

ORACLE



Oracle Database Services 2023

Get Started – Exam Code 1Zo-1093-23

Marcel Lamarca

Exadata Cloud Specialist

Oracle, Alliances and Channels LAD

April, 2024



SQL> select * from person where name = 'Marcel Lamarca'




MARCEL LAMARCA

Exadata Cloud Specialist

Upgrade, Utilities, Patching, Performance & Migrations

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 marcel.lamarca@oracle.com



About My Career

- 22 Years dedicated to study and support Oracle Databases.
- 12 Years working with Exadata (On-prem, C@C and Cloud Services) .
- 5 Year working for Oracle do Brasil
- 2 Year on Alliances LAD knowledge Team

Certifications

Oracle Cloud Specialist (OCS)

- Exadata Database Machine X9M Certified Specialist
- OCI Foundation 2020 / 2023
- Oracle Autonomous Database Administrator Professional 2019 / 2023
- Oracle Cloud Database Migration and Integration 2021
- OCI Cloud Certified Architect Associate 2022
- OCI Cloud Certified Architect Professional 2022
- OCI Multi-Cloud Architect Professional 2023
- Oracle Database Services Certified Professional 2023

Oracle Certified Professional (OCP)

- Oracle Database certified professional 10g, 11g, 12c and 19c.
- Mysql 8.0 Database Administrator Certified Professional

Oracle Certified Specialist (OCE)

- Grid/RAC Database Administrator 11g
- Oracle Golden Gate 12c Certified Implementation Specialist





Oracle Exam 1Z0-1093-23





- **1Z0-1093-23: Oracle Base Database Services 2023 Professional**



- Number of Questions **55**
- Format **Multiple Choice**
- Duration **90 minutes**
- Passing Score **68%**



Oracle Base Database Services 2023 Exam Topics

Exadata Database Service

- Explain the Exadata Database Service
- Provision Exadata
- Manage Exadata Infrastructure and VM Clusters
- Manage the Exadata Database Lifecycle
- Utilize Exadata Cloud Management tools

DB Systems VM

- Discuss Database Cloud Services (Overview)
- Provision Database Cloud Service on a Virtual Machine DB System
- Manage Database Cloud Service on a Virtual Machine DB System
- Manage the Database Lifecycle for dvcs Virtual Machine DB System
- Utilize Database Cloud Service Management Interfaces

Oracle Cloud Platform for Database in the Cloud

- Describe Oracle Cloud Platform for Database in the Cloud
- Describe Oracle Cloud Infrastructure Strategy (OCI)

NoSQL Database Cloud Service

- Explain connecting to the NoSQL Database Cloud service
- Explain table security management
- Explain table rate limiting
- Describe NoSQL data models
- Explain provisioned throughput for NoSQL Cloud Service
- Describe NoSQL language SDKs



MySQL Database Service and HeatWave Overview

- Describe the MySQL Database Service
- Manage MySQL Database
- Provision and connect to MySQL Database
- Monitor MySQL Database
- Set up Backup for MySQL Database Service
- DesC performance considerations for the MySQLService
- Create, manage, and use HeatWave

Oracle Cloud Infrastructure Database Management Service

- Describe the Oracle Cloud Infrastructure Database Management Service
- Install and configure Management Agent
- Register External Databases & enable and use Database Management
- View Fleet Summary and Management features
- Use Database Groups and Jobs



Agenda

1

Exadata Cloud

Exadata@Customer
Exadata Cloud Service

2

OCI DBCS service

DBCS Virtual single
DBCS Virtual RAC

3

Mysql service

OCI Mysql Services

4









NoSQL Service

OCI NoSQL Services

Choice of control and hybrid strategies

Use a single database for all deployments



							
Autonomous Database Serverless	Autonomous Database Dedicated	Exadata Cloud@Customer	Oracle Database Service on OCI Compute (VM)	Database Cloud Service (VM)	Exadata Cloud Service	Oracle Exadata On-Premises	Commodity HW, On-site
Fully automated data management with no human intervention	Fully automated, isolated data management with control	Database control, sovereignty, privacy req. of mission critical workloads managed by Oracle	Customer deployed and managed DB Workloads on OCI compute	DB Workloads running on BM/VM in public cloud	High performance DB workloads on Exadata in public cloud	For sensitive data with higher availability, perf needs	Customer-managed workloads running on commodity h/w





Oracle Exadata Cloud



Exadata Cloud on OCI Console

ORACLE Cloud Cloud Classic > Search resources, services, documentation, and Marketplace

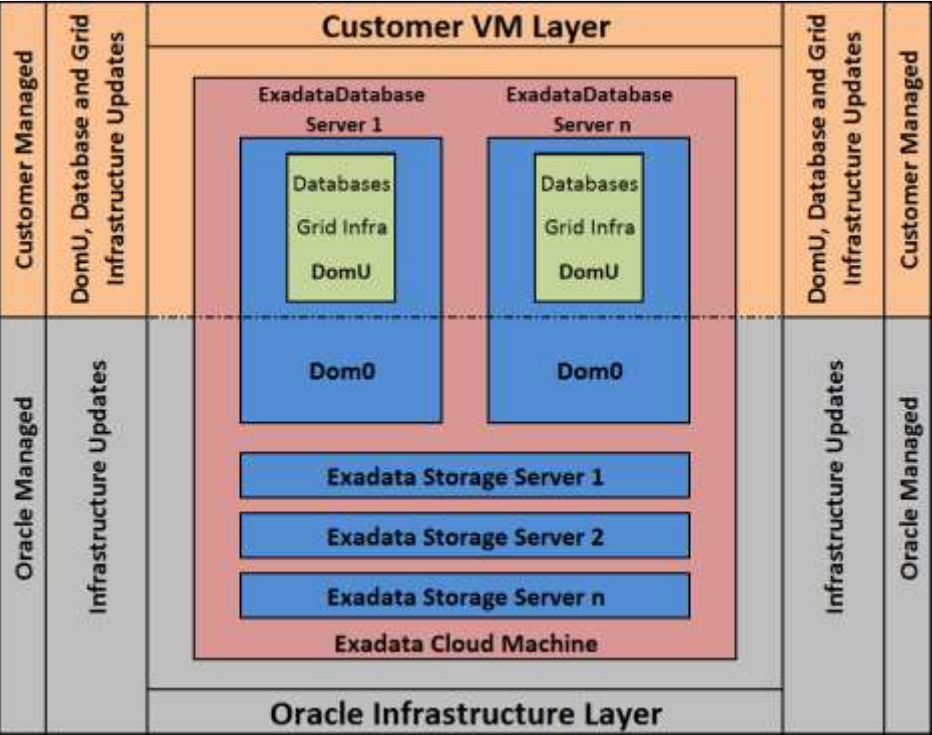
Search

- Home
- Compute
- Storage
- Networking
- Oracle Database**
- Databases
- Analytics & AI
- Developer Services
- Identity & Security
- Observability & Management

Oracle Database

- Overview**
- Autonomous Database**
 - Autonomous Data Warehouse
 - Autonomous JSON Database
 - Autonomous Transaction Processing
- Globally Distributed Autonomous Database**
- Autonomous Dedicated Infrastructure**
- Oracle Base Database Service**
- Oracle Exadata Database Service on Dedicated Infrastructure**
- Oracle Exadata Database Service on Cloud@Customer**
- Exadata Fleet Update**
- External Database**
- Data Safe - Database Security**
 - Overview
 - Security Assessment
 - User Assessment
 - Data Discovery
 - Data Masking
 - Activity Auditing
 - SQL Firewall
- Database Backups**
- GoldenGate**
- Operator Access Control**

Exadata Cloud | Domo vs DomU Roles and Responsibilities



About *Domo* Oracle Responsibilities

- Oracle Cloud Ops manage Exadata infrastructure (hardware, system software) & hypervisor (domo);
- Oracle Support is responsible for update any version;
- The customer is responsible for scheduling Domo maintenance and must provide at least 4 dates per year;

About *DomU* Customer Responsibilities

- Adjust license (BYOL or License included)
- Scale UP/Down resources
- For Exadatada Cloud at Customer Gen2 DomU uses KVM
- Customer have root access to domU;
- The customer is responsible for any update or configuration change on DomU;



Database Cloud Service | Exadata

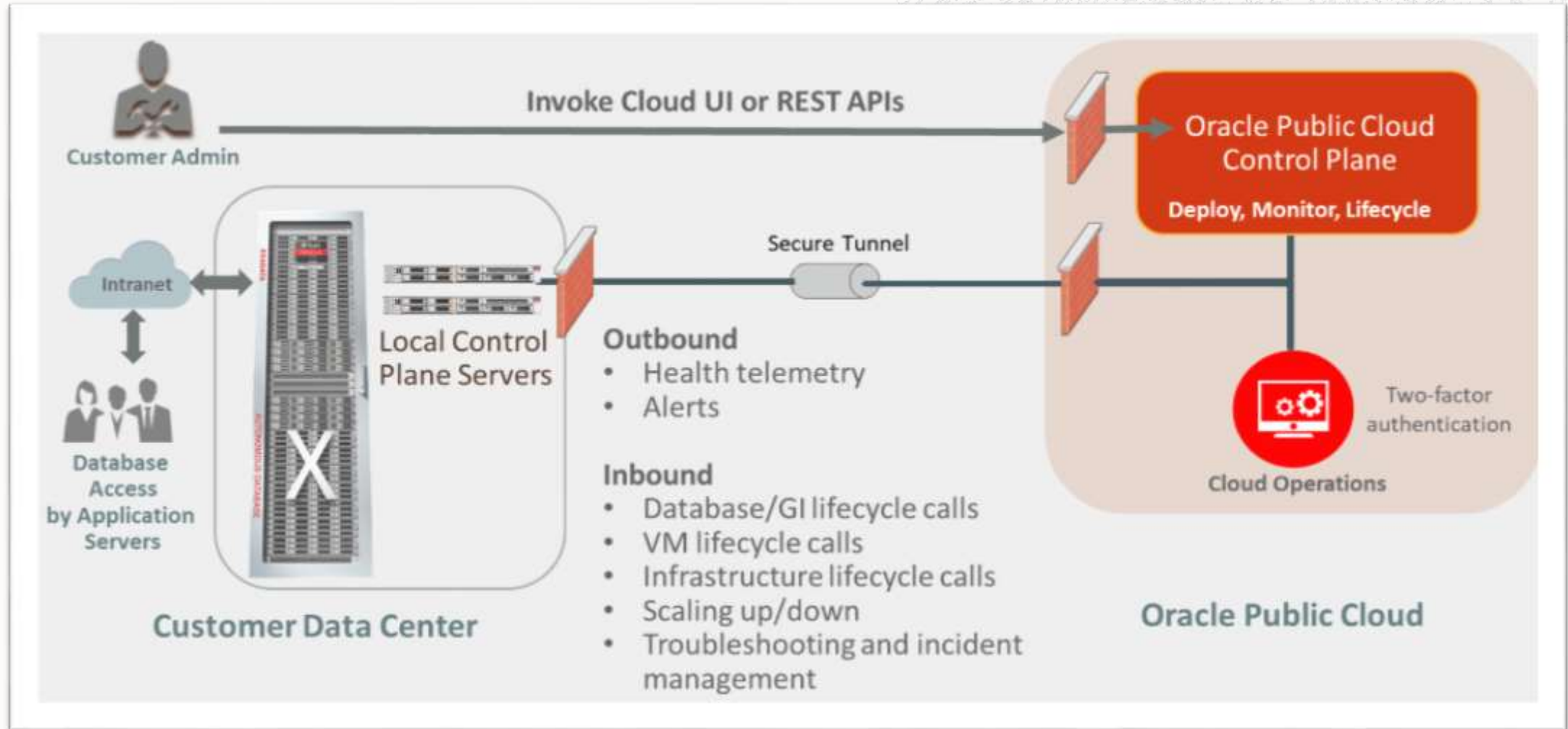
Understanding Oracle Exadata Cloud Service and Cloud at Customer



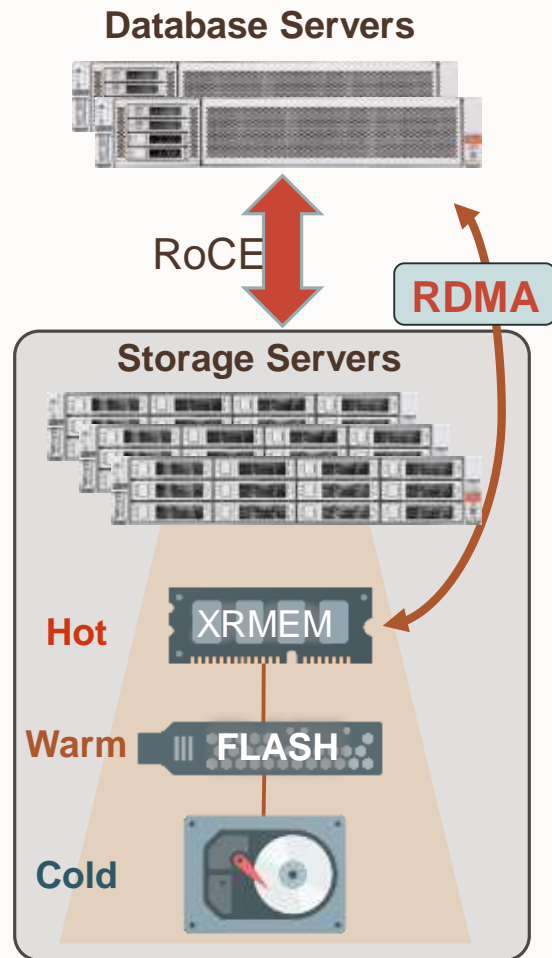
World's Best database machine, provisioning with GI

- As many databases as you want
- No Single Instance allowed. Just RAC!
- Start With 2 cores and Scale Up/Down OCPU's based on your requirement
- Data Guard with and across Ads
- Only Oracle Database Enterprise Editions allowed
- Works with Autonomous Database on Dedicated Infrastructure
- Requires a minimum 4 years usage commitment for the infrastructure

Exadata Cloud at Customer | Control Plane Workflow



Exadata architecture – scale out with intelligent storage



Scale-out system architecture and software

- Independent, online scaling of database and storage servers
- Scales from 2 to 210 Exadata X10M database servers
- Scales from 3 to 264 Exadata X10M storage servers
- Redundancy with fast failover provides high availability

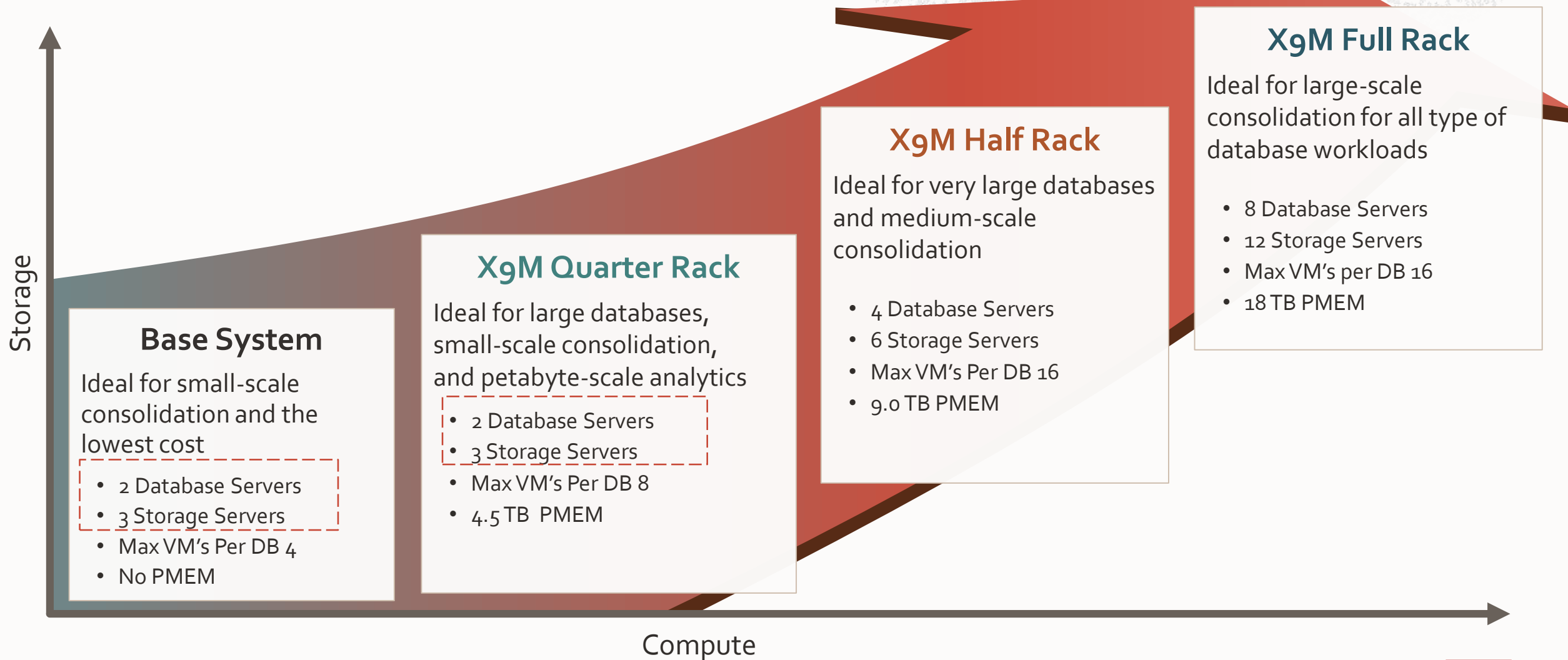
Database uses RDMA instead of I/O to read XMEM in Smart Storage

- Bypasses network and I/O software, interrupts, context switches
- Data is transparently managed in multiple storage tiers to minimize latency
- High-performance active-active 100 Gbit/s internal network maximize throughput
- Speeds up both database reads and commits

Database cluster virtualization

- Deploy environments with different needs on the same system
 - Dev-Test, Staging Production, DR
 - OLTP, Analytics, Mixed Workloads
- Share and manage pools of resources to increase efficiency and lower costs
- Isolate resources to meet differing security and predictability requirements

Exadata Cloud X9M Flexible Shapes



Exadata Cloud at Customer X1oM Shapes



Quarter Rack – X1oM

Total Capacity

DB Servers
Storage Servers

380 Cores – 2,780 GB Memory
192 TB Usable DB Storage

NEW
SHAPE



Quarter Rack – X1oM - L

380 Cores – 4,180 GB Memory
192 TB Usable DB Storage

NEW
SHAPE



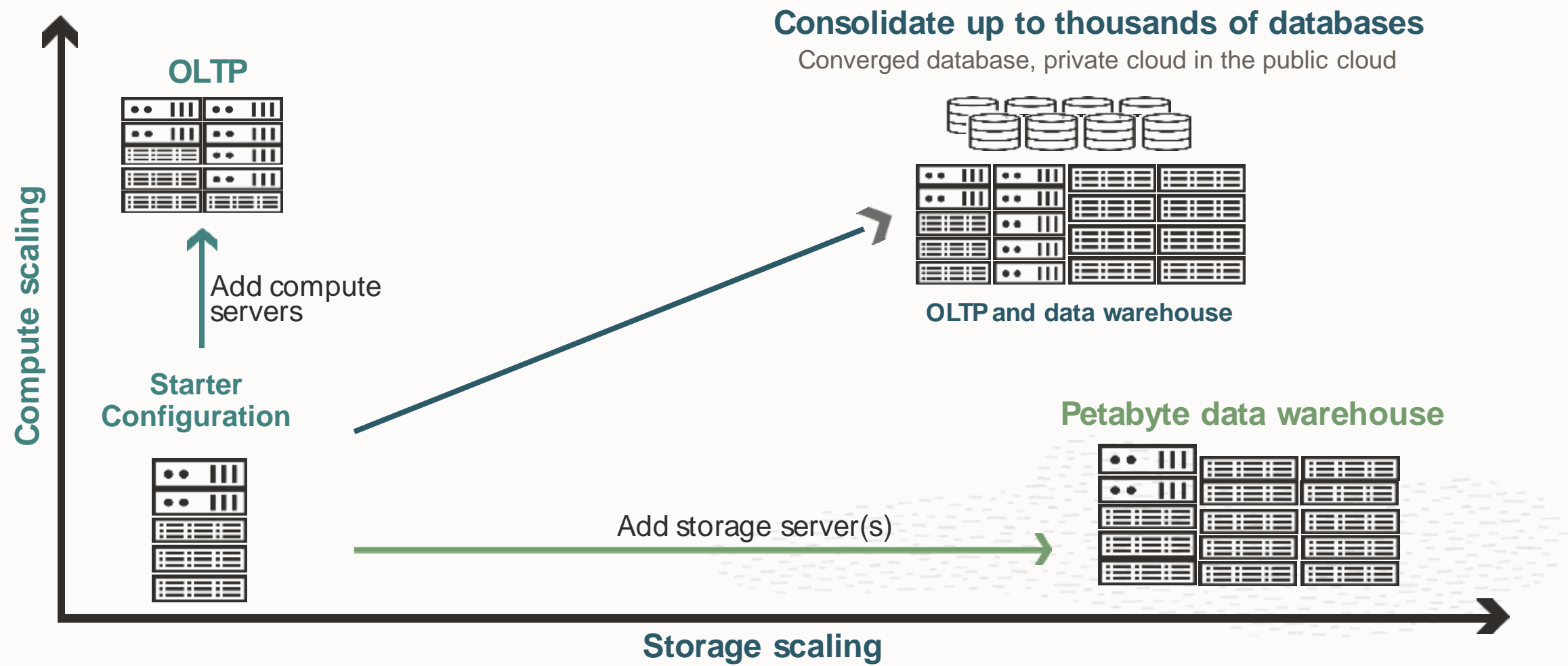
Quarter Rack X1oM-XL

380 Cores – 5,600 GB Memory
192 TB Usable DB Storage

There are no Half and Full rack shapes.
Expand Quarter Racks using Expansion Servers.



Easily right-size your service by adding compute and storage as needed



Online – No downtime scaling



Cloud Automation for Common Lifecycle Tasks

Oracle Cloud Web base UI, REST APIs, SDK, CLI, Terraform

- Scale OCPUs
- Create Database Homes and Databases
- Schedule Infrastructure Maintenance
- Update Operating System, Grid Infrastructure, and Databases
- Backup and recovery
- Enable Data Guard

Create Database

Database name:

Database version:

PDB name:

Database Home:

Database Home display name:

Create administrator credentials:

Scale VM Cluster

Configure the VM cluster

Specify OCPU count per virtual machine:

Requested OCPU count for the Exadata VM cluster:

Current Exadata storage:

Create Backup

Name:

If you previously used RMAN or dbcli to configure backups and then you switch to using the Console or the API for backups, a new backup configuration is created and associated with your database. This means that you can no longer rely on your previously configured unmanaged backups to work.

Enable Data Guard

Data Guard association details

Protection mode:

Transport type:

Async

Select Peer VM Cluster

Peer region:

US East (Ashburn)

Exadata Cloud Command Line Interface (*dbaascli*)

How to upgrade DBAAS Cloud Tooling using *dbaascli* (Doc ID 2350471.1)

Database Commands

- *dbaascli* database create
- *dbaascli* pdb create
- *dbaascli* pdb relocate



Backup Commands

- *dbaascli* database backup
- *dbaascli* database recover
- *dbaascli* create-dbstorage



Database Home Patch

- *dbaascli* database upgrade
- *dbaascli* db home patch
- *dbaascli* grid patch
- *dbaascli* update-dbhome



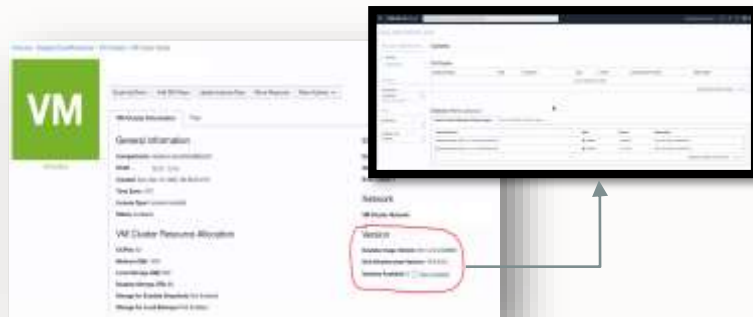
Exadata Cloud Pathing

Pathing domo, domU, Tooling, Grid and Oracle home, how and how to do

DOMU - CUSTOMER RESPONSIBILITY

Maintaining a secure Exadata Service instance in the best working order requires you to perform the following tasks regularly:

- Patching Grid Infrastructure.
- Patching Database software.
- Patching Exadata Software Image (SO).
- Patching Tooling (dbaascli).
- Patching other components installed on DomU.



DOMo - ORACLE RESPONSIBILITY

Oracle manages quarterly infrastructure maintenance updates of all other infrastructure components:

- Patching Database Servers (Dom0).
- Patching Storage servers.
- Patching Network switches.
- Patching Control Planes.

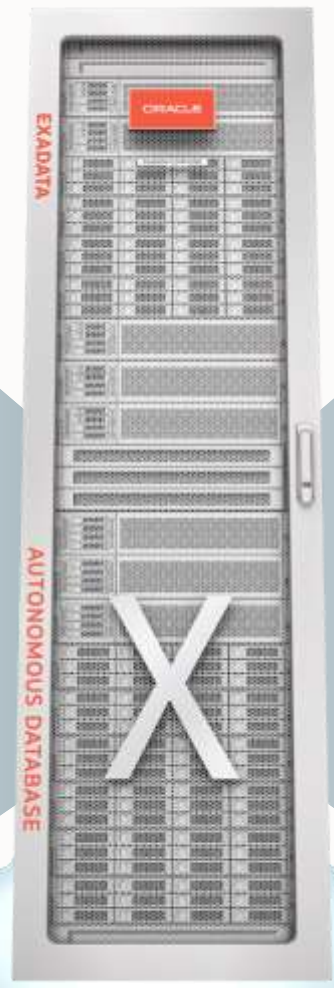
Quarterly maintenance updates may require a restart of the customer-managed guest virtual servers.

Quarter 1	Quarter 2	Quarter 3	Quarter 4
✓ JANUARY	✓ APRIL	✓ JULY	✓ OCTOBER
✓ FEBRUARY	✓ MAY	✓ AUGUST	✓ NOVEMBER
✓ MARCH	✓ JUNE	✓ SEPTEMBER	✓ DECEMBER

Oracle Database and Exadata Platform Innovations

-  Multitenant
-  In-Memory DB
-  Real Application Clusters
-  Active Data Guard
-  Partitioning
-  Advanced Compression
-  Advanced Security, Label Security, DB Vault
-  Real Application Testing
-  Advanced Analytics, Spatial and Graph
-  Management Packs for Oracle Database

All Oracle Database Innovations



All Exadata DB Machine Innovations

- Offload SQL to Storage
- RoCE Fabric
- XRMEM Data Accelerator
- Smart Flash Cache
- Storage Indexes
- Columnar Flash Cache
- Hybrid Columnar Compression
- I/O Resource Management
- Network Resource Management
- In-Memory Fault Tolerance
- Exafusion Direct-to-Wire Protocol



Fastest Cloud In Memory, Smart Scan and HCC

Unique: Smart Scan (SQL Offload)

- Data-intensive processing* runs in Exadata Storage, bypassing network bottlenecks and freeing up DB CPUs

Unique: Tiered Flash Cache

- Active data is automatically cached on PCI NVMe Flash, inactive data on low cost, high-capacity disks

Unique: Storage Indexes

- Eliminates I/O not relevant to a particular query

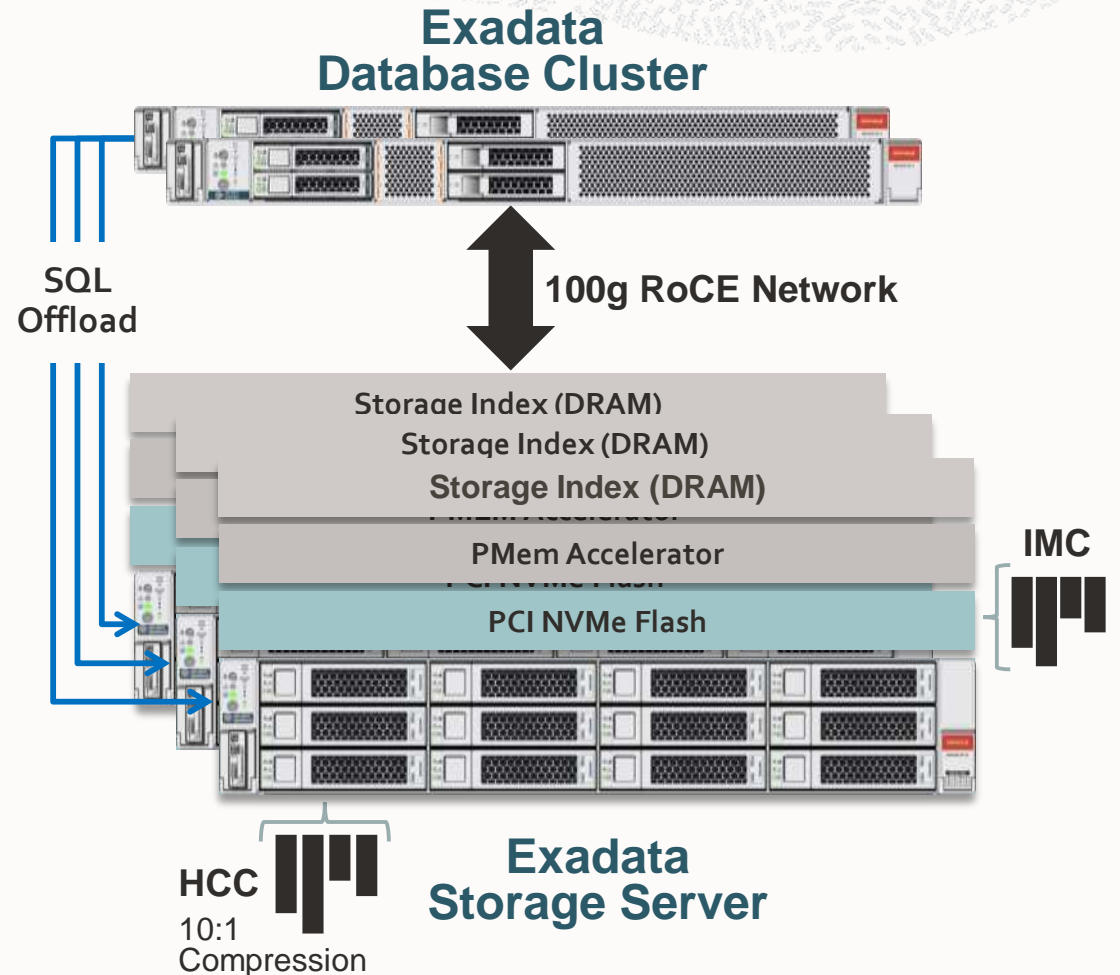
Unique: Hybrid Columnar Compression (HCC)

- Compressed, columnar format in storage, saving space, reducing I/O, speeding analytic queries

Unique: In-Memory Columnar (IMC)

- Extends In-Memory database performance to higher capacity Flash memory in storage

*Includes long-running SQL queries, backups, decryption, aggregation, data mining





Oracle Database Services (DBCS)



Oracle Database Cloud Service (DBCS) on OCI Console

ORACLE Cloud Cloud Classic > Search resources, services, documentation, and Marketplace

Q Search

Home
Compute
Storage
Networking
Oracle Database
Databases
Analytics & AI
Developer Services
Identity & Security
Observability & Management

Oracle Database

Overview

- Autonomous Database**
 - Autonomous Data Warehouse
 - Autonomous JSON Database
 - Autonomous Transaction Processing
- Globally Distributed Autonomous Database**
- Autonomous Dedicated Infrastructure**
- Oracle Base Database Service**

Oracle Exadata Database Service on Dedicated Infrastructure

Oracle Exadata Database Service on Cloud@Customer

Exadata Fleet Update

External Database

Data Safe - Database Security

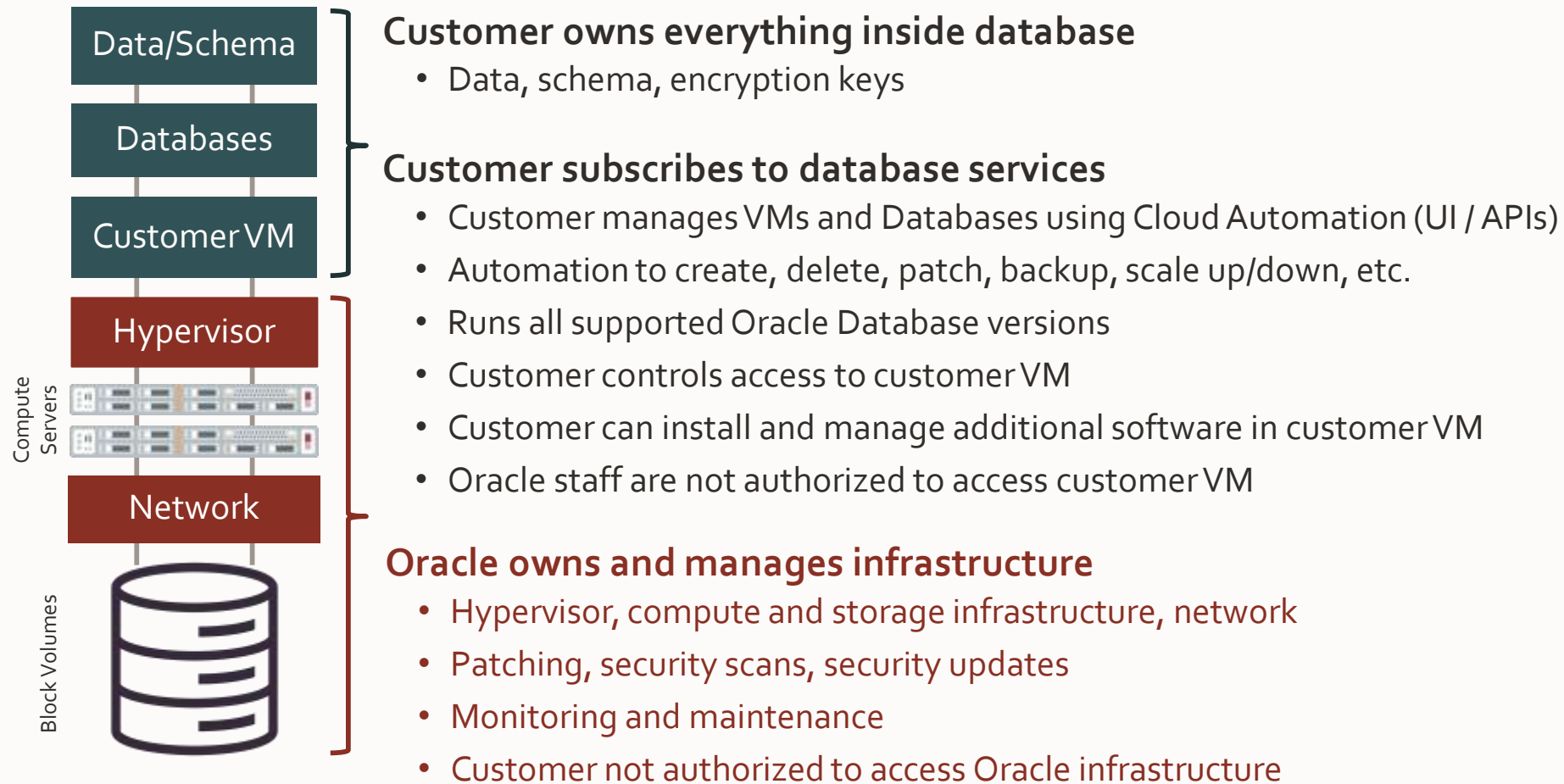
- Overview
- Security Assessment
- User Assessment
- Data Discovery
- Data Masking
- Activity Auditing
- SQL Firewall

Database Backups

GoldenGate

Operator Access Control

Customer managed databases with Oracle managed infrastructure



Database Cloud Service | Virtual Machine

Understanding Oracle OCI DBCS roles and limitations



Entry-level, provision with GI or LVM (fast-provision)

- 2 DB Systems types on VM

One Node – One VB Database System

Two Nodes – Two VM Clusters with Oracle RAC Features


- On A RAC shape, each node is assigned on a different fault domain
- **1 to 64 OCPU's** for Enterprise Edition
- **1 to 8 OCPU's** for Standard Edition
- **16 GB** memory per **OCPU**, up to **1 TB** total memory
- Requires Node reboot after any shape change


Oracle DBCS Virtual Machine Console provisioning


Change shape

Shape series

A shape determines the options for resources such as node count, core count and storage. [Learn more.](#)

**AMD**
Flexible OCPU count. AMD processors.

**Intel**
Flexible and fixed OCPU count. Intel processors. ✓

**Ampere**
Flexible OCPU count. Arm-based processors.

Intel X9
Flexible OCPU count ✓

Intel X7
Fixed OCPU count

Change shape

Configure OCPU

Name	OCPU	Memory	Network bandwidth	Theoretical max IOPS
<input checked="" type="checkbox"/> VM.Standard3.Flex	8	128 GB	8 Gbps	128K

You can customize the number of OCPUs. Other resources scale proportionately. [Learn more about flexible shapes.](#)

Number of OCPUs per node

1 32

1 Selected

Showing 1 Item

Configure storage

You can choose the storage management software type (Grid Infrastructure or Logical Volume Manager), the performance setting and specify how much storage to provision.

Oracle Grid Infrastructure
Block Volume Performance: Higher performance
256 GB available storage, 19.2K IOPS

Change storage

Configure the DB system

Total node count

2

Oracle Database software edition

Enterprise Edition Extreme Performance

Total storage (GB) *Read-only* ⓘ

912



Oracle DBCS Virtual Machine Console Management

Choose a license type

License included

Subscribe to new Oracle Database software licenses and the Database service.

Bring Your Own License (BYOL)

Bring my organization's Oracle Database software licenses to the Database service. [Learn more.](#)

Specify the network information

Virtual cloud network in **marlamar** [\(Change compartment\)](#)

Select a virtual cloud network

Client subnet in **marlamar** [\(Change compartment\)](#)

Select a Virtual Cloud Network first

Do not use a subnet that overlaps with 192.168.16.16/28, which is used by the Oracle Clusterware private interconnect on the database instance.

☐ Use network security groups to control traffic ⓘ

Hostname prefix ⓘ

Diagnostics collection

Enabling diagnostics collection and notifications allows you and Oracle Cloud operations to identify, investigate, track, and resolve guest VM issues quickly and effectively. You must subscribe to events to receive notifications. [Learn more.](#)

- ☒ **Enable diagnostic events**
Allow Oracle to collect and send fault notifications about critical, warning, and information events to me. [Learn more](#)
- ☐ **Enable health monitoring**
Allow Oracle to collect health metrics/events such as Oracle Database up/down, disk space usage, etc., and share them with Oracle Cloud operations. You might receive some event notifications. [Learn more](#)
- ☒ **Enable incident logs and trace collection**
Allow Oracle to collect incident logs and traces to enable fault diagnosis and issue resolution. [Learn more](#)

Continuous availability and scalability on 2-node RAC

Oracle Database on virtual machines

- 2 to 128 vCPUs
- Up to 1 TB GB memory



1-node database system

Oracle Database on virtual machines

- 2 to 128 vCPUs
- Up to 1 TB GB memory



1-node database system

RAC

Up to 80 TB of usable block-volume storage
Total 4 to 256 vCPUs, up to 2 TB total memory
Available with Enterprise Edition extreme performance

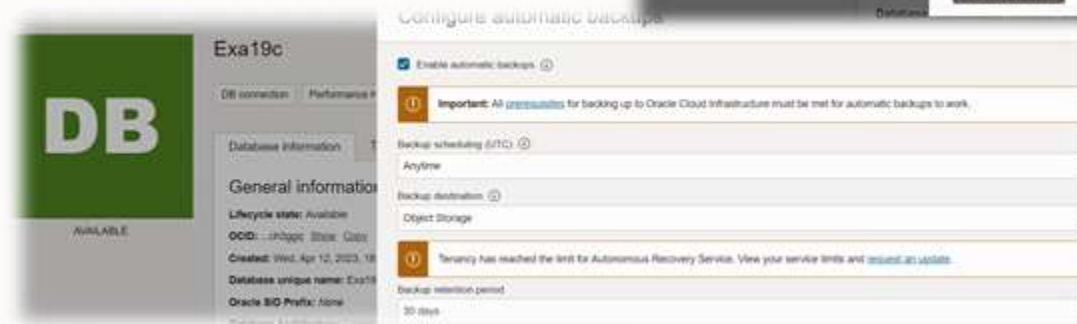
Oracle Database automatic backup

Manage backup and restore feature for VM/BM DB System

- Backup stored in Object or Local storage
- DB System in private subnets can leverage Service Gateway
- Start With 2 cores and Scale Up/Down OCPU's based on your requirement

Backup Options

- It is not possible to create a non-CDB via the console - use dbcli



Cloud Automation for Common Lifecycle Tasks

Oracle Cloud Web base UI, REST APIs, SDK, CLI, Terraform

- Scale OCPUs
- Create Database Homes and Databases
- Schedule Infrastructure Maintenance
- Update Operating System, Grid Infrastructure, and Databases
- Backup and recovery
- Enable Data Guard

Create Database

Database name:

Database version:

PDB name:

Database Home:

Database Home display name:

Create administrator credentials

[Create Database](#) [Cancel](#)

Scale VM Cluster

Configure the VM cluster

Specify OCPU count per virtual machine:

Requested OCPU count for the Exadata VM cluster:

Current Exadata storage:

[Scale](#) [Cancel](#)

Create Backup

Name:

If you previously used RMAN or dbcli to configure backups and then you switch to using the Console or the API for backups, a new backup configuration is created and associated with your database. This means that you can no longer rely on your previously configured unmanaged backups to work.

[Create Backup](#) [Cancel](#)

Enable Data Guard

Data Guard association details

Protection mode:

Transport type:

Async

Select Peer VM Cluster

Peer region:

US East (Ashburn)

OCI Command Line Interface (*DBCLI* and *OCI CLI*)

DBCLI

```
# dbcli create backup

# dbcli list-databases

# dbcli modify-database

# dbcli register-database
```

- **Must be executed on DB System host !**

OCI CLI

```
# oci database-management associated-
database-summary list-associated-databases
[OPTIONS]

# oci os bucket update [OPTIONS]

# oci data-safe audit-profile calculate-
audit-volume-available [OPTIONS]
```

Patching Concepts | in Place Patching



Oracle Home,
19.18.0



Patching Concepts | in Place Patching



~~Oracle Home,~~
~~19.18.0~~



```
SQL> SHUTDOWN IMMEDIATE
```

```
# DATAPATCH
```

Patching Concepts | Out-Of-Place Patching

Oracle Home,
19.18.0



```
SQL> SHUTDOWN IMMEDIATE
```



```
# DATAPATCH
```

New Oracle Home, 19.20.0

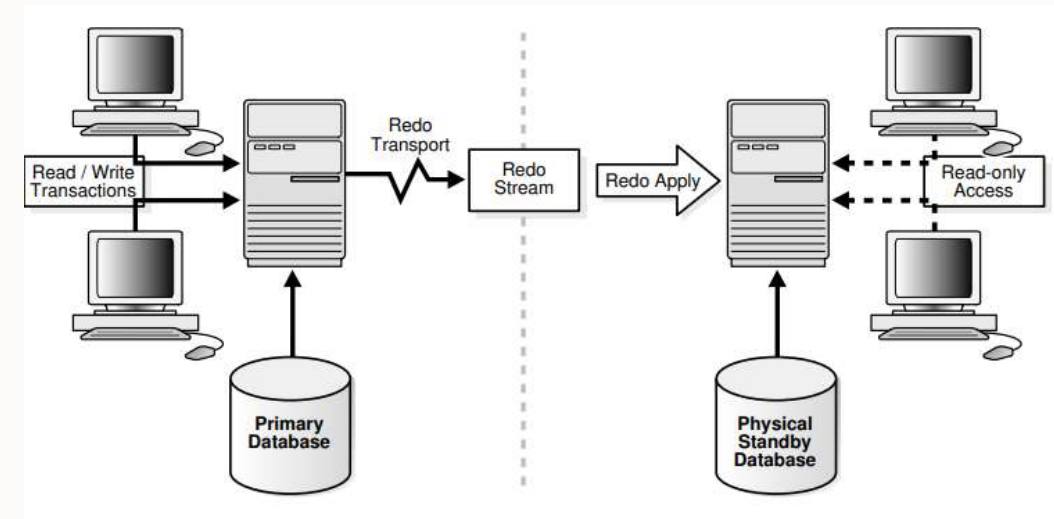


Oracle MAA OCI Data Guard



OCI Active Data Guard VS Data Guard

- Data Guard and Active Data Guard provide disaster recovery (DR) for databases with recovery time objectives (RTO) that cannot be met by restoring from backup.
- Oracle recommends that the DB system of **the standby database be in a different availability domain.**
- Patch apply process on DB Sysytems with Dataguard applies on Primary First



Oracle OCI Data Guard Network Requirements

- Properly configure the security list ingress and egress rules for the subnets of both DB systems in the Data Guard association to allow TCP traffic to flow between the applicable ports. **Ensure that the rules you create are stateful (the default).**
- The egress rules in the example show how to enable TCP traffic only for port 1521, which is a minimum requirement for Data Guard to work. If TCP traffic is already enabled on all of your outgoing ports (0.0.0.0/0), then you need not explicitly add these specific egress rules. Service Gateway can provide NW connectivity.

Rules(Prod)	Stateless	Source	IP Protocol	Source Port	Dest Port
Ingress	No	10.0.01.0/24	TCP	All	1521
Egress	No	10.0.1.0/24	TCP	All	1521
Rules(Sby)	Stateless	Source	IP Protocol	Source Port	Dest Port
Ingress	No	10.0.0.0/24	TCP	All	1521
Egress	No	10.0.0.0/24	TCP	All	1521



Avoid Data Guard Provisioning Error | Change Ingress and Egress roles

Enable Data Guard

1 DB system information
2 Database information

Provide information for the initial database

Configure standby database

Database image *Optional*

Click **Change Database Image** to select your software version.

Change database image

Database password

.....

Show advanced options

Data Guard Association cannot be created when standard database service port (1521) is blocked for instances in Subnet: ocid1.subnet.oc1.lad.aaaaaaacx5bqxh24cgppgrzg7pfsrf4okvwhboryv6pj63xs435li5hcwkq by security rules associated with Subnet: ocid1.subnet.oc1.lad.aaaaaaacx5bqxh24cgppgrzg7pfsrf4okvwhboryv6pj63xs435li5hcwkq.

Previous Enable Data Guard Cancel

Oracle OCI Physical Data Guard Console Management

Database Information

Tags

General information

Lifecycle state: Available

OCID: ...32vonq Show Copy

Created: Sat, Oct 22, 2022, 19:54:02 UTC

Database Role: Standby

Database unique name: DB12_iad1r5

Oracle SID Prefix: None

Database Architecture: Container Database

Character Set: AL32UTF8

Backup

Automatic backup: Disabled ⓘ

Data Guard

Status: Enabled

Encryption

Encryption Key: Oracle-managed key



Data Guard Associations

Enable Data Guard

Peer database	Peer DB system	Peer role	Protection Mode	Transport type	Apply lag	Data Guard Type	Launched
DB12	DB12STDBY	Standby	Maximum Availability	Sync	0 seconds	Mounted (Data Guard)	Sat, Oct 22, 2022, 19:50:14 UTC

Showing 1 item < 1 of 1 >

Edit Data Guard Association

Data Guard association details

Data Guard Type

Active Data Guard

Active Data Guard is a licensed option to the Oracle Database Enterprise Edition and enables advanced capabilities that extend the basic Data Guard functionality. These capabilities include Real-Time Query and DML Offload, Automatic Block Repair, Standby Block Change Tracking, Fast Sync, Global Data Services, and Application Continuity. [Learn more](#)

Data Guard

Oracle Data Guard ensures high availability, data protection, and disaster recovery for enterprise data. Data Guard provides a comprehensive set of services that create, maintain, manage, and monitor one or more standby databases to enable production Oracle databases to survive disasters and data corruptions. Data Guard maintains these standby databases as transactionally consistent copies of the production database. [Learn more](#)

Protection mode

Maximum Availability

Data Guard Associations

Enable Data Guard

Peer database	Peer DB system	Peer role	Protection Mode	Transport type	Apply lag	Data Guard Type	Launched
DB12	single_marcel01	Standby	Maximum Availability	Sync	0 seconds	Mounted (Data Guard)	Sat, Oct 22, 2022, 19:50:14 UTC

Switchover

Edit Data Guard Association

Copy Peer Database OCID

Copy Peer DB System OCID



VM Data Guard Switchover through OCI Console

ORACLE Cloud

Cloud Classic >

Search resources, services, documentation, and Marketplace

US East (Ashburn) v

Overview > Oracle Base Database > DB Systems > DB System Details > Database Home Details > Database Details > Work requests > Work request details

WR

IN PROGRESS

Switchover Data Guard

Work request information

Switchover Data Guard

In progress

0% complete

Operation: Switchover Data Guard

Accepted: Tue, Apr 25, 2023, 22:28:56 UTC

OCID: ...s3rhla Show Copy

Started: Tue, Apr 25, 2023, 22:29:33 UTC

Compartment: acteamlad (root)/marlamar

Finished: —

Switchover Database

Help

Are you sure you want to perform a database switchover? A switchover reverses the primary and standby database roles.

Enter the database admin password

OK

Cancel

WR

SUCCEEDED

Switchover Data Guard

Work request information

Switchover Data Guard

Succeeded

100% complete

Operation: Switchover Data Guard

Accepted: Tue, Apr 25, 2023, 22:28:56 UTC

OCID: ...s3rhla Show Copy

Started: Tue, Apr 25, 2023, 22:29:33 UTC

Compartment: acteamlad (root)/marlamar

Finished: Tue, Apr 25, 2023, 22:32:43 UTC















MySQL Database Service



Oracle NoSQL Database Services on OCI Console

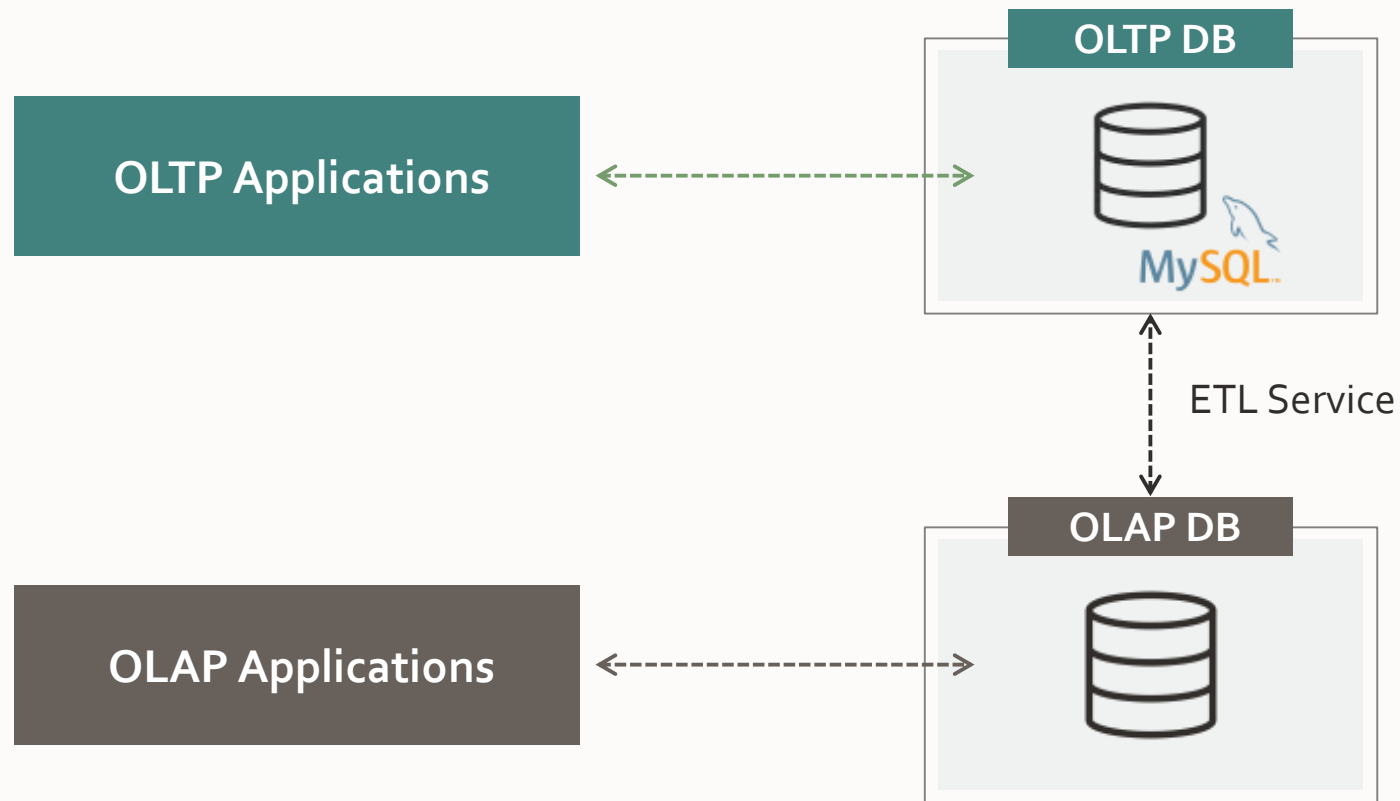
The screenshot displays the Oracle Cloud console interface. At the top, the header includes the Oracle Cloud logo, a 'Cloud Classic' button, and a search bar. The left sidebar contains a navigation menu with links to Home, Compute, Storage, Networking, Oracle Database, **Databases** (highlighted with a red dashed box), Analytics & AI, Developer Services, and Identity & Security. The main content area is titled 'Databases' and features a red-bordered box around the 'MySQL HeatWave' section, which includes links to Overview, DB Systems, Backups, Channels, and Configurations. Below this, the 'PostgreSQL' section is visible with links to Overview, DB Systems, Backups, and Configurations. To the right, there are additional links for 'MySQL HeatWave on AWS' (Administration), 'Oracle NoSQL Database' (Tables), 'OpenSearch' (Clusters, Backups), and 'Redis' (Clusters).

MySQL is the #1 Open Source Database

Rank			DBMS	Database Model	Dec 2023
Dec 2023	Nov 2023	Dec 2022			
1.	1.	1.	Oracle 	Relational, Multi-model 	1257.41
2.	2.	2.	MySQL 	Relational, Multi-model 	1126.64
3.	3.	3.	Microsoft SQL Server 	Relational, Multi-model 	903.83
4.	4.	4.	PostgreSQL 	Relational, Multi-model 	650.90
5.	5.	5.	MongoDB 	Document, Multi-model 	419.15

DB-ENGINES

MySQL is optimized for OLTP, not designed for analytic processing



Separate analytics database

Complex ETL

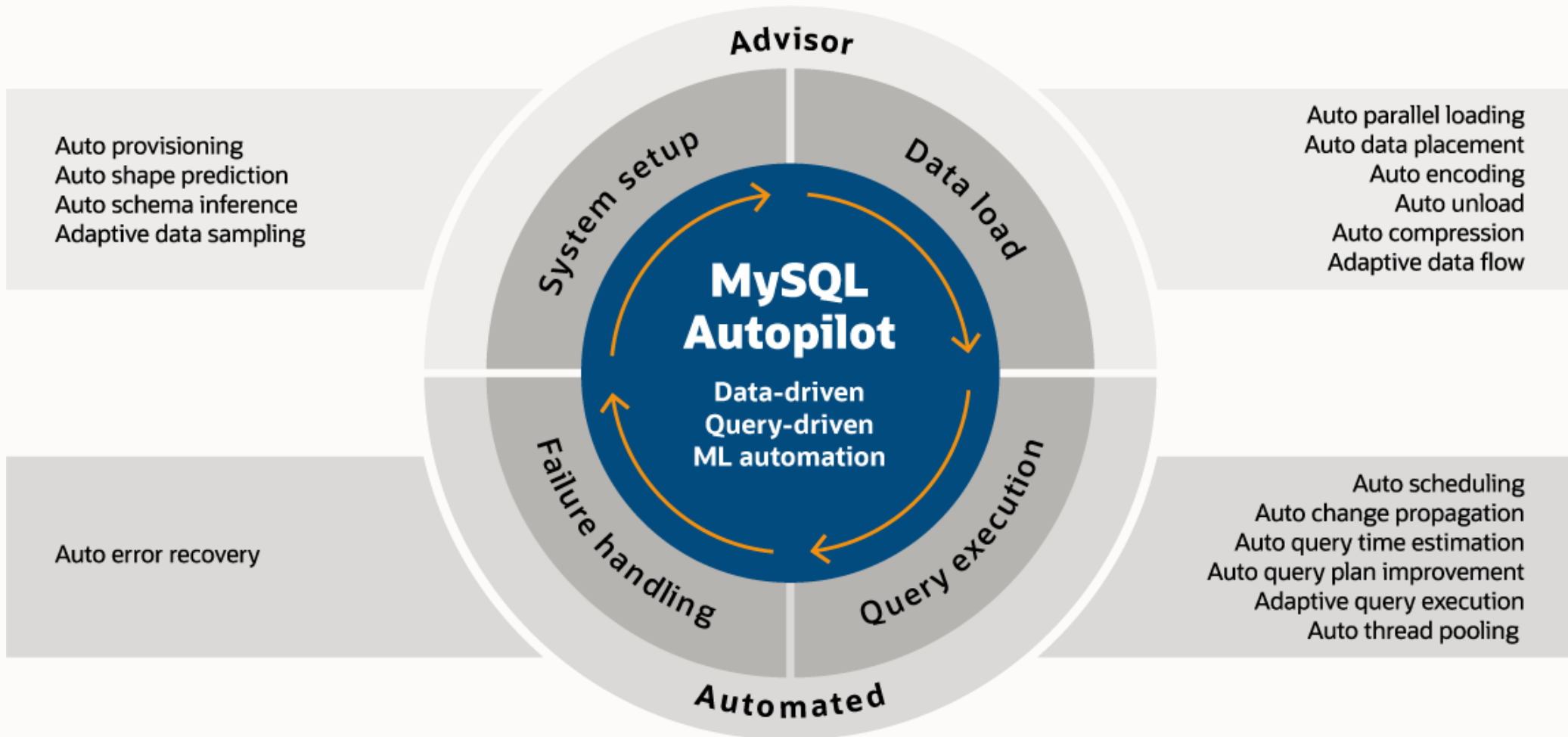
No real-time analytics

Security & compliance risks

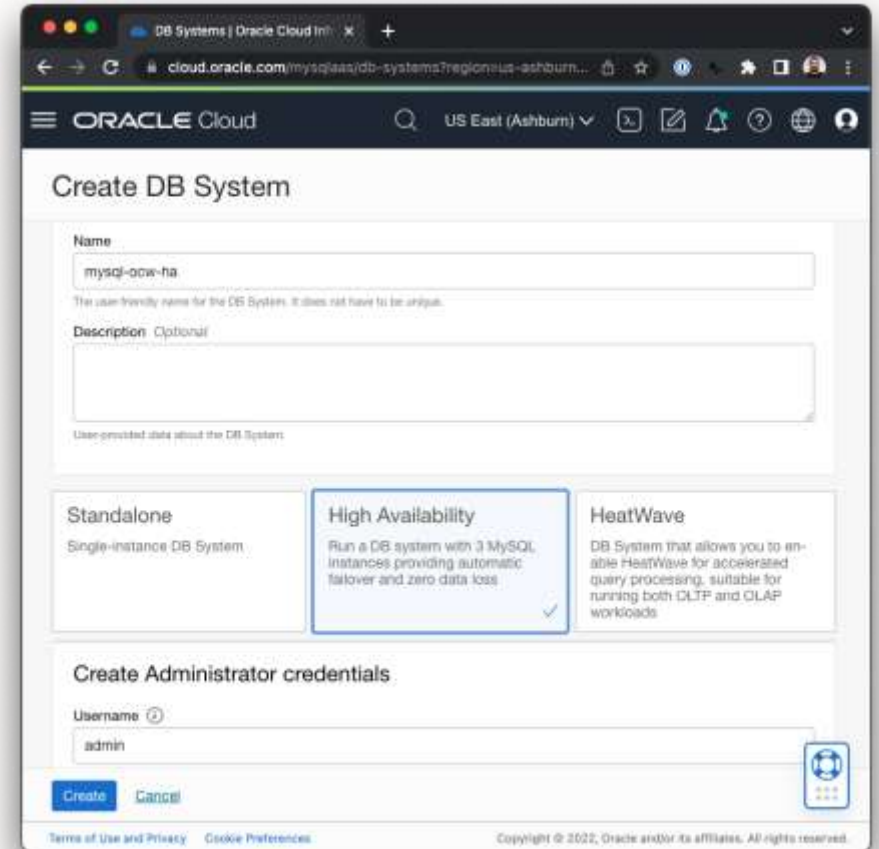
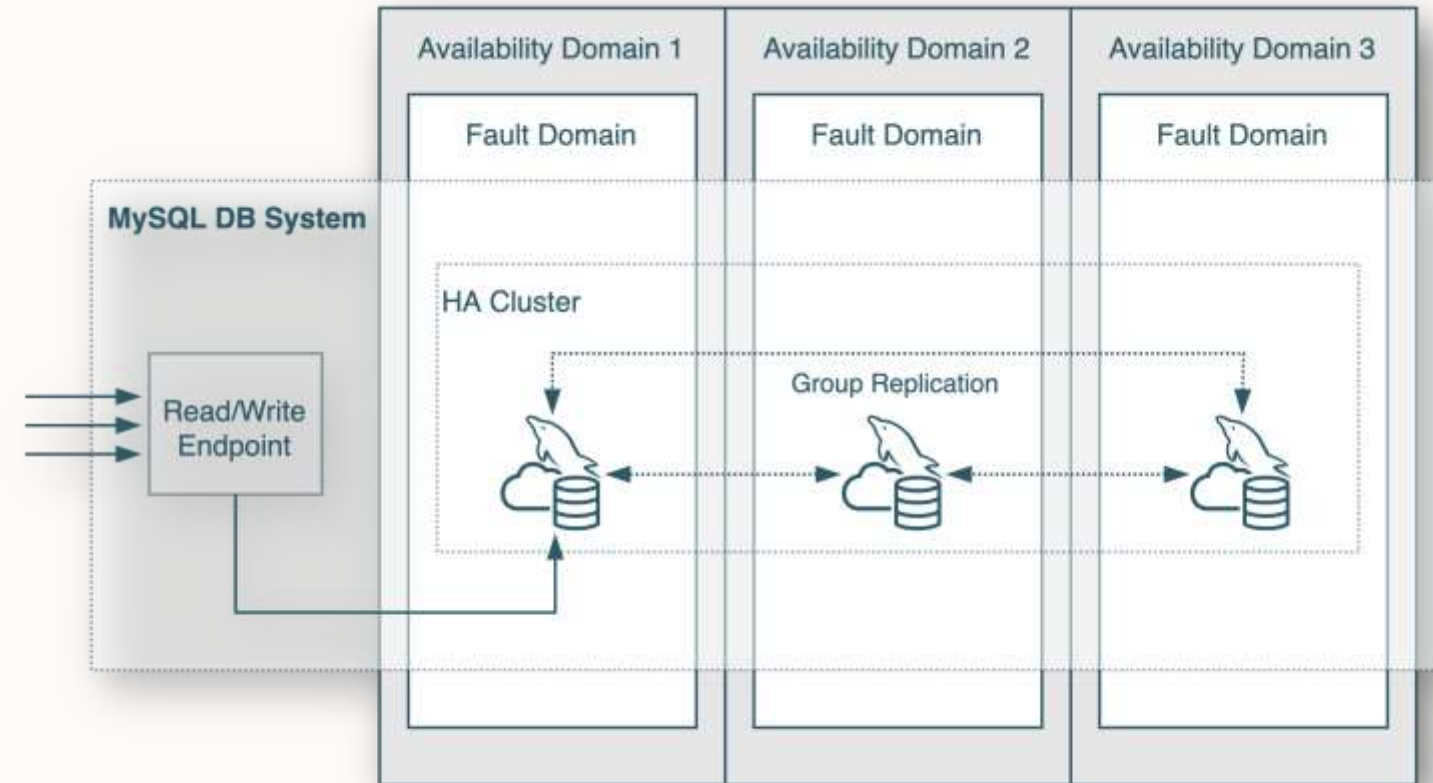
Increased costs

Machine learning-powered automation for MySQL HeatWave

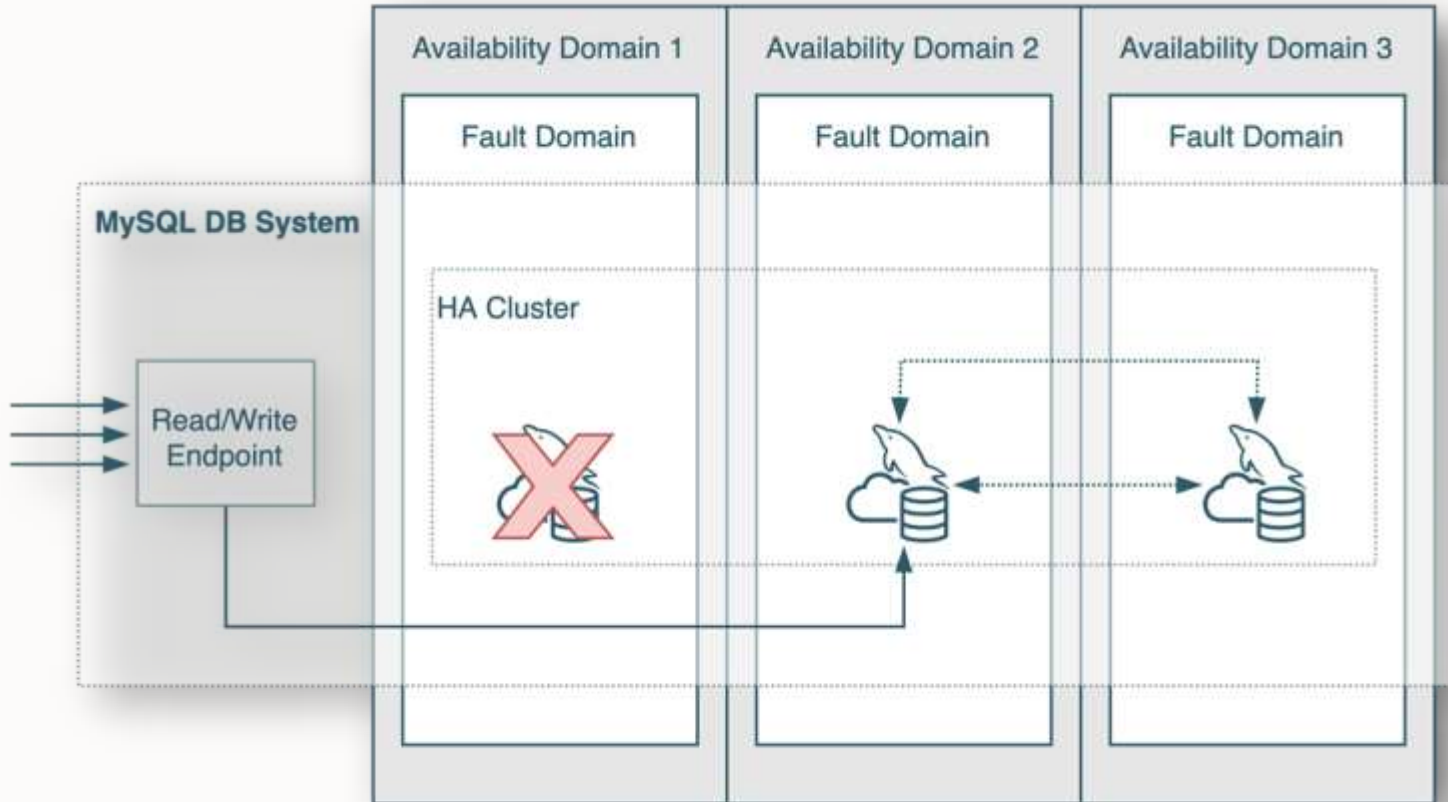
High query performance at scale, higher OLTP throughput, and the best price performance



High Availability



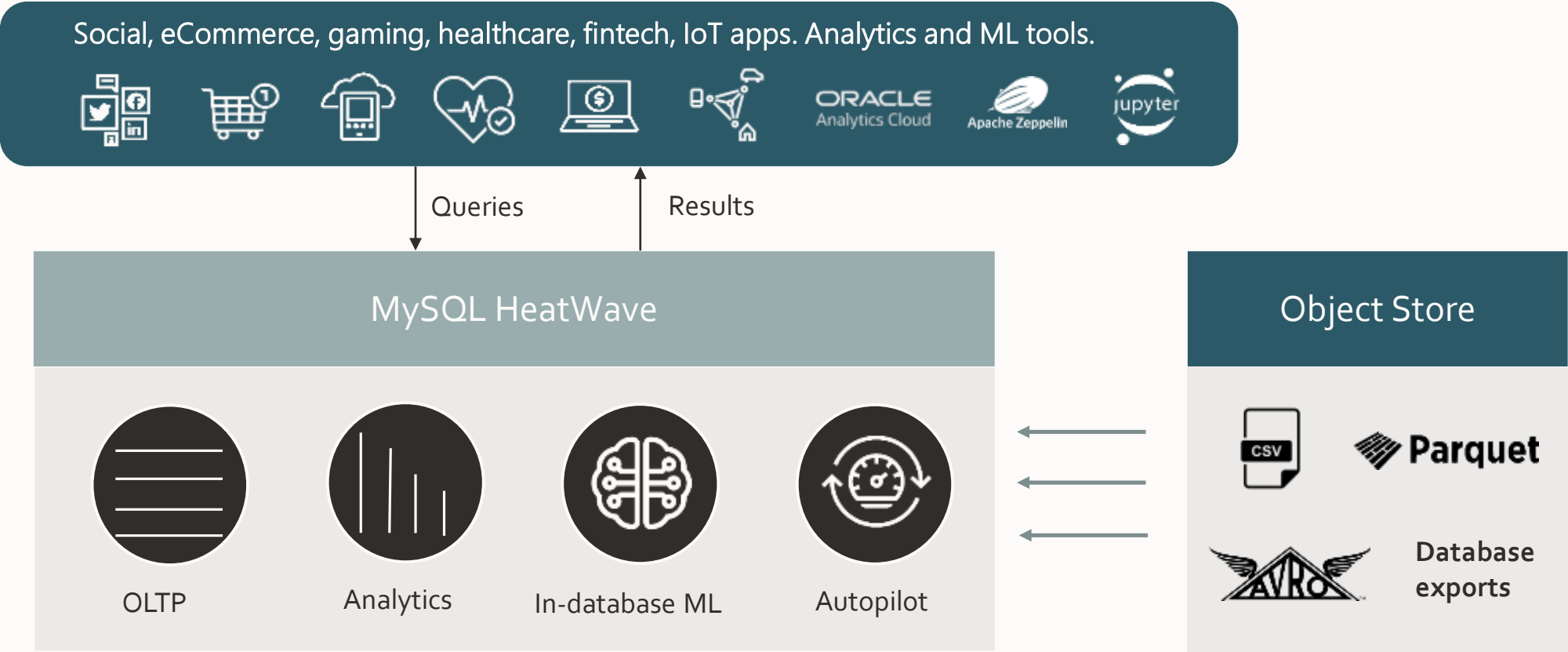
High Availability



- SLA 99.99%
- Automatic failover
- Manual switchover
- Rolling upgrades during maintenance
 - Less than 1 minute impact
 - MySQL version upgrades and OS security patches
- RPO: 0
- RTO: Less than a minute

MySQL HeatWave overview

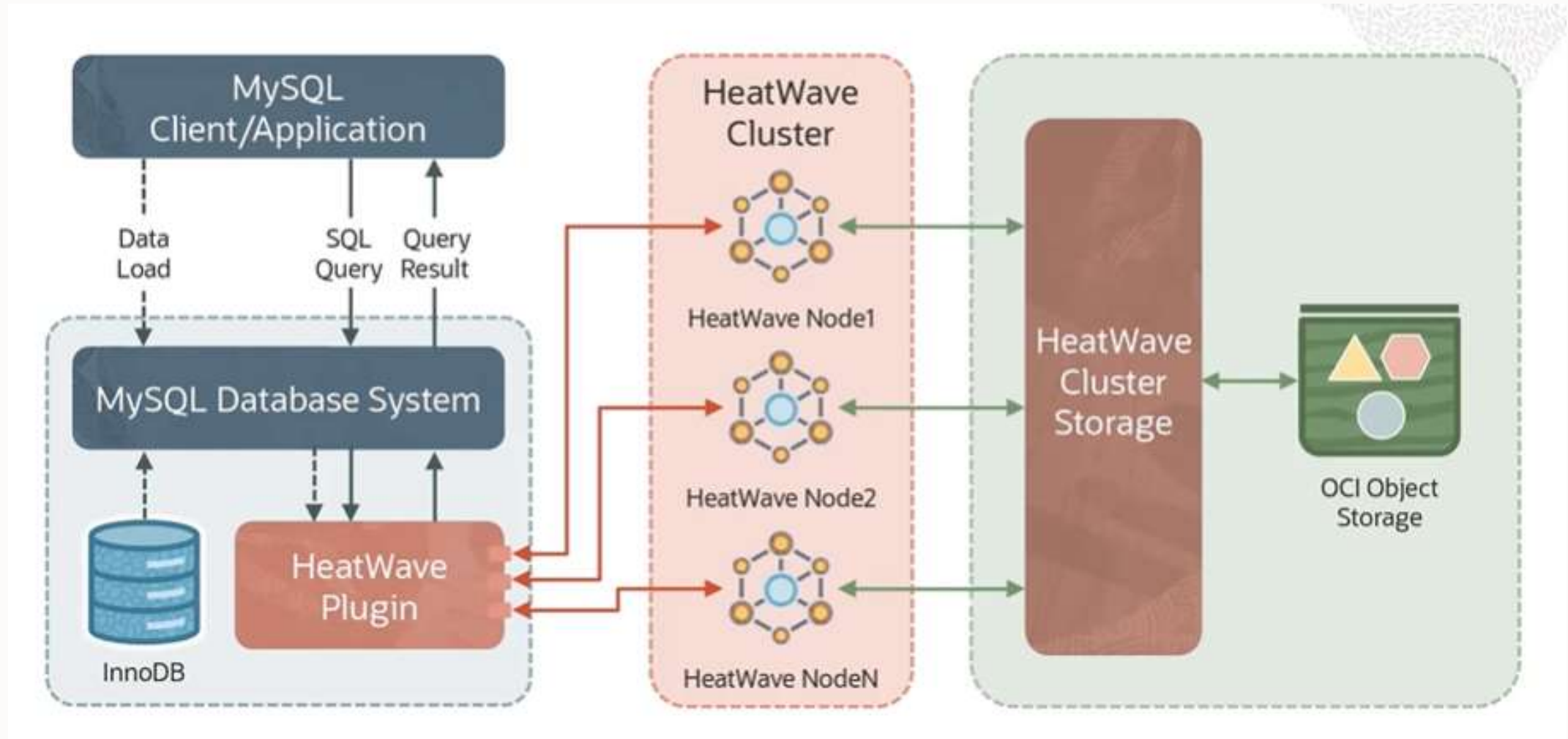
Transactions, real-time analytics across data warehouse and data lake, and machine learning in one database service



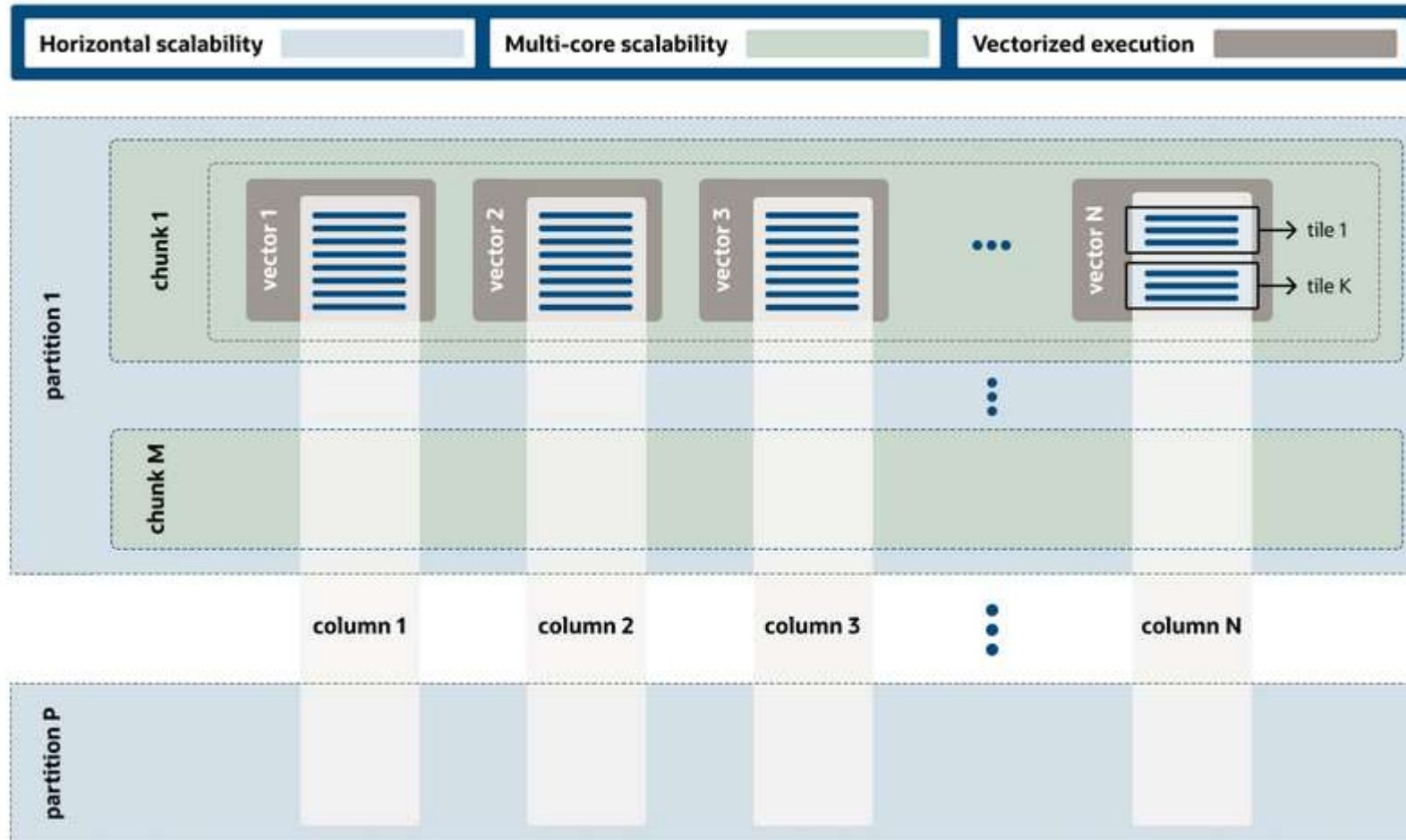
For both non-MySQL and MySQL workloads



MySQL Heatwave Architecture



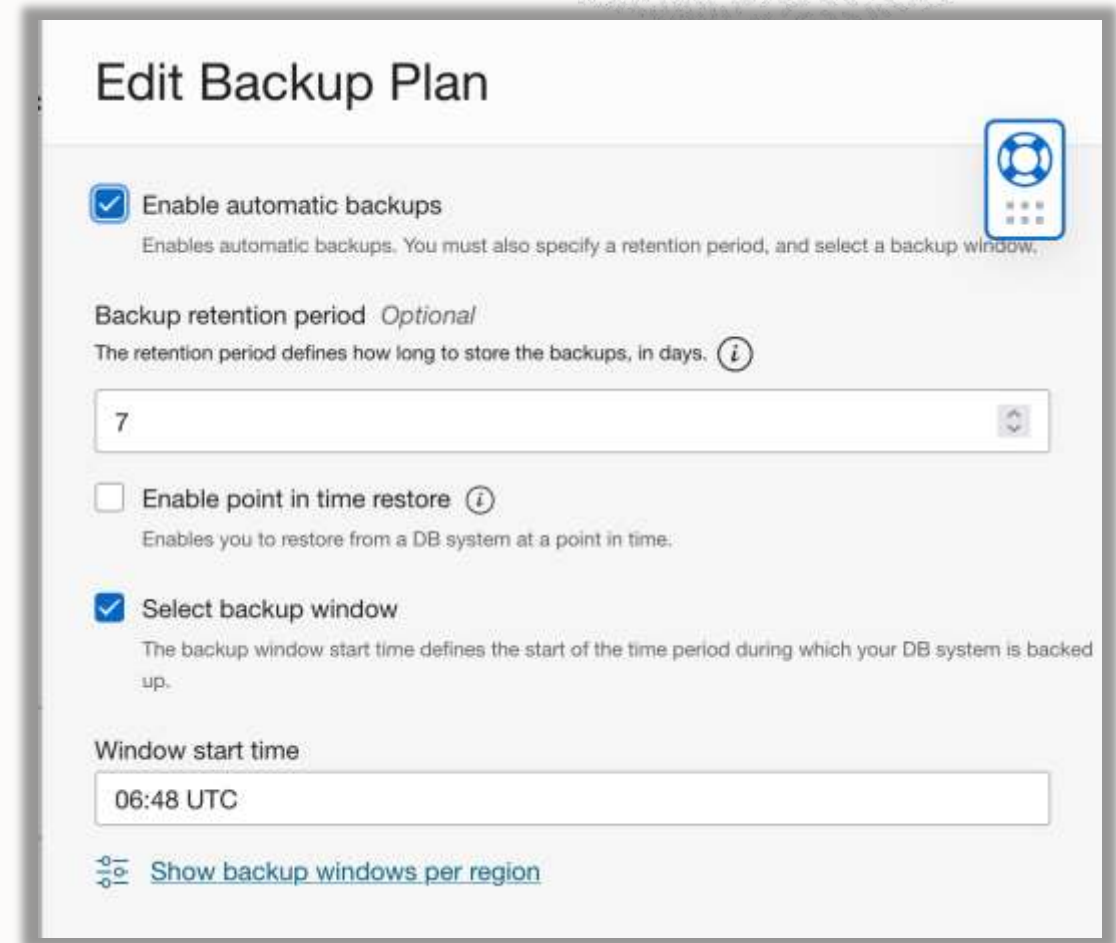
In-Memory hybrid Heatwave columnar Format



Backups

Manual or Automatic

- Retention Period from 7 up to 35 days
- When to Backup
- Full or Incremental
- Point-in-Time Recovery (only non-HA DB Systems)



Edit Backup Plan

☒ **Enable automatic backups**
Enables automatic backups. You must also specify a retention period, and select a backup window.

Backup retention period *Optional*
The retention period defines how long to store the backups, in days. ⓘ


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☐ **Enable point in time restore** ⓘ
Enables you to restore from a DB system at a point in time.

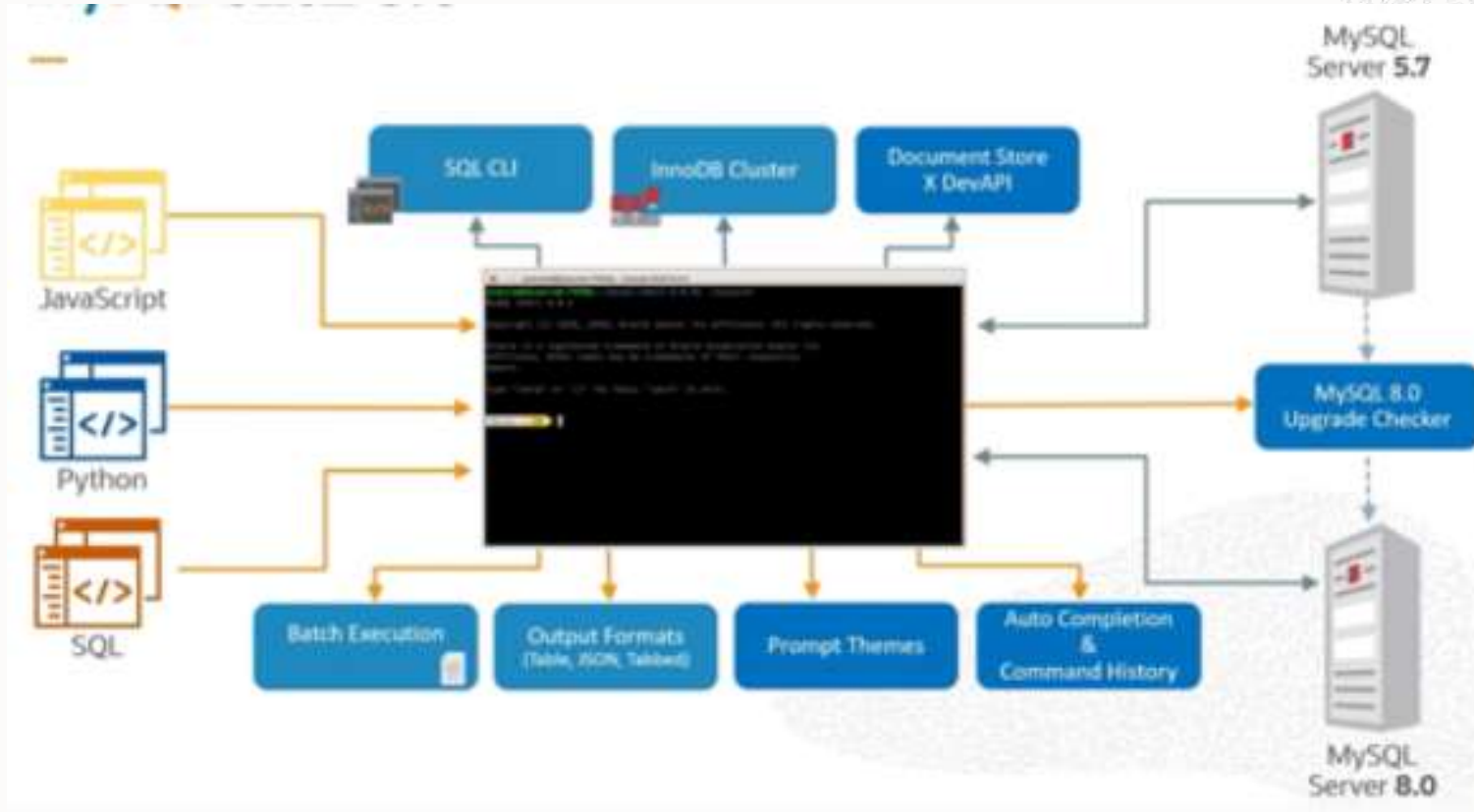
☒ **Select backup window**
The backup window start time defines the start of the time period during which your DB system is backed up.

Window start time

06:48 UTC

 [Show backup windows per region](#)

Understanding MySQL shell tool



Endpoint

Connect to the DB System using a MySQL client/connector via the endpoint below [How do I connect?](#)

Private IP Address: 10.0.1.253 | [Copy](#) ⓘ

Internal FQDN: -

Availability Domain: yQUJ:US-ASHBURN-AD-1

Fault Domain: FAULT-DOMAIN-2

MySQL Port: 3306

MySQL X Protocol Port: 33060

```
# sudo yum -y install mysql-shell
```




Oracle NoSQL Cloud Service



Oracle NoSQL Database Services on OCI Console

ORACLE Cloud

Cloud Classic >

Search resources, services, documentation, and Marketplace

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Redis

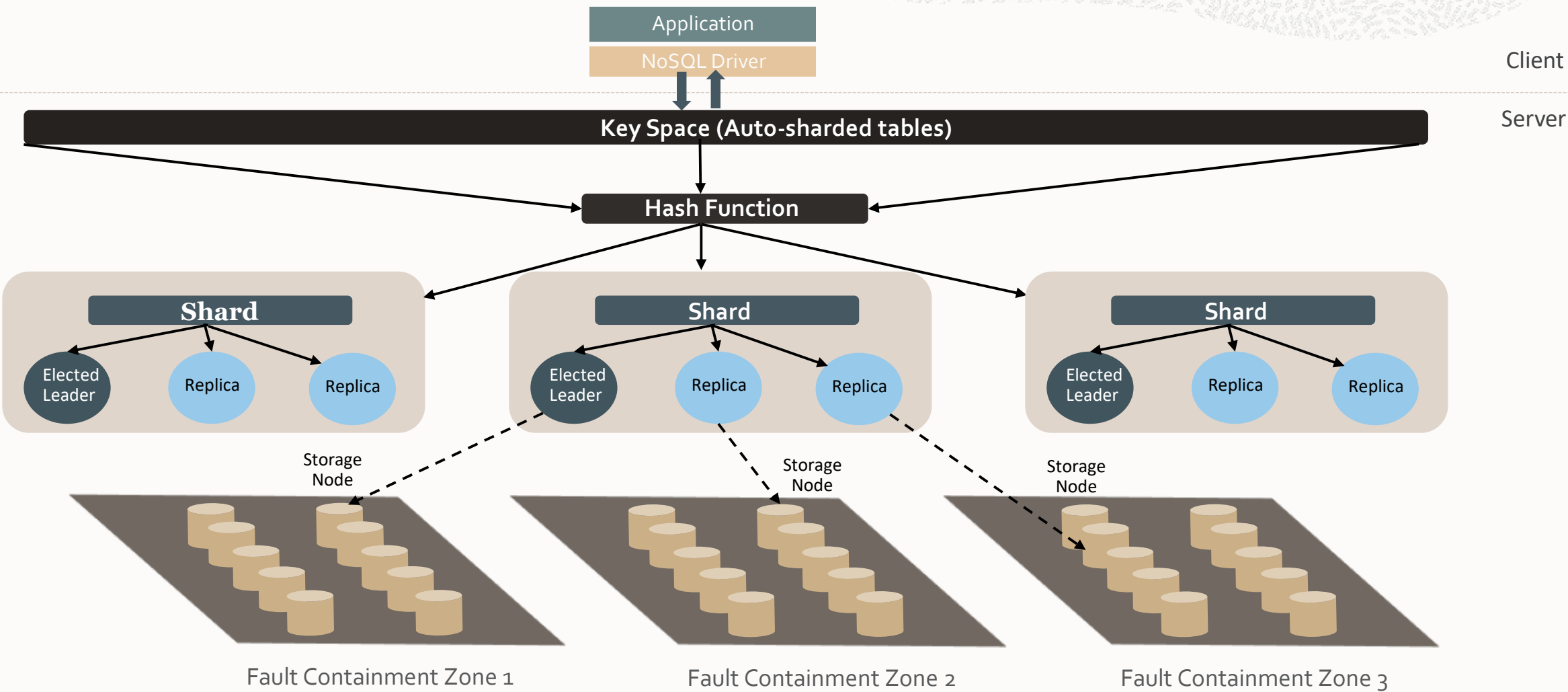
Clusters

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Oracle NoSQL Database Architecture Overview

A distributed, shared nothing key/value data store architected for HA



Oracle NoSQL Database Cloud Service

Built for extreme, dynamic workloads of today's modern applications

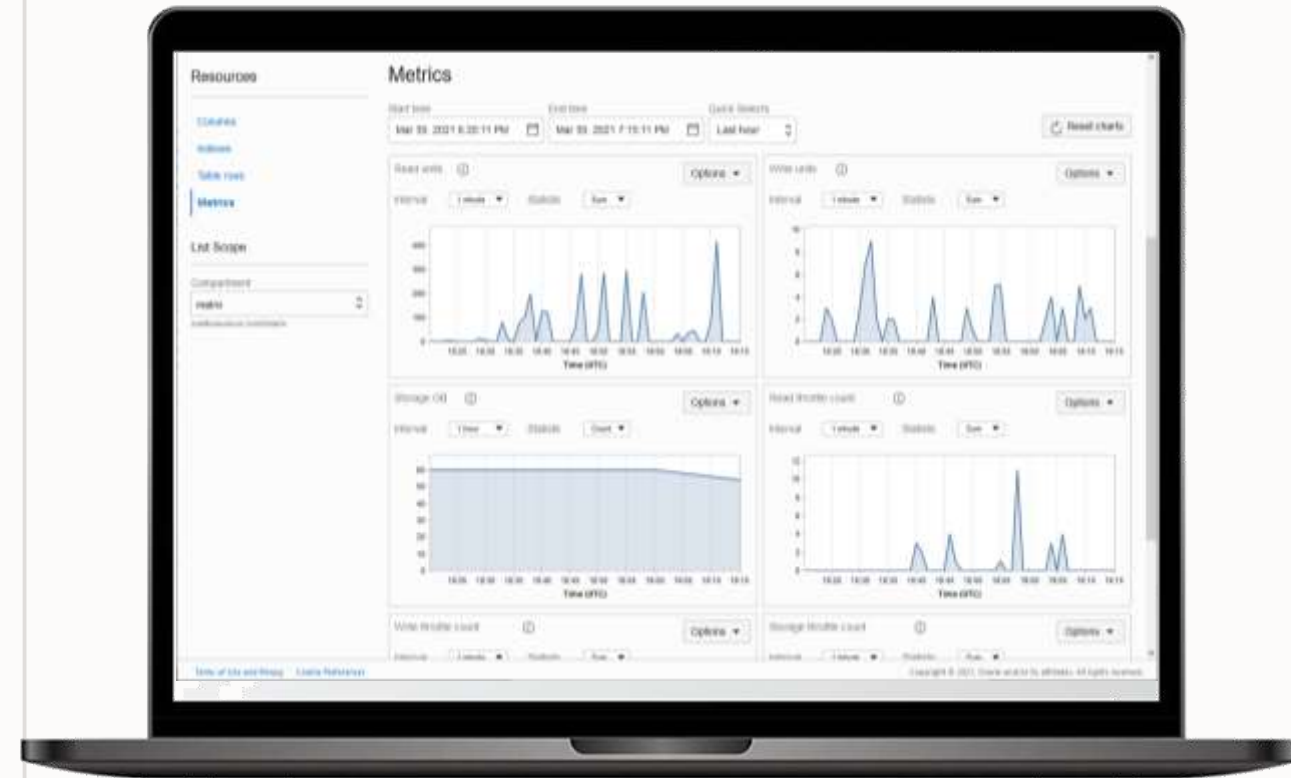


Fast, Flexible NoSQL Database Service at any scale

- Fully managed, serverless NoSQL database **table service**
- Single digit millisecond and **predictable** latency at any scale
- **Linear throughput scaling** for **extreme** workloads
- Multi-model support (document, fixed schema, key/value)
- **Built-in high availability** for business continuity
- Fully **ACID compliant** and **adjustable** read consistency
- Serverless computing through Oracle Functions
- Available in 30 OCI commercial regions worldwide (Mar 2022)

Differentiated Use Cases

- **Request level granularity** for extreme workloads, and handles **spikes and drops optimally**
- Fast, constant, high-volume workloads requiring **predictable low latency** for **highly responsive applications**
- Designed for business applications requiring **scale, performance,** and **high availability** with flexible consistency



Oracle NoSQL Database Cloud Service - Metrics

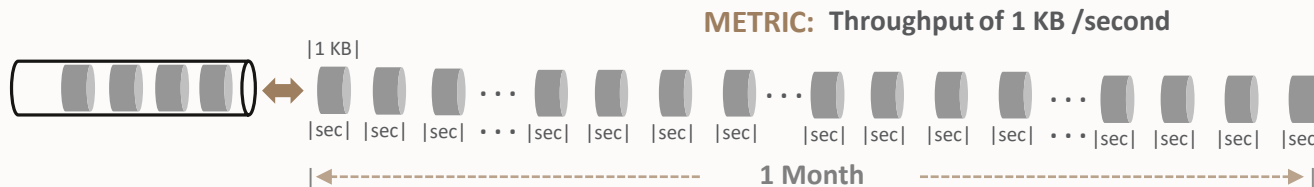
Throughput provisioning

1 Write Unit

- The throughput of up to 1 kilobyte (KB) of data per second for a write operation over a one-month period
- Approximately 2.67 million writes per month

1 Read Unit

- The throughput of up to 1 kilobyte (KB) of data per second for an eventually consistent read operation
- Approximately 2.67 million eventually consistent reads per month
- 2 Read units are needed for an absolute consistent read



Period of a month
= $3600 \text{ KB/Hr} \times 744 \text{ Hr}$
= 2.67 million (writes/reads) KBs

Oracle NoSQL Database Cloud Service – Capacity

Provisioned capacity vs. on-demand capacity

Provisioned Capacity

- Must determine read/write units in advance
- Adjustments done via API or console
- Increasing unlimited
- Decreases limited to 4 per day
- Pay for what you provision
- Deep understanding of workload needed

On-Demand Capacity

- Automatic scaling
- No rate limiting in your application
- No workload characterization
- Simple to use
- Pay for what consumed



Data Models

Key-Value, Schemaless JSON, Fixed Schema

create table if not exists myTable(id long generated always as identity,
resNum string,
value JSON,
primary key((shard(id))))

```
{  
  "lastName": "Jones",  
  "firstName": "Philly-Joe",  
  "bagInfo": [ {  
    "tagNum": "17657806285185",  
    "lastSeenAt": "LHR",  
    "flightLegs": [ {  
      "flightNo": "BM254",  
      "flightDate": "2019-02-28T22:00:00",  
      "fltRouteSrc": "SYD",  
      "fltRouteDest": "LHR"  
    } ]  
  } ]  
}
```

Key-Value

```
record = {'resNum' : 'JS8PKQ',  
         'value' : {  
           'lastName' : 'Jones',  
           'firstName' : 'Philly-Joe',  
           'bagInfo' : [...] }  
}  
  
req = PutRequest().set_table_name('myTable').  
      set_value(record)  
handle.put(request)
```

Schema-less JSON

```
statement = ( 'select  
              m.value.bagInfo.lastSeenAt  
            from  
              myTable m  
            where  
              m.bagInfo.tagNum = '17657806285185' )  
  
request = QueryRequest().set_statement(statement)  
result = handle.query(request)
```

Fixed Schema

```
statement = ( 'select  
              m.value  
            from  
              myTable m  
            where  
              m.resNum = 'JS8PKQ' )  
  
request = QueryRequest().set_statement(statement)  
result = handle.query(request)
```

Oracle NoSQL Database Cloud Service – Provisioned Capacity

Provisioned throughput

- Provision reads/sec, writes/sec, GB storage at table creation time
 - Dynamically increase
 - Dynamically decrease

JAVA code sample:

```
TableRequest tableRequest = new TableRequest()
    .setStatement("create table if not exists foo (id integer,
value JSON)")
    .setTableLimits(new TableLimits(2000, 100, 500))
    .setTimeout(1000);
TableResult res = NoSQLHandle.tableRequest(tableRequest);
```

2000 read units

100 write units

500 GB Storage

Modify the table lowering the read units to 1000

```
tableRequest.setTableLimits(new TableLimits(1000, 100, 500))
```

Note: Every TableRequest is a DDL call to the NoSQL store and may be performed 4 times within a minute.



Resources



OCI Basic Administration concepts

- Oracle Cloud Database Services Professional (University)

<https://mylearn.oracle.com/ou/learning-path/become-an-oracle-cloud-database-services-professional-2023/122178>

- OCI Foundations Associate (2023) (University)

<https://mylearn.oracle.com/ou/learning-path/become-an-oci-foundations-associate-2023/122043>

- OCI Architect Associate (2023) (University)

<https://mylearn.oracle.com/ou/learning-path/become-an-oci-architect-associate-2023/122195>

- OCI Architect Professional (University)

<https://mylearn.oracle.com/ou/learning-path/become-an-oci-architect-professional-2023/122238>



Oracle Database Cloud Services (DBCS) link References

- Oracle Database Cloud Services Documentation

<https://docs.oracle.com/en-us/iaas/base-database/index.html>

- Real Application Cluster (RAC) Administrator Guide

<https://docs.oracle.com/en/database/oracle/oracle-database/21/racad/real-application-clusters-administration-and-deployment-guide.pdf>

- Oracle Database 19c Administrator Guide

<https://docs.oracle.com/en/database/oracle/oracle-database/19/admin/#Oracle%C2%AE-Database>

- Oracle Database 23c Administrator Guide

<https://docs.oracle.com/en/database/oracle/oracle-database/19/admin/#Oracle%C2%AE-Database>

OCI MySQL service and Heatwave link References

- **MySQL HeatWave Implementation Associate (University Training)**

<https://mylearn.oracle.com/ou/learning-path/become-a-mysql-heatwave-implementation-associate/128102>

- **MySQL Web Site**

<https://mysql.com>

- **MySQL Web Site for developers**

<https://dev.mysql.com>

- **Oracle MySQL web Page**

<https://www.oracle.com/mysql>

- **MySQL Github Repository**

<https://github.com/mysql>

- **Getting Started with MySQL HeatWave on OCI**

<https://developer.oracle.com/learn/technical-articles/getting-started-with-mysql-heatwave-on-oci>

Exadata Cloud Link References

- **Exadata Cloud Service Product Page**

<https://www.oracle.com/engineered-systems/exadata/database-service/>

- **Exadata Cloud at Customer product page**

<https://www.oracle.com/engineered-systems/exadata/cloud-at-customer/>

- **Exadata Cloud at Customer Documentation**

<https://docs.oracle.com/en/engineered-systems/exadata-cloud-at-customer/>

- **Exadata Cloud Services documentation**

<https://docs.oracle.com/en-us/iaas/exadatacloud/exacs/exadata-cloud-infrastructure-overview.html>

- **Exadata X9M Datasheet**

<https://www.oracle.com/a/ocom/docs/engineered-systems/exadata/exadata-cloud-infrastructure-x9m-ds.pdf>

- **Exadata Cloud DbaaScli commande reference**

<https://docs.oracle.com/pt-br/iaas/exadata/doc/ecc-using-dbaascli.html>

Exadata Cloud Link References

- Exadata X10M Cloud at Customer Datasheet

<https://www.oracle.com/a/ocom/docs/engineered-systems/exadata/exadb-cc-x10m-ds.pdf>



Oracle NoSQL Database Cloud Service Link References

- Oracle NoSQL product page

<https://www.oracle.com/database/nosql/>

- Oracle NoSQL Database Cloud Services Documentation

<https://docs.oracle.com/en/cloud/paas/nosql-cloud/>

- Oracle NoSQL Database Cloud Service: Most flexible NoSQL Database

https://www.youtube.com/watch?v=TtZOy_NRouc

- Live Labs - NoSQL Cloud Service

<https://apexapps.oracle.com/pls/apex/f?p=133:180:17361911969675::::wid:642>

- Live Labs - Oracle NoSQL powers Video On-Demand applications

<https://apexapps.oracle.com/pls/apex/f?p=133:180:17361911969675::::wid:3694>

- Live Labs - Discover Server less Apps Using NoSQL Cloud Service

<https://apexapps.oracle.com/pls/apex/r/dbpm/livelabs/view-workshop?wid=879&clear=RR,180&session=17361911969675>



Oracle NoSQL Database Cloud Service Link References

- NoSQL Database Cloud Service Policies Reference

<https://docs.oracle.com/en/cloud/paas/nosql-cloud/ncsai/oracle-ndcs-policies-reference.html#GUID-34315873-9617-4DF8-855B-D6E9540A2971>



Thank you

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