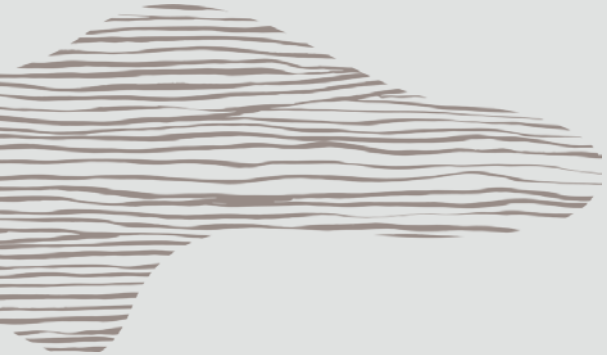
Oracle OpenWorld 2019

SAN FRANCISCO



Best Practices for Oracle Exadata Cloud Deployments

PRO4864

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Lawrence To Senior Director – MAA – Oracle

Swami Kiran Senior IT Manager – Data and Information Management – World Bank Group

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Agenda

- Oracle Exadata Cloud Offerings Overview
- Selecting the Cloud MAA Architecture
- Oracle Exadata Cloud Configuration Best Practices
- Cloud MAA Life Cycle Operations: Tips and Pointers
- Real World Implementation: World Bank Group

Best Practices for Oracle Exadata Cloud Deployments

Oracle Exadata Cloud Overview

Oracle Exadata Advantage

Ideal Database Hardware

Leading edge enterprise-grade components for maximum performance and value

Smart System Software

Database-aware algorithms vastly improve the effectiveness of ALL workloads

Automation

Automated infrastructure integrated with Oracle Autonomous Database

Identical On-Premises and Cloud

Oracle Exadata Cloud Offerings

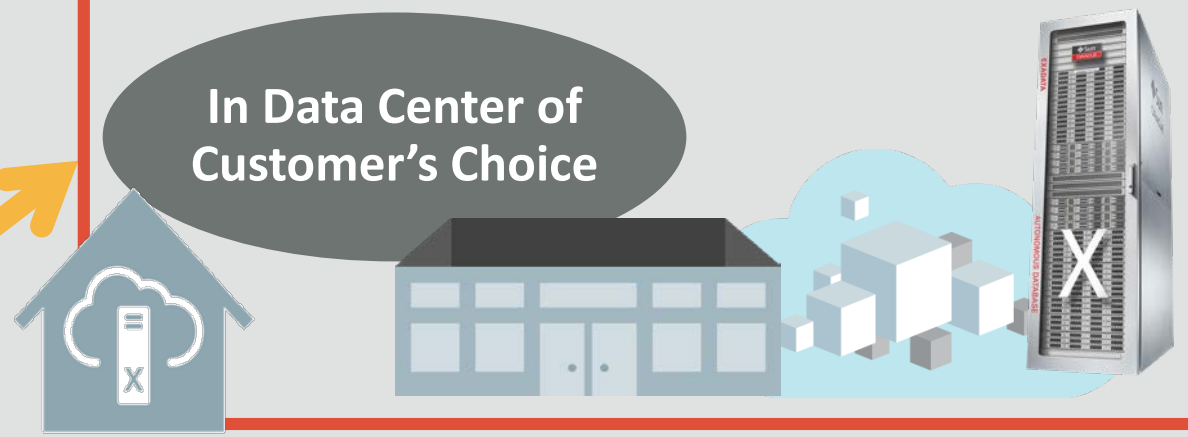
Core Exadata Platform

+

- Flexible Subscription Model
- Database PaaS Services
- Secure Virtual Networks
- Cloud Security and Hardening
- Oracle-Managed Exadata Infrastructure

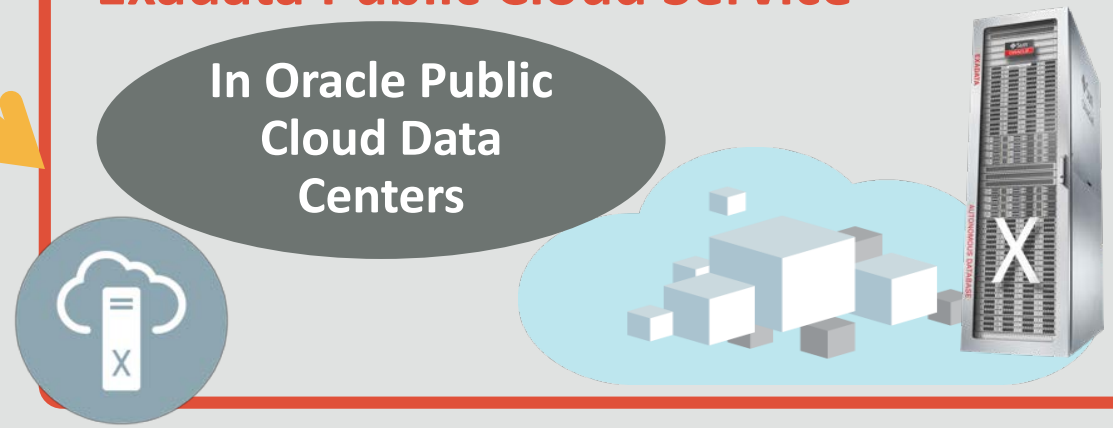
Exadata Cloud at Customer

In Data Center of Customer's Choice

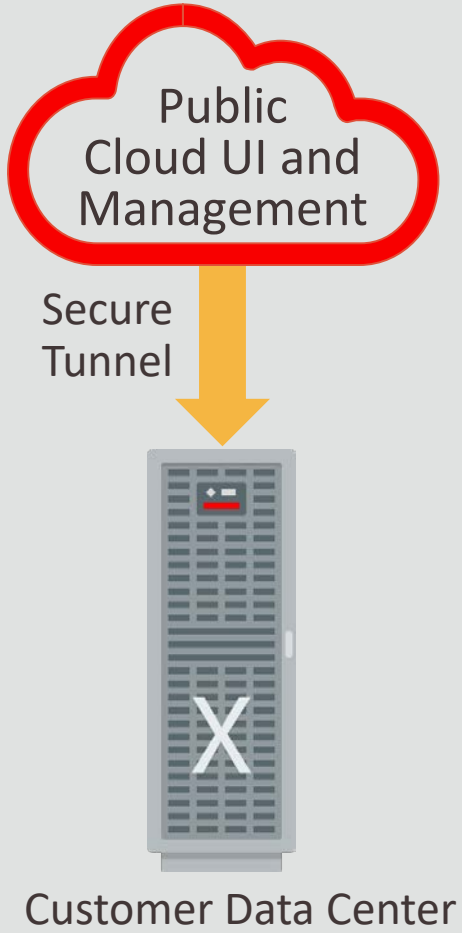


Exadata Public Cloud Service

In Oracle Public Cloud Data Centers



Gen 2 Exadata Cloud at Customer—What's New



- Gen 2 public cloud manages Gen 2 Exadata Cloud at Customer
  - Eliminates additional control plane rack in customer data center
  - Simpler, lower cost, faster time to value
- New Exadata Cloud at Customer X8 hardware
  - Faster CPUs, more cores, more storage than ExaCC X7
- Simpler connectivity to customer network
  - Adapts to customer networking standards and requirements
- Now supports Oracle Database 19c
  - Long-term support for the 12.2 family
- Ready for Autonomous Database at Customer

Runs the best database on the best platform in the best Cloud in your data center

Best Practices for Oracle Exadata Cloud Deployments

Selecting the Right Maximum Availability Architecture for Exadata Cloud

What Are Your Service Level Agreements and Business Factors?

Impact of Downtime

Cost of downtime

- Business/Market Share
- Application or Database
- Consolidated set of applications or databases

Downtime (RTO)

How much downtime before serious business impact?

- For planned maintenance?
- for Local Failures?
- for Disasters and Corruptions?

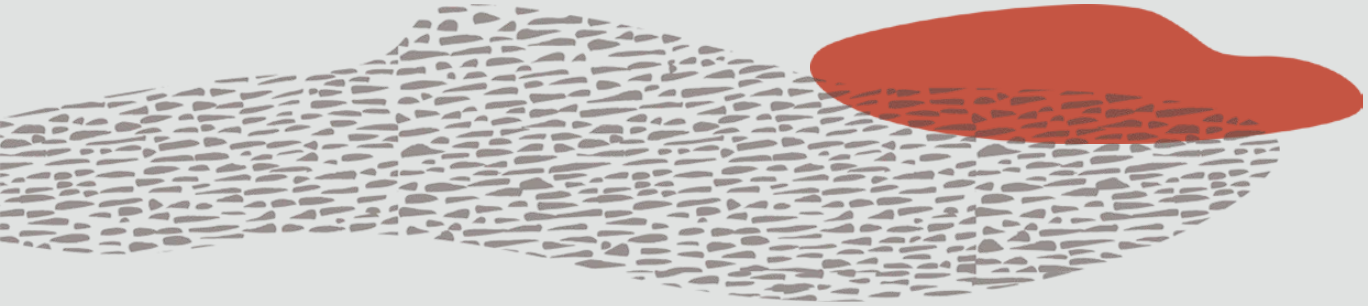
Data Loss (RPO)

How much data can I lose before the business suffers irreparable damage?

MAA Architecture

Pick the architecture that fits your needs.

- Any environmental restraints?
- Application needs to be close to the database
- Specific region or location
- Network latency and bandwidth requirements

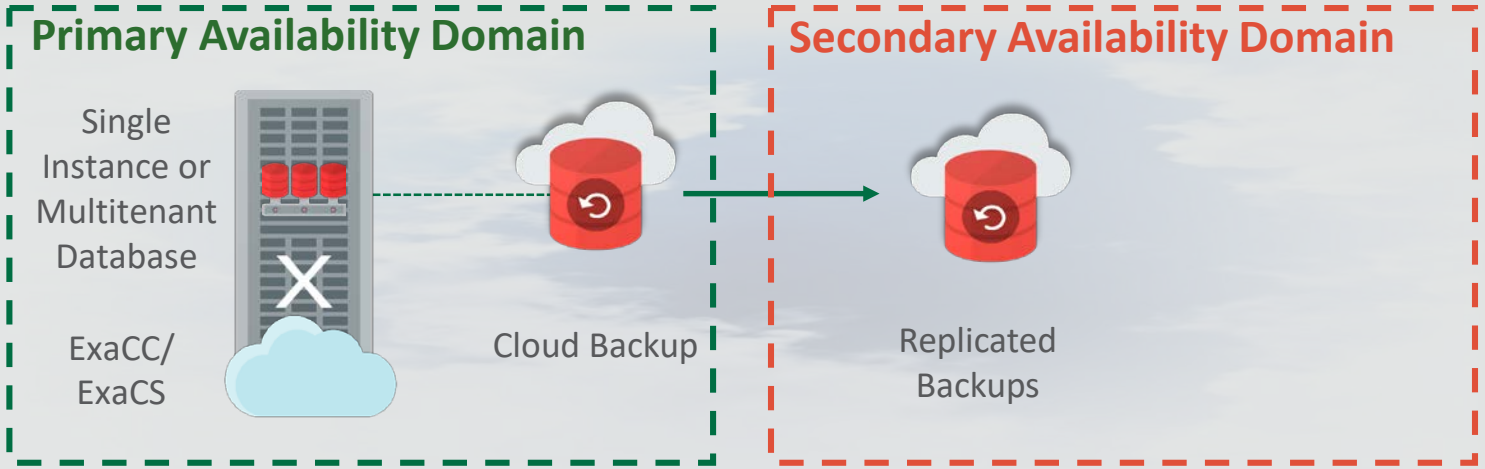


Oracle Maximum Availability Architecture(MAA) Solution Options

BRONZE

Dev, Test, Prod - Single Instance or Multitenant Database with Backups

- HA infrastructure for storage and network
- Single Instance with Clusterware HA Management
- MAA cloud backup/restore
  - Cloud object storage backups with copy across AD for public cloud
  - ZDLRA with incremental forever and near zero RPO for Cloud@Customer
- Multitenant Database/Resource Mgmt with PDB features
- Online Maintenance
- Some corruption protection
- Flashback technologies



Outage Matrix

Unplanned Outage	RTO / RPO*
Recoverable node or instance failure	Minutes to hour ***
Disasters: corruptions and site failures	Hours to days. RPO since last backup or near zero with ZDLRA
Planned Maintenance	
Software/hardware updates	Minutes to hour***
Major database upgrade	Minutes to hour

* RPO=0 unless explicitly specified

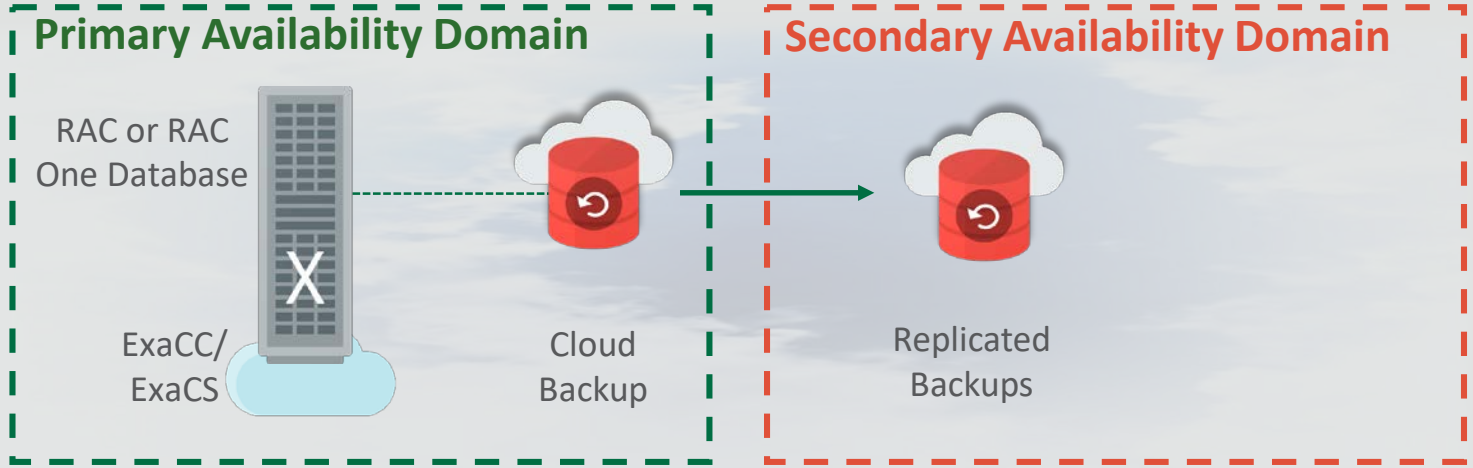
*** Exadata systems has RAC but Bronze Exadata configuration with Single Instance database running with Oracle clusterware has highest consolidation density to reduce costs

SILVER

Prod/Departmental

Bronze +

- Real Application Clustering (RAC)
- Application Continuity



Outage Matrix

Unplanned Outage	RTO/RPO*
Recoverable node or instance failure	Seconds
Disasters: corruptions and site failures	Hours to days. RPO since last backup or near zero with ZDLRA
Planned Maintenance	
Software/Hardware updates	Zero**
Major database upgrade	Minutes to hour

* RPO=0 unless explicitly specified

** To achieve zero, follow application checklist

GOLD

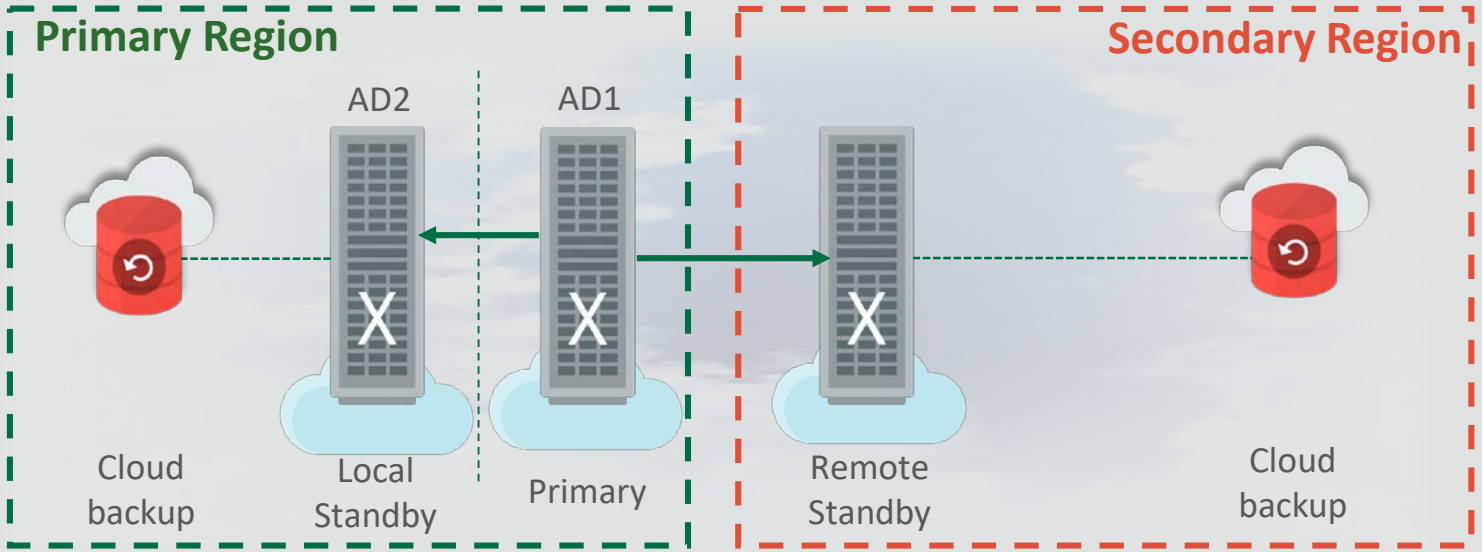
Mission Critical

Silver +

- Active Data Guard
- Comprehensive Data Protection

MAA Architecture:

- Minimum one standby either across AD or region.
- ExaCC/ExaCS primary in one data center(or AD) replicated to a standby ExaCC/ExaCS in another data center
- Local backups on both sites



Outage Matrix

Unplanned Outage	RTO/RPO*
Recoverable node or instance failure	Seconds
Disasters: corruptions and site failures	**Seconds. RPO zero or seconds**
Planned Maintenance	
Software/Hardware updates	Zero
Major database upgrade	**Seconds**

* RPO=0 unless explicitly specified

PLATINUM

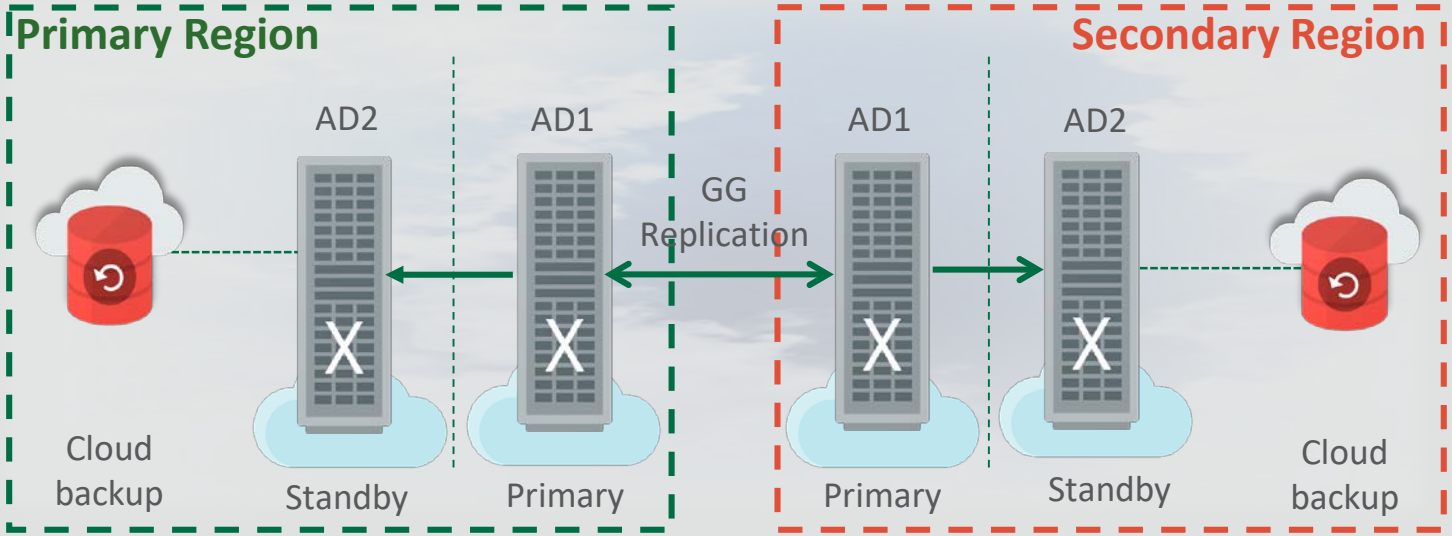
Extreme Critical

Gold +

- GoldenGate Active/Active Replication
- Optional Editions Based Redefinition

MAA Architecture:

- Each GoldenGate "primary" replica protected by Exadata, RAC and Active Data Guard
- ExaCC/ExaCS primary in one data center (or AD) replicated to another primary ExaCC/ExaCS in remote data center (or AD)
- Oracle GG & Editions Based Redefinition for zero downtime application upgrade
- Local/cloud backups on both sites
- To achieve zero downtime, custom failover to available GG replica required



Outage Matrix

Unplanned Outage	RTO/RPO*
Recoverable node or instance failure	Seconds
Disasters including corruptions and site failures	Zero**
Planned Maintenance	
Most common software/hardware updates	Zero
Major database upgrade, application upgrade	Zero**

* RPO=0 unless explicitly specified ** application failover is custom

Best Practices for Oracle Exadata Cloud Deployments

Oracle Exadata Cloud Configuration Best Practices

Oracle Exadata Cloud Best Practices – In the Cloud, ExaCS and ExaCC are Deployed with Exadata and MAA Best Practices

- Exadata Cloud deployment has built-in Exadata and MAA best practices
- Future: 100% score at deployment time
- Refer to Oracle Exadata Database Machine exachk or HealthCheck (Doc ID 1070954.1)

Best Practices for Oracle Exadata Cloud Deployments

Cloud MAA Life Cycle Operations: Tips and Pointers

Cloud Tip 1 : Sizing, Planning and Deployment

"Avoid Outages and Poor Performance"

Understand your requirements

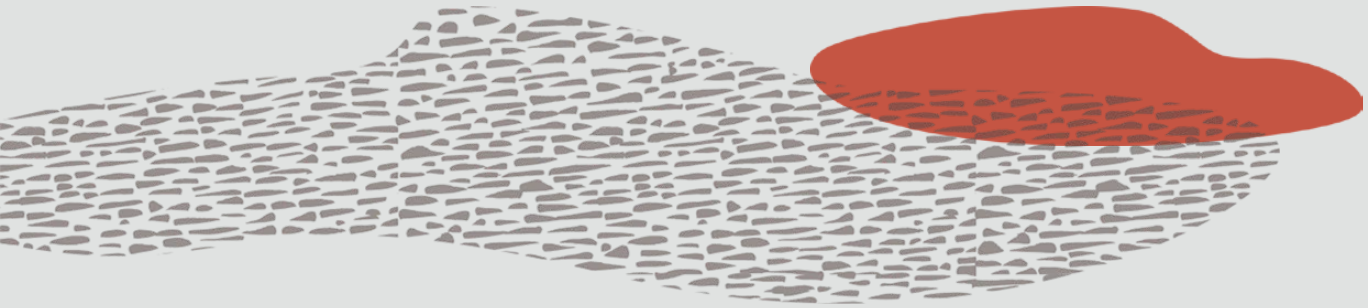
1. Database CPU processing
2. Database Memory*
3. Database Storage capacity and throughput*

Determine all databases to be consolidated based on requirements

Pick the correct Exadata shape

Work with Oracle Sales Consultant

**No oversubscription of memory and storage*



Cloud Tip 2: Cloud Database Creation and Deployment Success Factors

Creating Cloud databases with Exadata and MAA templates

1. Install latest cloud software (auto update after 18.2.3.2) which includes dynamic hugepage adjustments
2. Use only cloud console or cloud APIs to create databases to leverage Exadata MAA database defaults
3. Change memory and performance settings for the application
4. Monitor hugepages and memory to accommodate all database and ASM SGAs for each node
5. Run exachk

WARNING: Do NOT use DBCA or custom create databases scripts. Avoid carrying over your previous init parameters. Avoid using ACFS for database and backup files, audit or dump directories.

Cloud Tip 3: Use ZDM for Database Migration to Cloud

Tip 3a: Use ZDM for automated physical migration

- Backup/Restore for Instantiation
- Encryption conversion can happen in cloud without impacting on-premise
- Data Guard switchover reduces time
- Refer to www.oracle.com/goto/zdm

ZDM production release is coming very soon!!!

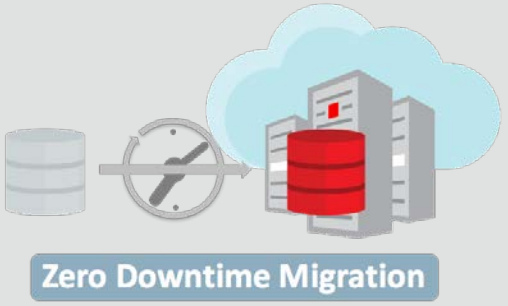
WARNING: Understand your network bandwidth by running some preliminary network tests to determine throughput (MOS 2064368.1)

Tip 3b: Use MV2OCI for automated logical migration

- MV2OCI and MV2ADB uses Data Pump to instantiation and to re-optimize data
  - Complete orchestration, prechecks and cloudify
  - Encryption conversion will happen in the cloud without impacting on-premise
  - ZDM integration coming soon
- GoldenGate solution reduces downtime
  - Oracle Database Migration with an Oracle GoldenGate Hub Configuration
  - Future ZDM solution with GoldenGate.
  - GoldenGate restrictions still applicable

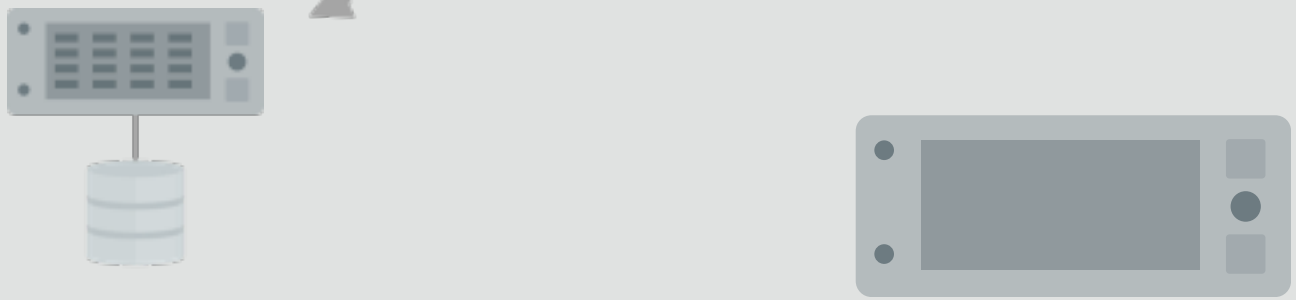
Zero Downtime Migration

Workflow



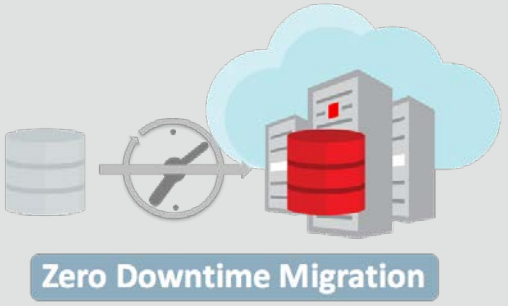
Download & Configure ZDM 1

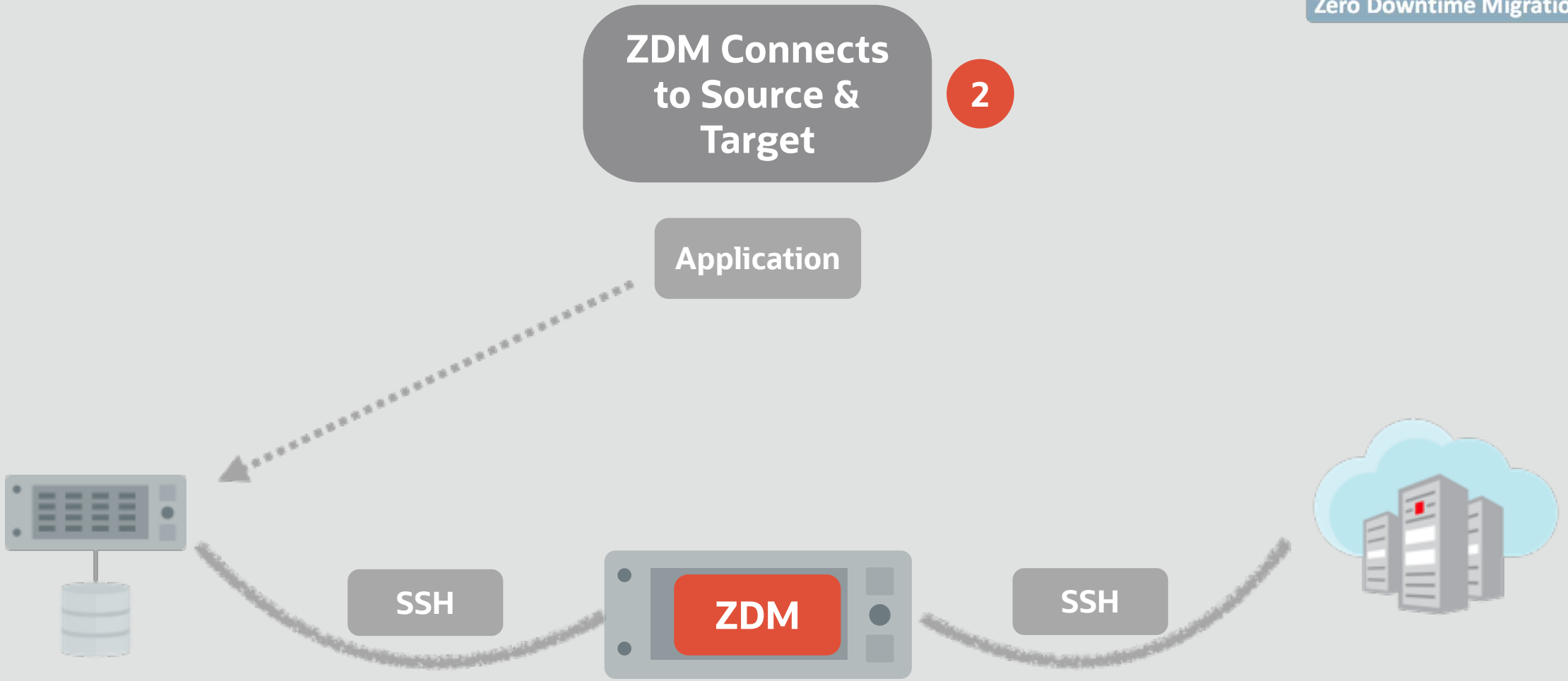
Application



Zero Downtime Migration

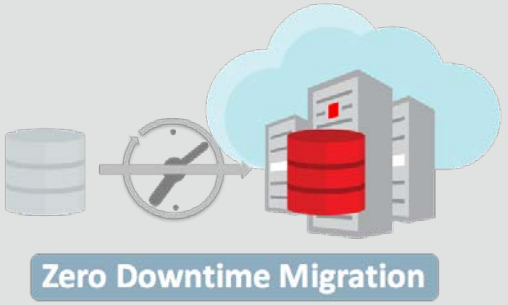
Workflow



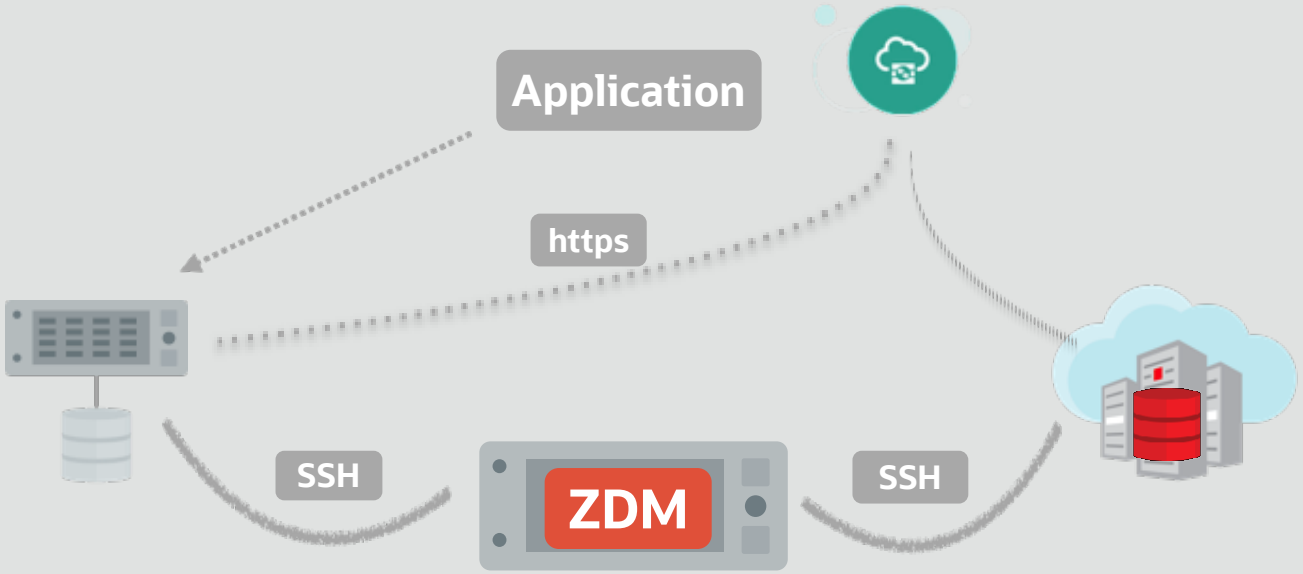


Zero Downtime Migration

Workflow



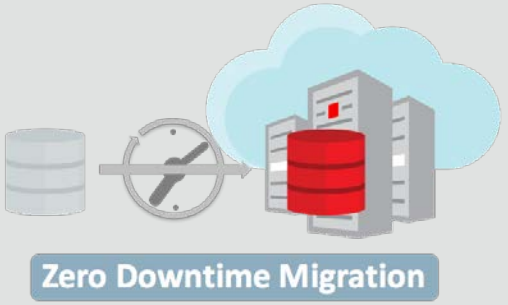
ZDM Instantiates Standby 3



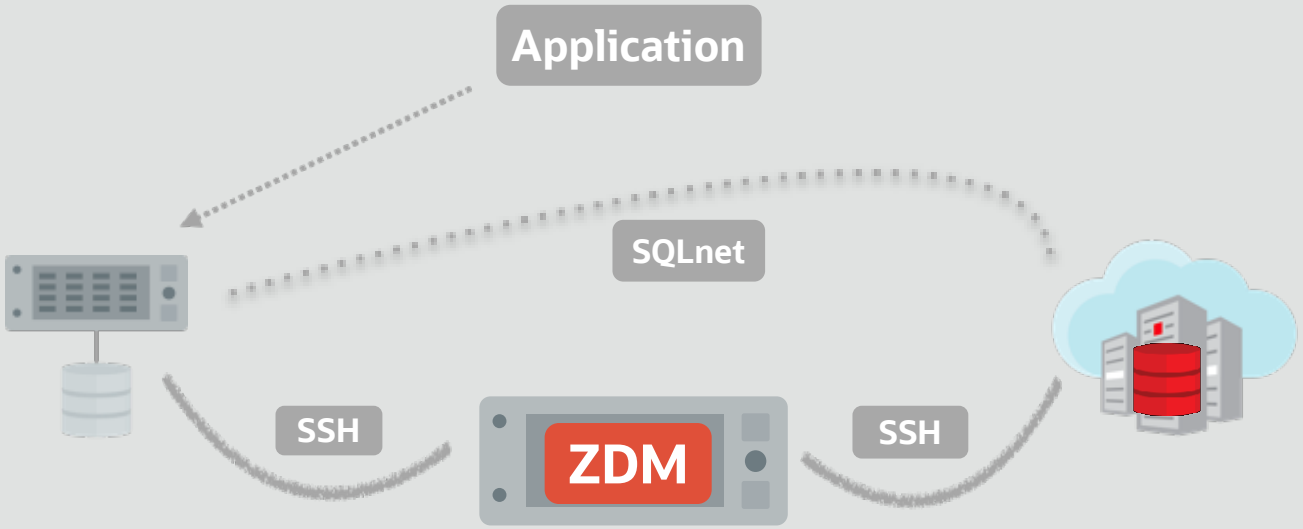
- Standby is instantiate with cloud backup and restore

Zero Downtime Migration

Workflow



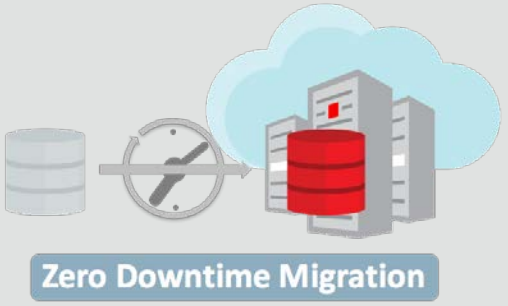
Hybrid Data Guard 4

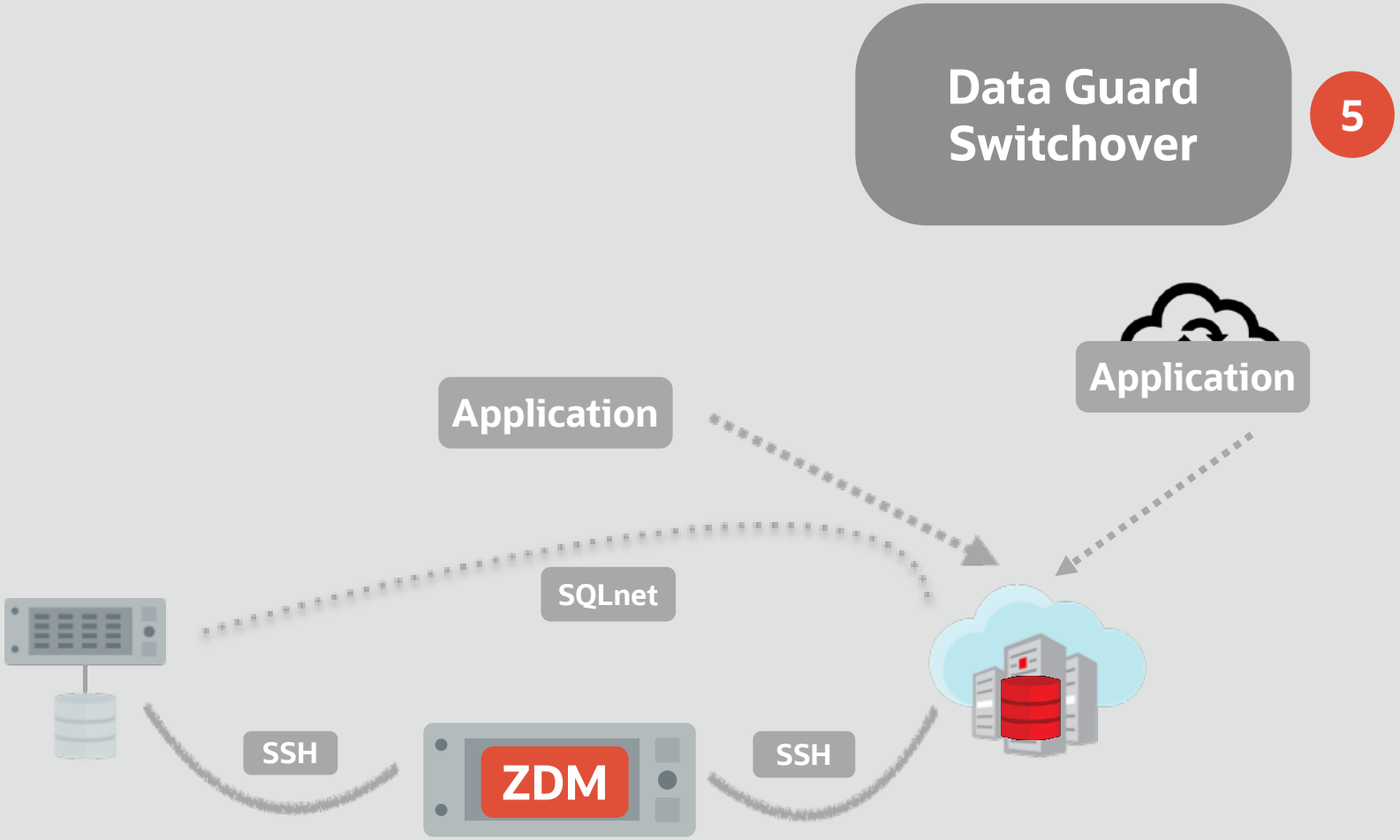


- Data Guard is setup with MAA practices
- Redo Transport and Real Time Apply Starts
- Lag is monitored

Zero Downtime Migration

Workflow





- Data Guard Switchover with seconds to minutes of downtime
- Database is registered as new cloud database so cloud life cycle operations can be enabled

- Application from on-premise or in the cloud connects to new Primary in the cloud

Cloud Tip 4: Prepare for Cloud Infrastructure Software Updates

"Oracle manages infrastructure software updates"

- Exadata Network and Storage
  - Zero database or application downtime
  - During window, *reduce maximum IO throughput*
- Exadata Dom0 updates should occur quarterly
  - Zero database downtime with RAC Rolling
  - Zero application downtime if Continuous Availability - Application Checklist for Continuous Service for MAA Solutions and MOS 2385790.1 practices
  - During window, *prepare for reduced DB compute processing*

Cloud Tip 5: Prepare for DB and GI Quarterly Software Updates

- Customer is responsible for DB/GI Quarterly Software Updates to maintain stability and security compliance
- Zero database downtime with RAC rolling
- Zero application downtime only if Continuous Availability - Application Checklist for Continuous Service for MAA Solutions is followed
- During window, prepare for reduce DB compute processing
- Key Practices for Success
  - Prerequisites:
    - exachk
    - software plan and
    - exadbcpatchmulti -precheck_async or dbaascli patch db prereq
  - During patching:
    - use exadbcpatchmulti or dbaascli
    - one offs applied separately
    - only run datapatch after all databases in DG environment is patched
  - *Refer to Patching an Exadata DB System*

Cloud Tip 6: Prepare for Exadata Quarterly Software Updates

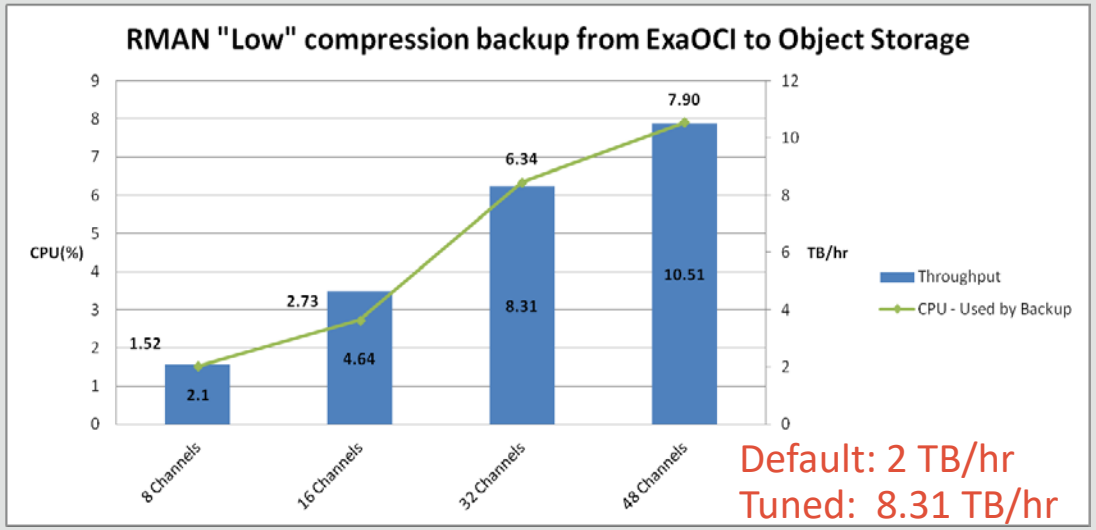
- Customer responsible for Exadata operating system software updates
- Zero database downtime with RAC rolling
- Zero application downtime only if Continuous Availability - Application Checklist for Continuous Service for MAA Solutions is followed
- During window, prepare for reduce DB compute processing
- Key Practices for Success
  - Installing, Updating, and Managing Non-Exadata Software
  - How to update the Exadata System Software (DomU) to 19c from 18c on the Exadata Cloud Service in OCI (Doc ID 2521053.1)
  - How to update the Exadata System Software (DomU) on the Exadata Cloud Service in OCI (19.x to 19.x) (Doc ID 2566035.1)

WARNING: Avoid customizations since they will need to be removed prior to software update and added back afterwards

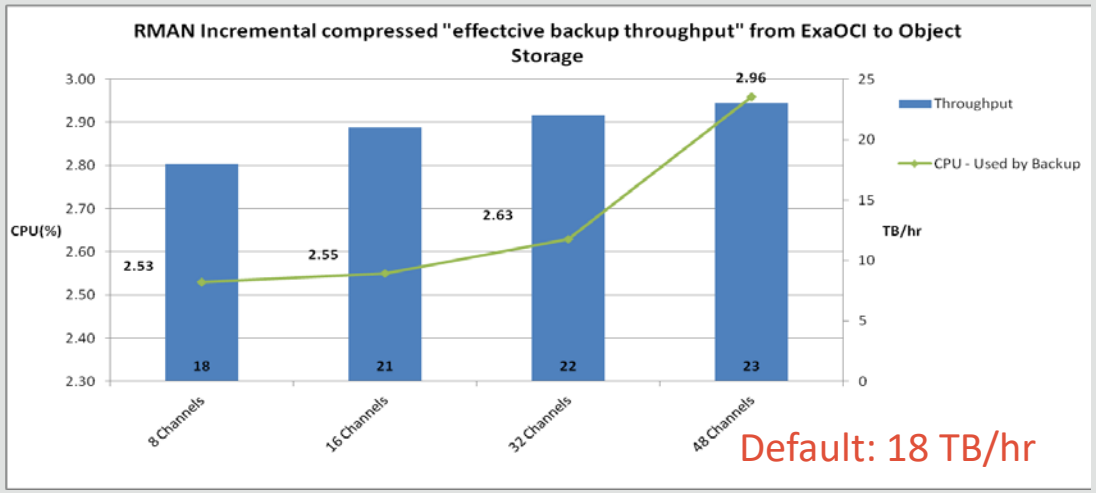
Cloud Tip 7: Use MAA Cloud Backup/Restore Best Practices

- Cloud MAA practices integrated with automatic backup and latest tooling
- Refer to Oracle Cloud Infrastructure Exadata Backup & Restore Best Practices using Cloud Object Storage
- Use cloud backup APIs and use ZDLRA for Exadata Cloud@Customer
- Customizing Backup Settings by Using a Generated Configuration File
  - Pick least intrusive backup start time (bkup_daily_time)
  - For cloud object storage, pick the day you want to level 0 backup (bkup_oss_L0_day)
  - All other defaults are generally good
  - Increase RMAN parallelism (bkup_channels_node=4 default) if current backup/restore rate is not acceptable (e.g. 2.1 TB/hour observed)
- Periodic restore test is recommended

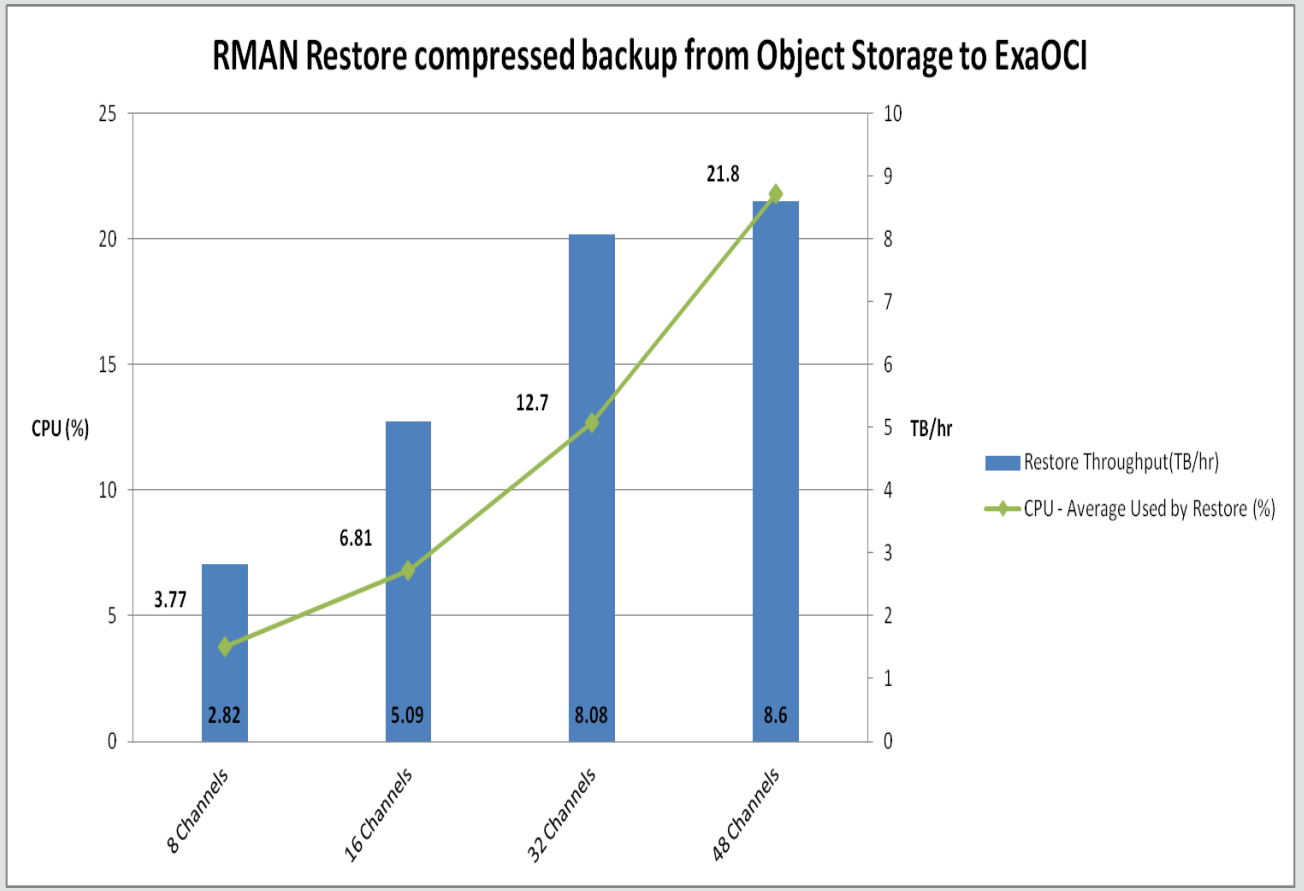
Backup and Restore Performance Improvements



Default: 2 TB/hr
Tuned: 8.31 TB/hr



Default: 18 TB/hr



Default: 2.8 TB/hr Tuned: 8 TB/hr

Oracle MAA Best Practices for Oracle Cloud Backups

Cloud Tip 8: Leverage Exadata Health Checks and Integrate Monitoring and Alerting

- Real Time Monitoring and Monthly Health Checks keep the Exadata Cloud system healthy and sound
- Oracle Exadata Database Machine exachk or HealthCheck (Doc ID 1070954.1)
  - Execute monthly and address FAILURES and WARNINGS
- Use Enterprise Manager
  - Deploy EM agents in each database server (DomU)
  - Monitor cluster, ASM, and database
  - Refer to Oracle Enterprise Manager for Exadata Cloud, Exadata Health and Resource Utilization Monitoring - Exadata Database Machine KPIs and Exadata Health and Resource Utilization Monitoring - Adaptive Thresholds
- Use Cloud Console to monitor overall state of your cloud targets

Final Tip: Leverage Cloud Documentation and MAA Cloud OTN Collateral

Refer to MAA Cloud OTN

- https://www.oracle.com/database/technologies/high-availability/oracle-cloud-maa.html
- Oracle Cloud: Maximum Availability Architecture Presentation
- Continuous Availability - Application Checklist for Continuous Service for MAA Solutions
- Hybrid Data Guard to Exadata Cloud Services - Production Database on Premises and Disaster Recovery with OCI Exadata Cloud Services
- Oracle GoldenGate Microservices Architecture on Oracle Cloud Infrastructure

Refer to Cloud Documentation

- Exadata OCI: https://docs.cloud.oracle.com/iaas/Content/Database/Concepts/exaoverview.htm
- Exadata Cloud@Customer: https://docs.oracle.com/en/cloud/cloud-at-customer/exadata-cloud-at-customer/exacc/this-service.html

Best Practices for Oracle Exadata Cloud Deployments

Real World Implementation: World Bank Group

Swamy Kiran
Senior IT Officer, Data & Information Management
ITS Treasury

The World Bank Group

ITS Treasury WBG & IFC

WORLD BANK GROUP
INTEGRATED SERVICES
Information and Technology Solutions

Swamy Kiran, Senior IT Officer, Data and Information Management

Organization Overview

- Financial Services
- Treasury Systems and products
- Market position : Global
- Key IT locations : USA, India

Oracle Engineered Systems (ES)

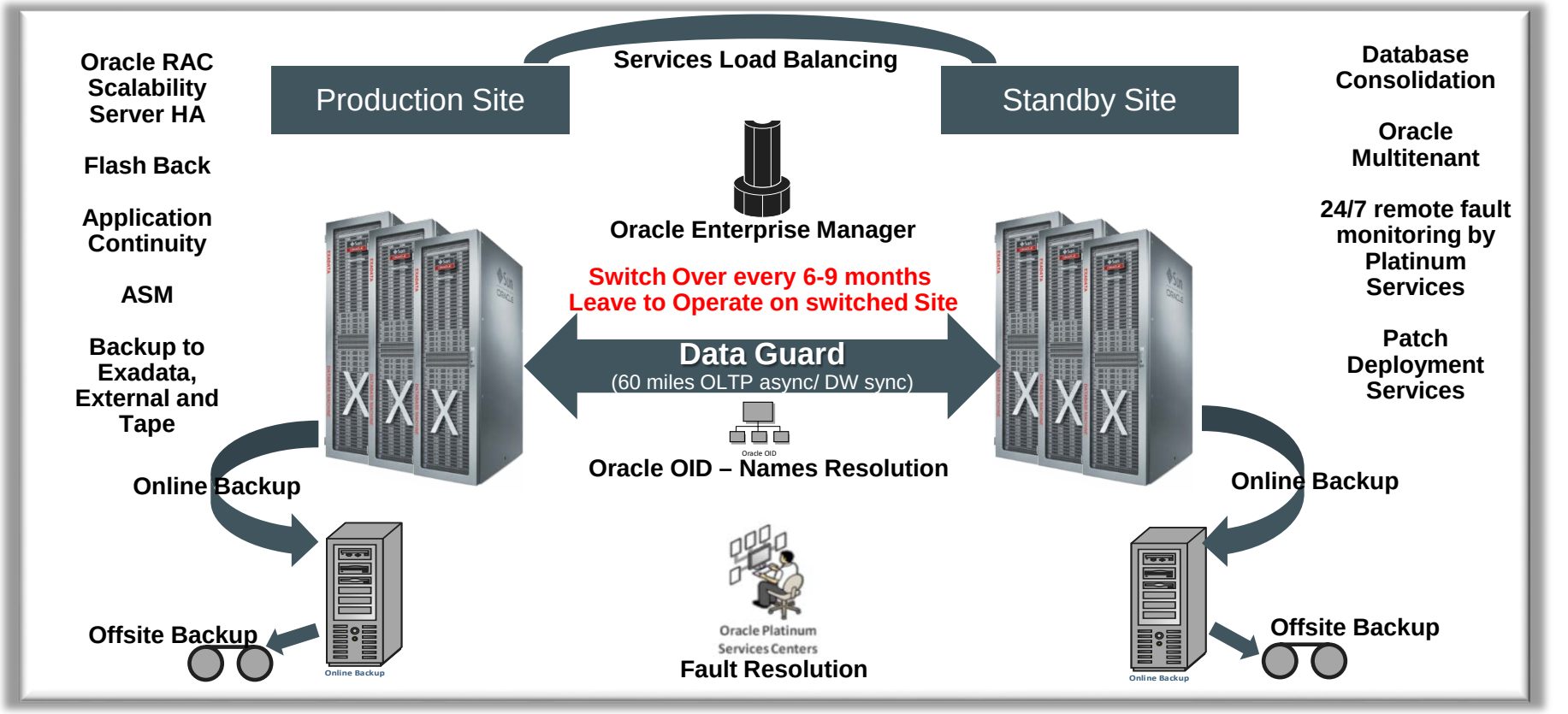
- Oracle Exadata
- Quantities : 9 (X4-2)
- We are in production 4+ years
- WBG+IFC Treasury 40+ Applications are running on Oracle ES – Trading Applications, Money Market, Enterprise Data Management - Both OLTP & Warehouse
- All of our Exadata systems are covered by Platinum Services

Oracle Exadata MAA Perspectives

- Eliminate risk of downtime and data loss
- Consolidation of Database work load - DB as a Services
- Reduced Complexity of database infrastructure
- Improve quality of service while increasing ROI
- Reduce down time, Reliable & Scalable Performance and End-to-End Management
- Twice a year patching – Patch assessment is completed by Platinum Services team
- Prepare for planned and un-planned outages

MAA Architecture at WBG-IFC Treasury

Best Practice of MAA helped us not to failover in last 4yrs



PoV (Proof of Value) - Objective

➢ Background

World Bank's Treasury (IBRD and IFC) currently use Oracle Exadata Machines to operate Oracle databases in the bank's on-premise data centers. The current Exadata Machines X4-2 reaches end-of-life in 2019, these Exadata needs migrate next generation currently X7-2.

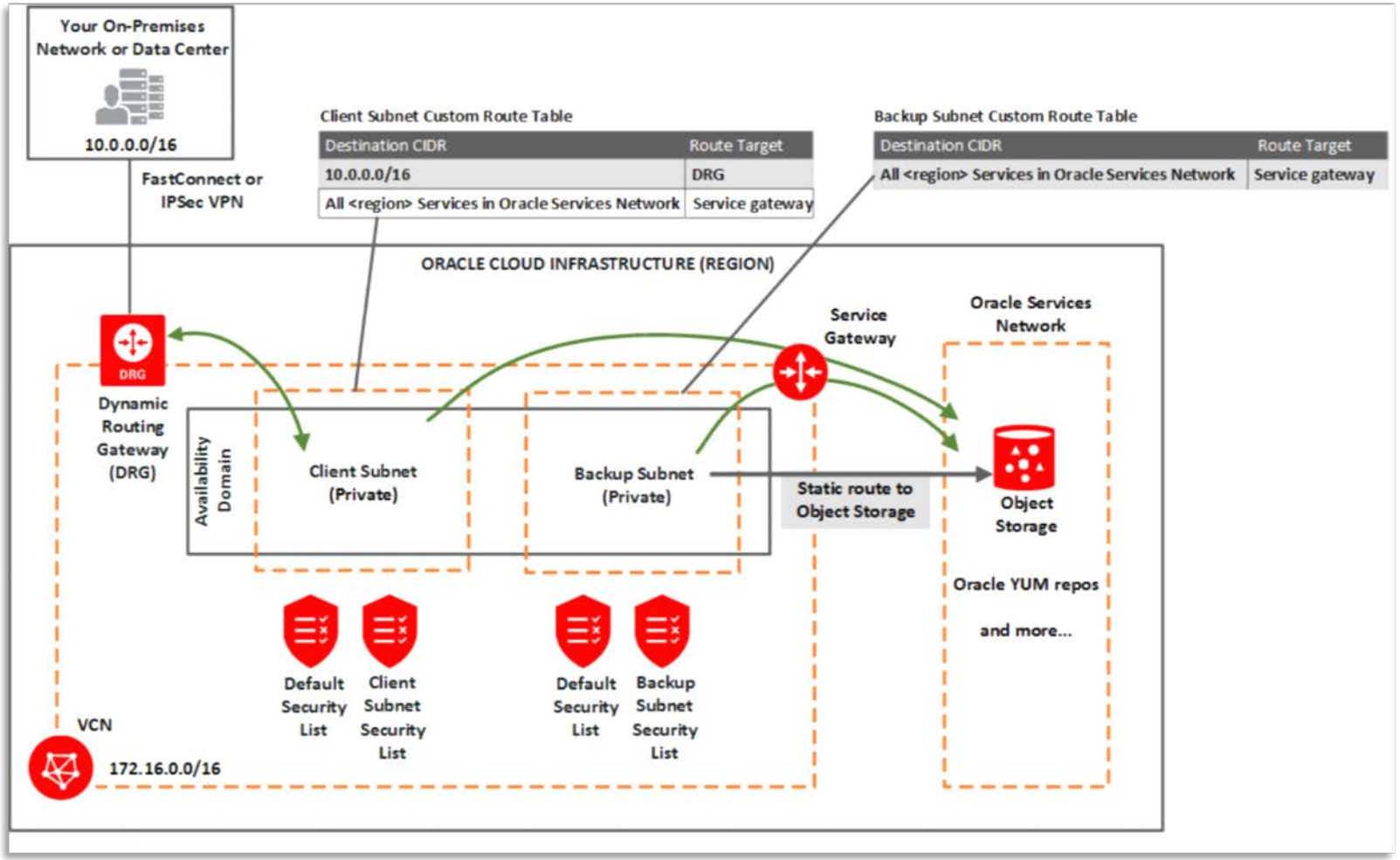
There are 3 options to move to next generation offered by Oracle

- This POV will help World Bank gather information to assist the upcoming decision on moving to Exadata Cloud Service.

➢ POV Objectives

- ✓ ExaCS/Exadata Functional Equivalence: Demonstrate that Oracle's Exadata Cloud Service operates in the same fashion as Oracle Exadata Database Machine on premise.
- ✓ On-premise Application Access to Exadata CS: Demonstrate an on-premise application accessing data contained within Oracle Exadata Cloud Service.
- ✓ Performance of Exadata CS: Document the performance characteristics of Oracle Exadata Cloud Service.

PoV Architecture at WBG-IFC Treasury



Best Practices for – Exadata DB Systems

Oracle recommends to follow some of the best practice guidelines to ensure the manageability of your Exadata DB Systems ExaCS

- SSH Key settings associated with Exadata DB Systems
- Apply “only” patches available via cloud Exadata DB Services
- Apply quarterly patches regularly
- Networking : Subnets, Route tables, Static route, Dynamic routing gateway (DRG), FastConnect (BGP) - follow as per the setup requirements
- Exadata Cloud Service – Data Guard between Availability Domains and Regions
- Exadata Database Backup – Exadata and Object Storage

Best Practices for Oracle Exadata Cloud Deployments

Conclusion

Conclusion

- Many ways ensure availability and performance from Oracle Exadata Cloud
  - Oracle Exadata Cloud Service
  - Oracle Exadata Cloud at Customer

- Understand what your business needs are
- Know which MAA to implement
- Stay updated

Resources

Oracle MAA with Exadata Cloud at Customer and Exadata Cloud Service White Paper:
https://oracle.com/technetwork/database/availability/exacc-exacs-maa-bestpractices-4031192.pdf

Oracle MAA Best Practices for the Oracle Cloud:
https://www.oracle.com/database/technologies/high-availability/oracle-cloud-maa.html

Oracle MOS Note 1302539.1: Best Practices for Corruption Detection, Prevention, and Automatic Repair in Oracle Exadata Cloud
https://mosemp.us.oracle.com/epmos/faces/DocumentDisplay?_afrLoop=2636187374130 21&id=1302539.1&_afrWindowMode=0&_adf.ctrl-state=nis81py9j_4

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

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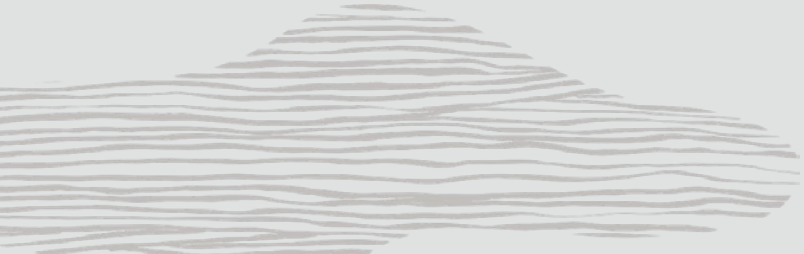

What's Ahead

Thursday

10:00-10:45 Exadata Cloud at Customer: Data Security 101 PRO4867
Moscone South – Room 213

1:15-2:00 MAA Best Practices for Oracle Database 19c TIP4847
Moscone South - Room 213

10:00-10:45 Exadata Cloud at Customer on Oracle Cloud Infrastructure: Features and Scalability CON5075
Moscone West - Room 3003

2:15-3:00 Best Practices for the Most Impactful Oracle Database 18c and 19c Features TIP4855
Moscone South - Room 205

Best Practices for Oracle Exadata Cloud Deployments

Q&A