<table>
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<th>RTO/RPO Service Level Objectives</th>
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<tbody>
<tr>
<td>Recoverable node or instance failure</td>
<td>Zero or single digit seconds</td>
</tr>
<tr>
<td>Disasters including corruptions and site failures</td>
<td>Zero</td>
</tr>
<tr>
<td>Planned Maintenance</td>
<td></td>
</tr>
<tr>
<td>Most common software/hardware updates</td>
<td>Zero</td>
</tr>
<tr>
<td>Major database upgrade, application upgrade</td>
<td>Zero</td>
</tr>
</tbody>
</table>

(f1): RPO=0 unless explicitly specified
(f2): To achieve zero downtime or lowest impact, apply application checklist best practices
(f3): Application failover is custom or with Global Data Services
GoldenGate plus 2 Optional Approaches to Further Protect Your Applications

Use Oracle Golden Gate
Required

Use Edition-based
Redefinition
Optional

Use Oracle Sharding
Alternative
GoldenGate plus 2 Optional Approaches to Further Protect Your Applications

Use Oracle Golden Gate
Required

Use Edition-based Redefinition
Optional

Use Oracle Sharding
Alternative
Oracle GoldenGate Microservices Architecture

Capture: committed transactions are captured (and can be filtered) as they occur by reading the transaction logs.

Trail: stages and queues data for routing.

Distribution Server/Receiver: distributes data for routing to target(s).

Route: data is compressed, encrypted for routing to target(s).

Delivery: applies data with transaction integrity.

Bi-directional
Key GoldenGate Improvements Simplify Platinum

1. GoldenGate Hub simplifies migration and administration by offloading work from source and target
   • New GoldenGate cloud market place automates GG hub deployment
   • Cross endianness capture enables cross platform migration
   • Upcoming Zero Downtime Migration integration with GoldenGate
2. GoldenGate Microservices simplifies administration and management

Oracle Database Migration with an Oracle GoldenGate Hub Configuration

Oracle GoldenGate Microservices Architecture with Oracle Real Application Clusters Configuration Best Practices

Future: Zero Downtime Migration
www.oracle.com/goto/zdm
Oracle GoldenGate

MAA Best Practices

- Transparent Role Transitions in Data Guard Configurations
  - No manual intervention required with FSFO and DG Broker
  - Configuration makes use of:
    - Oracle Grid Infrastructure Bundled Agent (XAG)
    - DBFS or ACFS for shared GoldenGate files (trails and checkpoint files)
    - Role based services
    - Integrated Extract (with HANDLEDLFAILOVER option for ASYNC DG)
    - Microservices Architecture for simpler administration
Data Center Architecture & Requirements

• A minimum of 2 Regions for Disaster Recovery Failover
  • Region is a localized geographic area
  • West Coast NAS – Primary example
  • East Coast NAS – Secondary example
• Each Region should have a minimum of 2 Availability Domains (AD)
• Availability Domain Characteristics
  • AD’s are isolated from each other & fault tolerant
  • AD’s do not share infrastructure such as power, cooling or AD Network
  • A failure of one AD does not effect other AD’s.
  • AD’s within a Region are connected via high speed network within same geographical area.

High Speed with < 1ms Latency
Sample Deployment

- Primary Database
- Standby Database
- Observer
- ADG Redo Transport (SYNC or ASYNC)
- Integrated Extract
- LogMining Server
- Trail and other OGG Files in DBFS
- Bidirectional GoldenGate Replication
- Warehouse
- Redo Transport
- OCI Connection
- File I/O
Sample Deployment – Post Role Transition

(OLD) Primary Database

Observer

(NEW) Primary Database

LogMining Server

ADG Redo Transport (SYNC or ASYNC)

Integrated Extract

Trail/Checkpoint/BR Files In DBFS

Bidirectional GoldenGate Replication

Redo Transport

OCI Connection

File I/O

Warehouse
GoldenGate plus 2 Optional Approaches to Further Protect Your Applications

Use Oracle Golden Gate
Required

Use Edition-based Redefinition
Optional

Use Oracle Sharding
Alternative
Edition-Based Redefinition

Online Application Upgrade

- Enables application upgrades to be performed online
- Code changes installed in the privacy of a **new edition**
- Data changes are made safely by writing only to new columns or new tables not seen by the old edition
- An **editioning view** exposes a different projection of a table into each edition to allow each to see just its own columns
- A **cross-edition trigger** propagates data changes made by the old edition into the new edition’s columns, or (in hot-rollover) vice-versa
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**Alternate Platinum Option: Sharding**

Highly scalable, fault tolerant architecture for Internet Applications

- **Custom Built Application** optimized to use shard keys
- **Horizontal partitioning** of data across independent databases (shards)
  - Each shard holds a subset of the data
  - Can be single-node or RAC or PDB
  - Replicated for high availability
- **Shared-nothing architecture:**
  - Shards don’t share any hardware (CPU, memory, disk), or software (Clusterware)

A single *logical DB* sharded into N physical Databases
Deployment of a System-Managed SDB with Active Data Guard

Region Availability_Domain1

Clients

Connection Pools

Shard Director shdir1,2

Shard Catalog shardcat

Shard Director shdir3,4

Shard Catalog shardcat_stdby

Region Availability_Domain2

Connection Pools

Shardgroup shgrp1

Primaries...

Shardgroup shgrp2

HA Standbys...

Data Guard Fast-Start Failover
Sharding Configuration Options

Use Sharding with Active Data Guard, RAC or Oracle GoldenGate

- Active Data Guard with Fast-Start Failover
- GoldenGate 'chunk-level' active-active replication with automatic conflict detection/resolution
- Optionally – complement replication with Oracle RAC for server HA

https://www.oracle.com/database/technologies/high-availability/sharding.html
Maximum Availability Architecture (MAA)

Summary & Resources
Maximum Availability Architecture

- MAA Home:
  - http://oracle.com/goto/maa
- On-Premise MAA:
- Exadata MAA:
- Cloud MAA:
Provide the best HA, DR and data protection solution for Oracle databases

Continue to enhance validated MAA solutions

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