ORACLE

Oracle Cloud DBA

Lear how to stay up to date on this Dbaas era – Day 1

Marcel Lamarca
Exadata Cloud Specialist
Oracle, Alliances and Channels LAD
February, 2024

SQL> select * from person where name = ‘Marcel Lamarca’

SCAN ME

MARCEL LAMARCA

Exadata Cloud Specialist

Upgrade, Utilities, Patching, Performance & Migrations

marcel-lamarca

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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 2019
- 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)

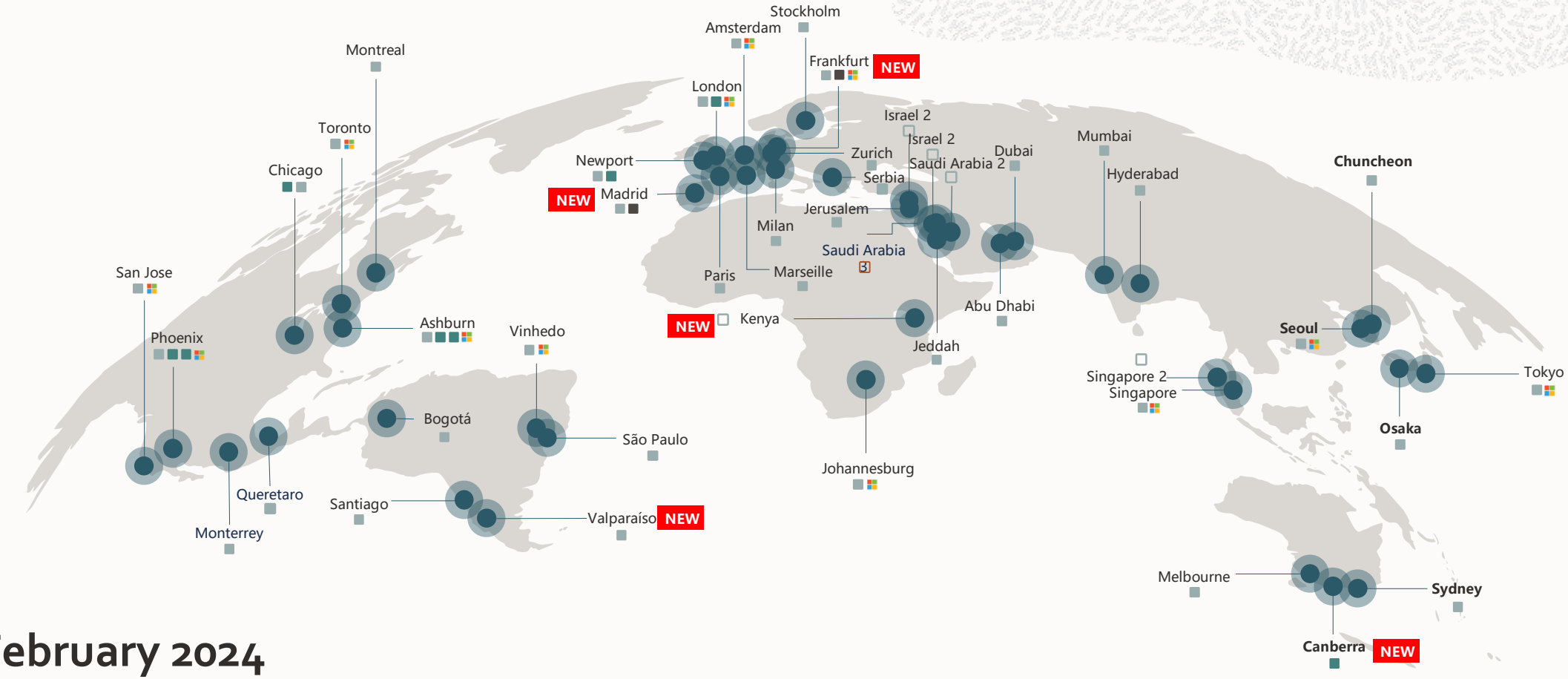
- Grid/RAC Database Administrator 11g
- Oracle Golden Gate 12c Certified Implementation Specialist

Agenda

1. Oracle Exadata Cloud
2. OCI Backup database options
3. Oracle NoSQL Database Cloud Service
4. Resources

OCI Cloud Region Maps

Oracle Cloud Infrastructure Global Footprint



February 2024

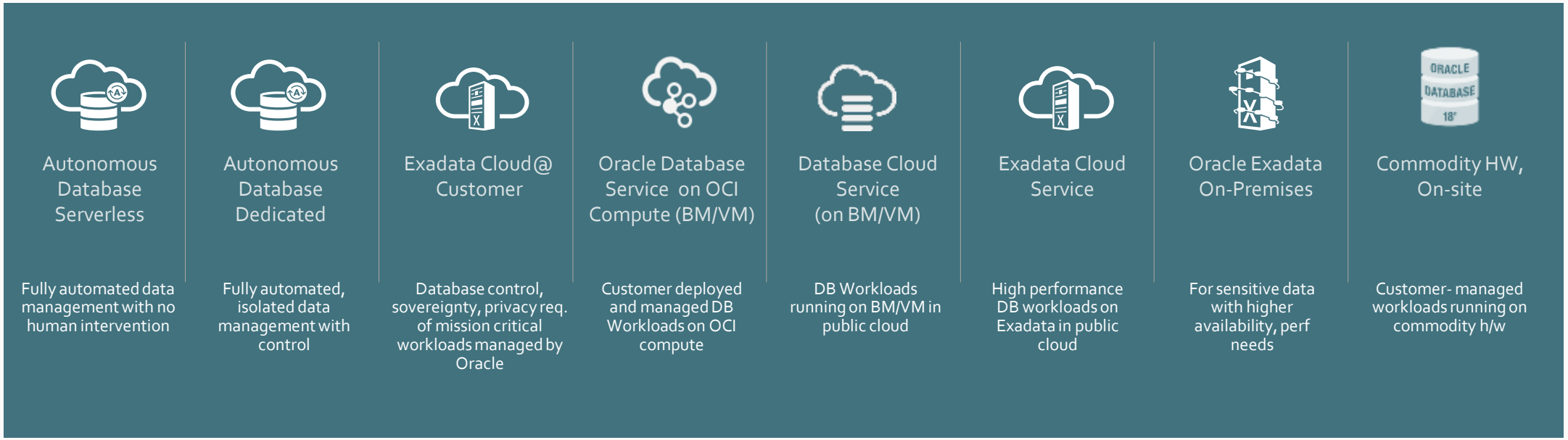
48 regions; 5 more planned

12 Azure Interconnect Regions

Oracle Database deploy options

Choice of control and hybrid strategies

Use a single database for all deployments



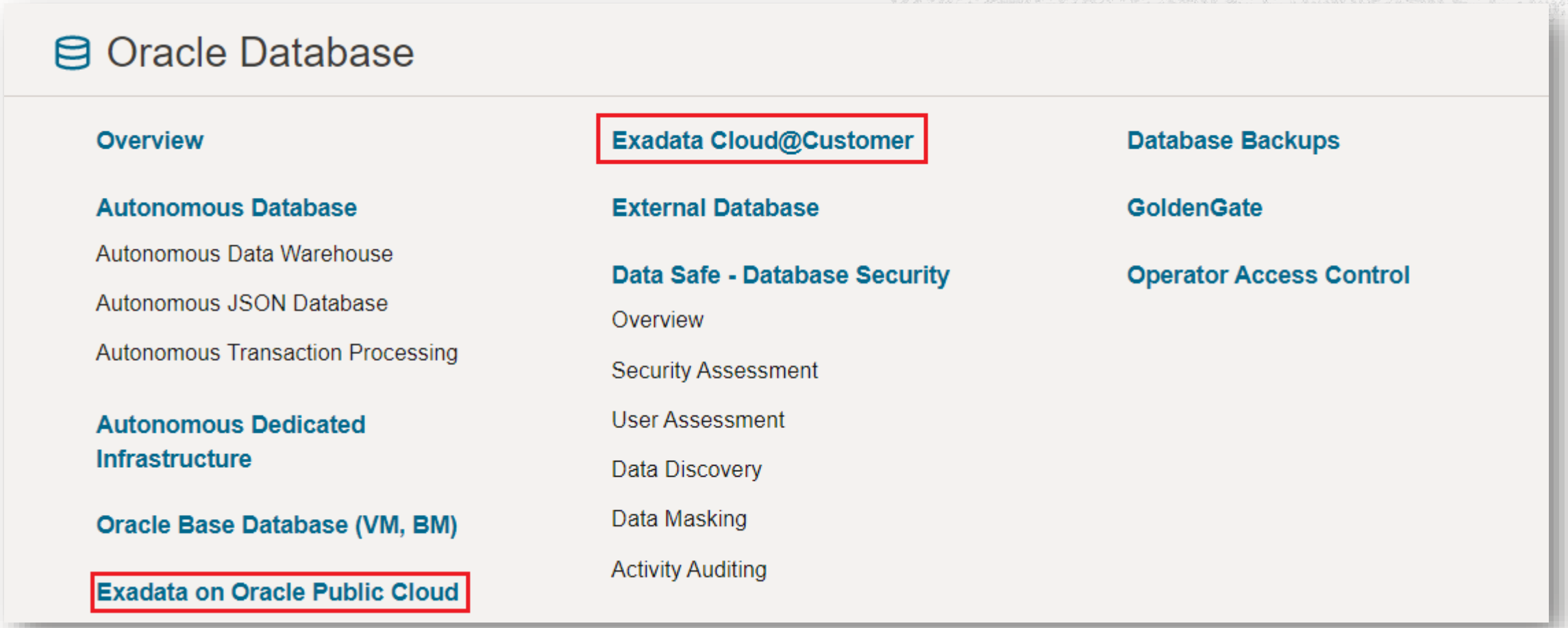
Oracle Exadata Cloud

Exadata runs everywhere

Identicality across deployments improves IT agility and reduces costs

On-premises	Public Cloud	Hybrid Cloud	Multicloud
			
Exadata Database Machine	Exadata in Oracle Cloud Infrastructure (OCI)	Exadata Cloud@Customer	Exadata through Oracle Database Service for Azure

Exadata Cloud | OCI Console



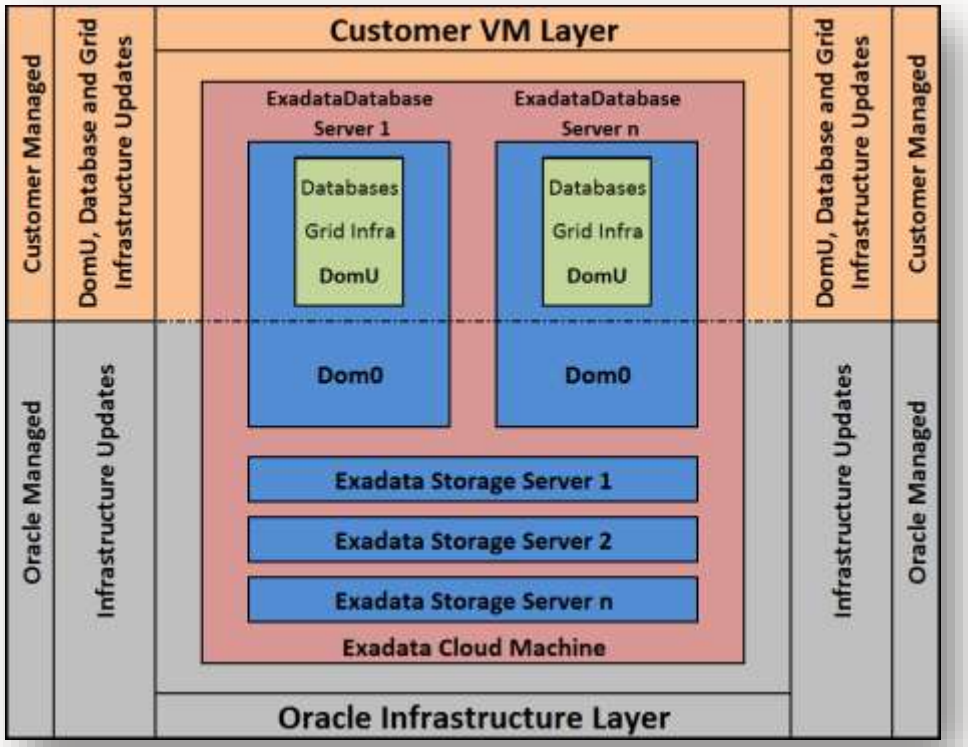
Database Cloud Service | Exadata

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

Exadata Cloud | Dom0 vs DomU Roles and Responsabilities



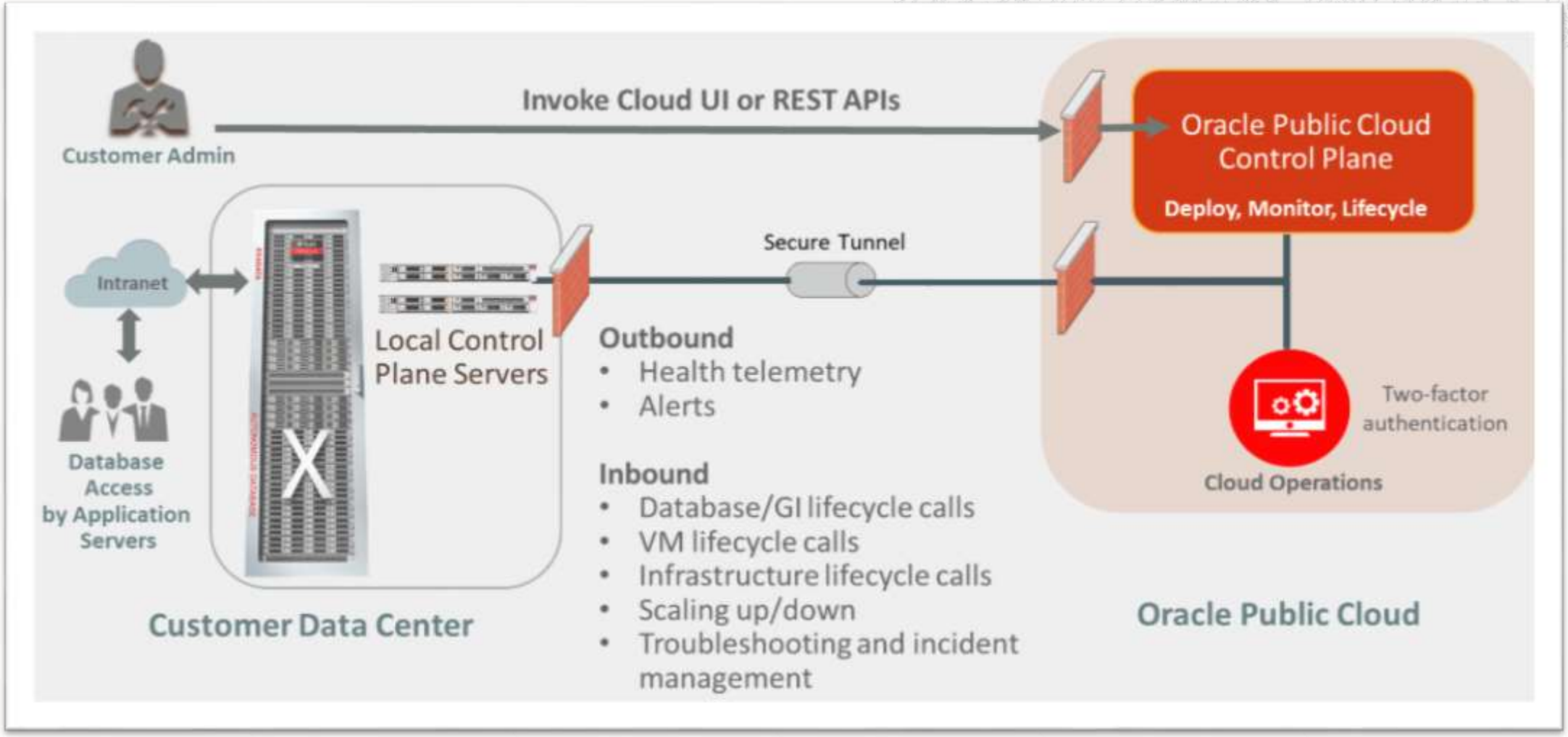
About *Domo* Oracle Responsibilities

- Oracle Cloud Ops manage Exadata infrastructure (hardware, system software) & hypervisor (domo);
- Oracle Support is responsible for update any version;
- For ExaCC gen1, Oracle Support open an SR and request customer formal approval;
- For Exacc Gen2, the customer is responsible for scheduling Domo maintenance and must provide at least 4 dates per year;

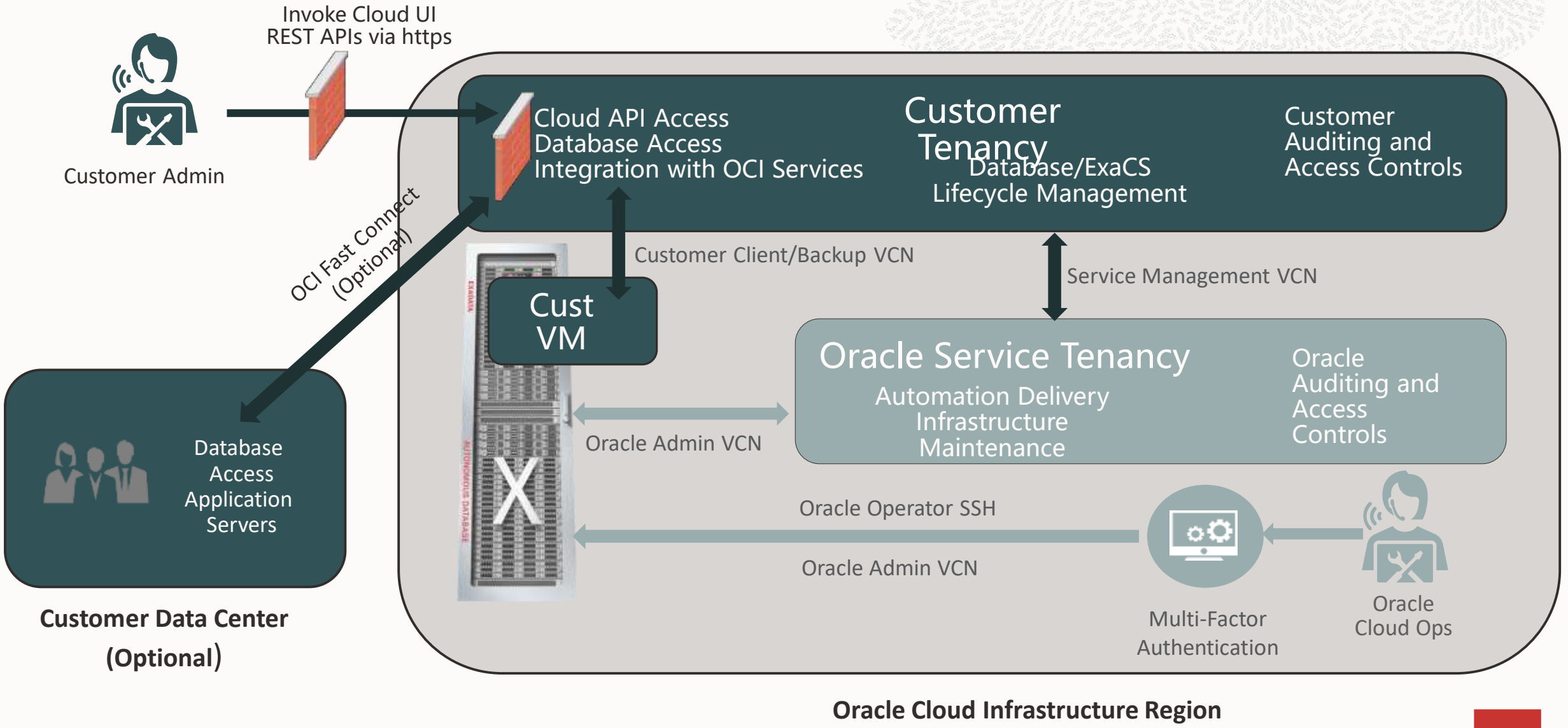
About *DomU* Customer Responsabilities

- Adjust license (BYOL or License included)
- Scale UP/Down resources
- For Exadata C@C Gen 1 DomU uses Xen for virtualiztion
- 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;

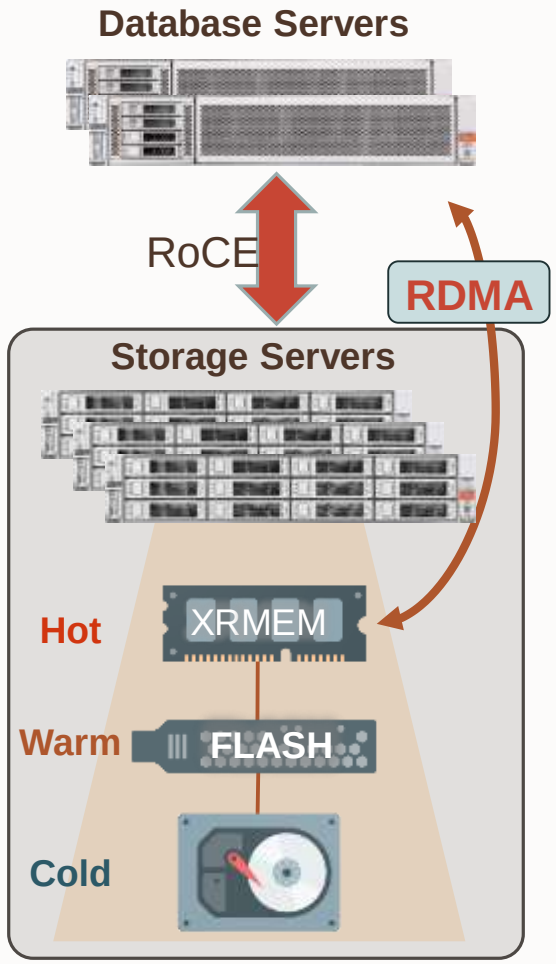
Exadata Cloud at Customer | Control Plane Workflow



Exadata Cloud Service Architecture



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 XRMEM in Smart Storage

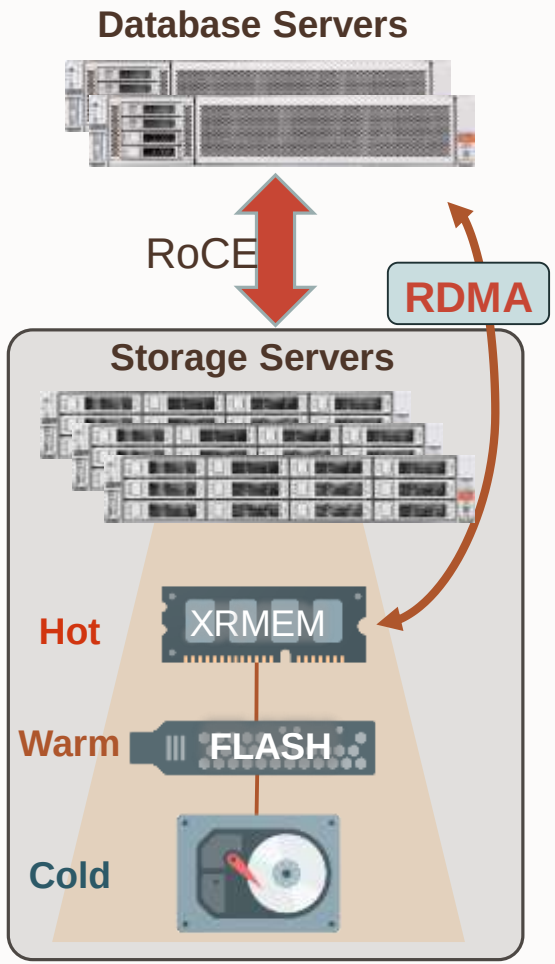
- Bypasses network and I/O software, interrupts, context switches
- Data is transparently managed in multiple storage tiers to minimize latency
- High-performance active-active 100 Gbit/s internal network maximize throughput
- Speeds up both database reads and commits

Database cluster virtualization

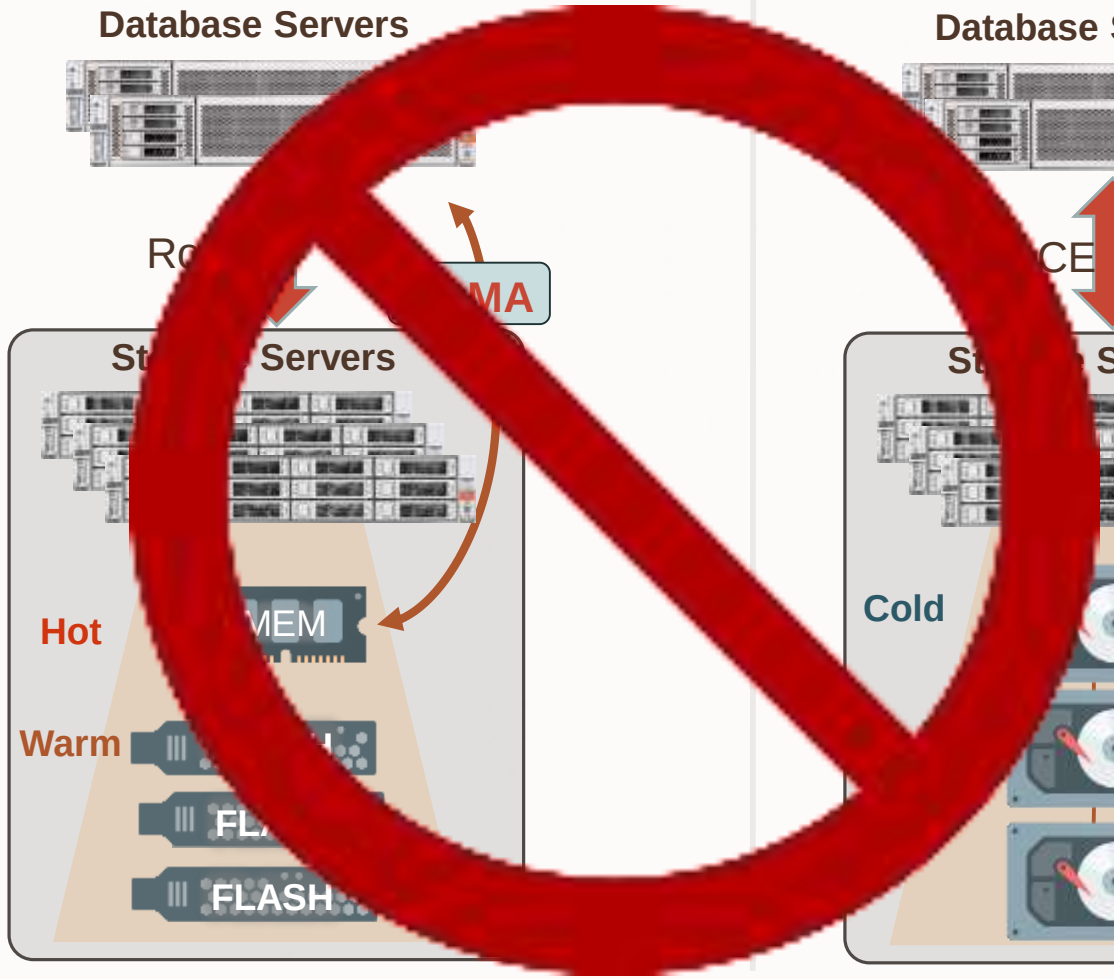
- Deploy environments with different needs on the same system
  - Dev-Test, Staging Production, DR
  - OLTP, Analytics, Mixed Workloads
- Share and manage pools of resources to increase efficiency and lower costs
- Isolate resources to meet differing security and predictability requirements

There are no EF and XT Storage options for Exadata Cloud

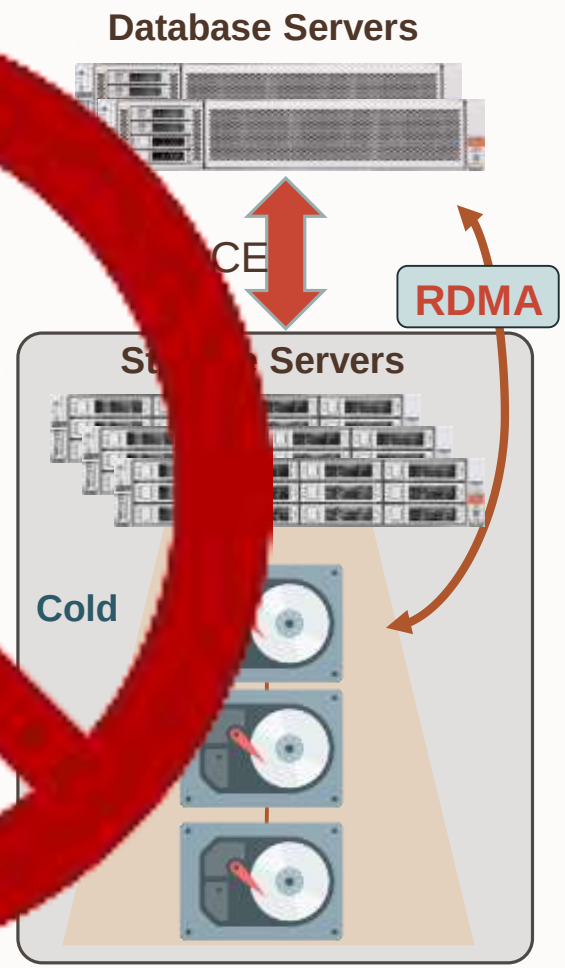
High-Capacvity (HC) Storage



Extreme Flash (EF) Storage

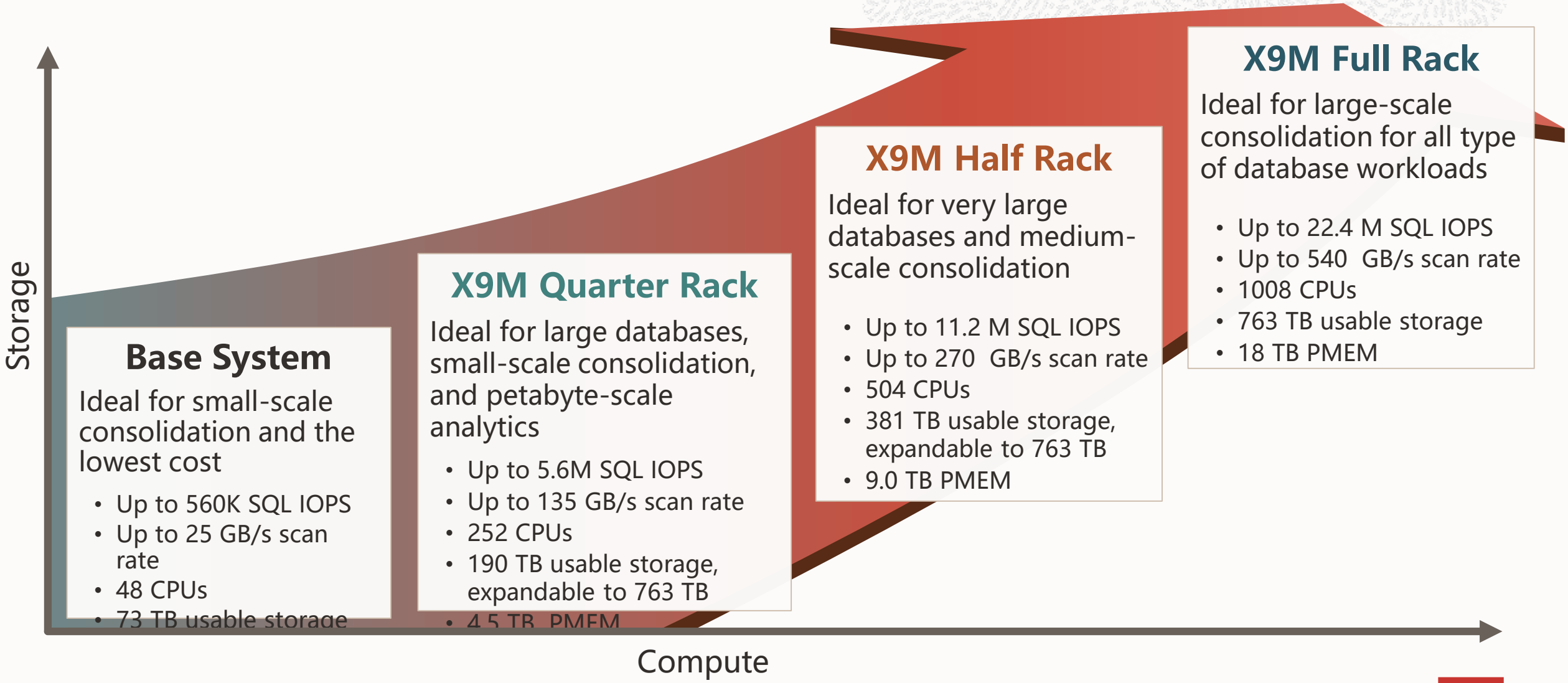


Extended (XT) Storage



Exadata Cloud X9M Flexible Shapes

Available in high-performance, cost-effective shapes to match enterprise needs



Exadata Cloud at Customer X10M Shapes

Quarter Rack – X10M

<u>Total Capacity</u>

DB Servers
Storage Servers

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

NEW SHAPE

Quarter Rack – X10M - L

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

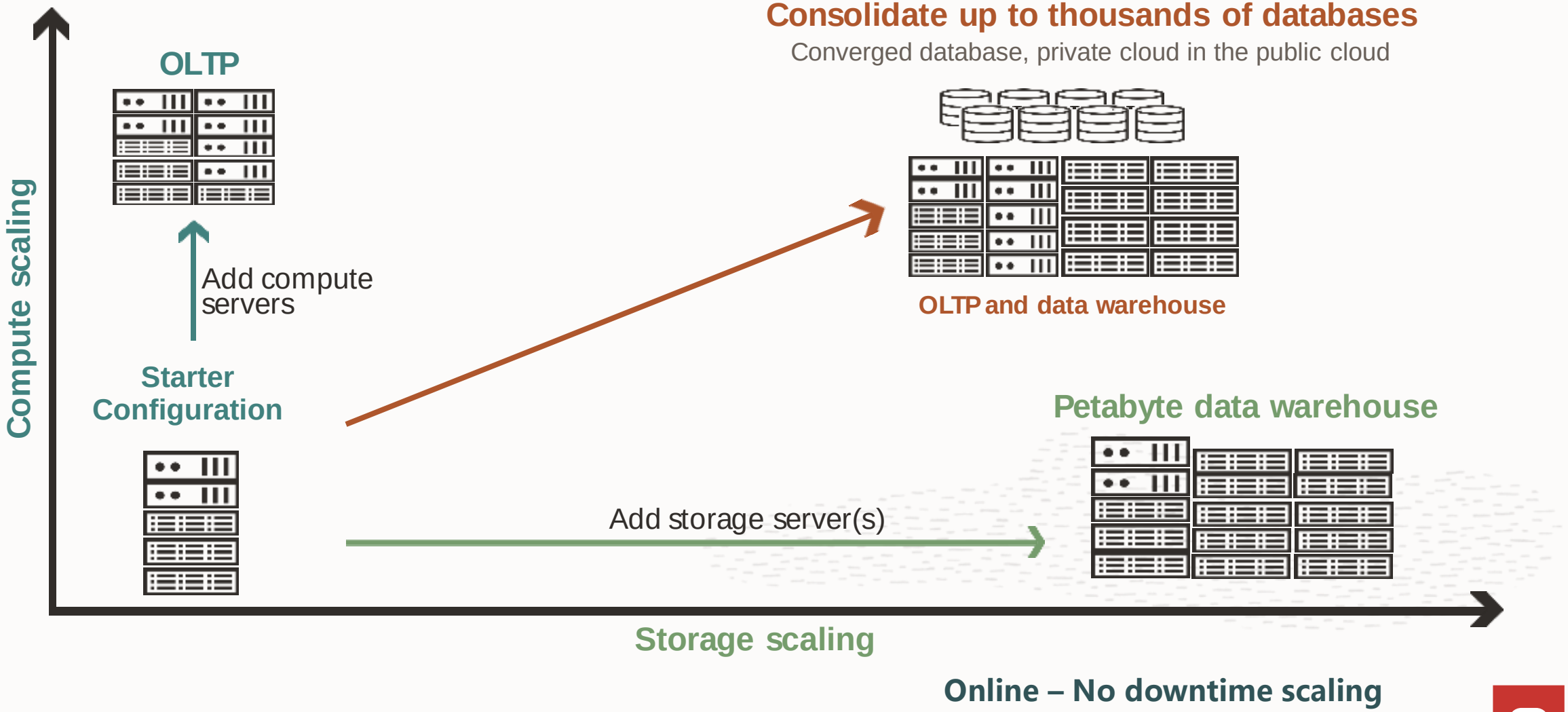
NEW SHAPE

Quarter Rack X10M-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

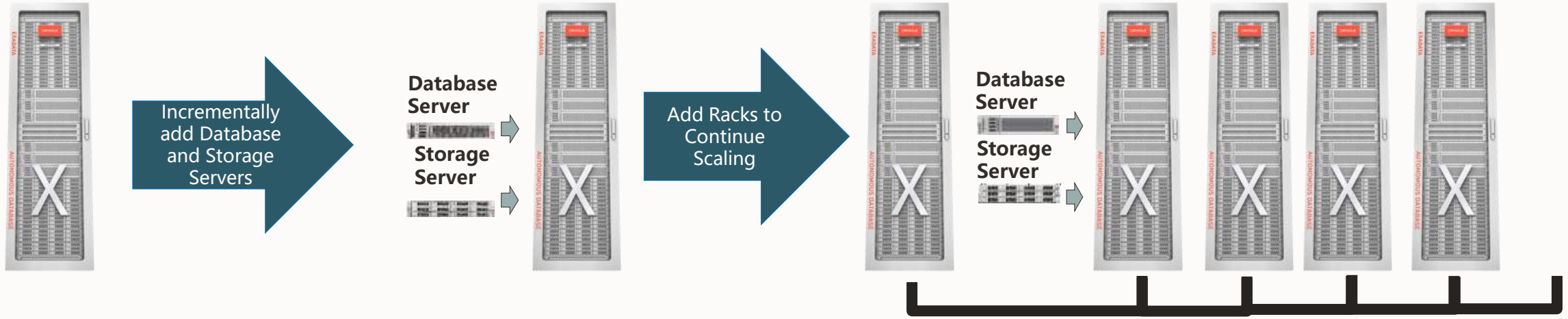


Exadata Cloud@Customer X10M Shapes

All Configurations greater than a Quarter Rack are elastic

Standard Configuration

Elastic Configuration



Start with a Standard Configuration

- Quarter Rack
- Quarter Rack-L
- Quarter Rack – XL

Elastically Expand Rack with Servers

- Database Server
- Storage Server

- Can NOT mix Database Servers with different memory configurations
  - e.g. X10M cannot be mixed with X10M-XL

Continue to Expand Servers using Expansion Rack(s)

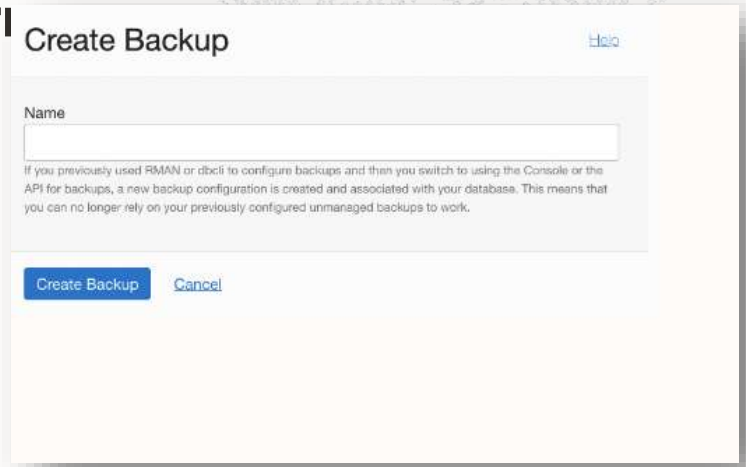
- Up to 6 Racks including primary rack
- Max 32 Database Servers
- Max 64 Storage Servers
- Max 5 Expansion Racks

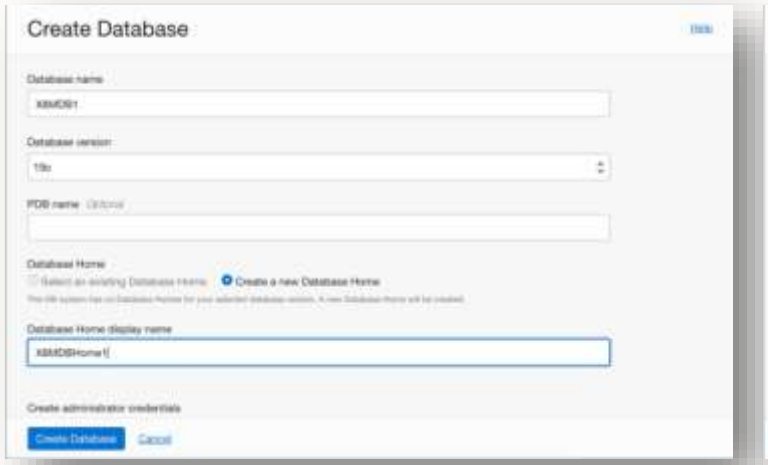
Exadata Cloud tools

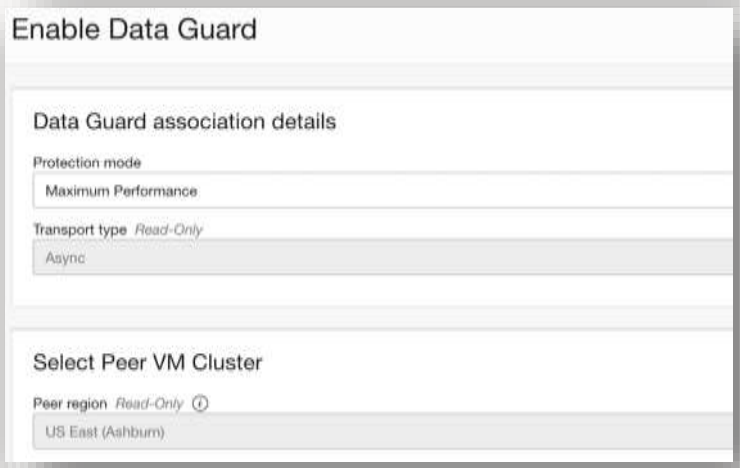
Cloud Automation for Common Lifecycle Tasks

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

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





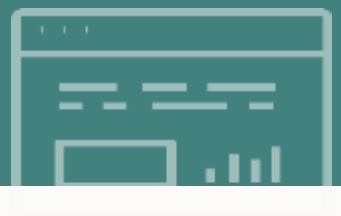


Exadata Cloud Command Line Interface (*dbaascli*)

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

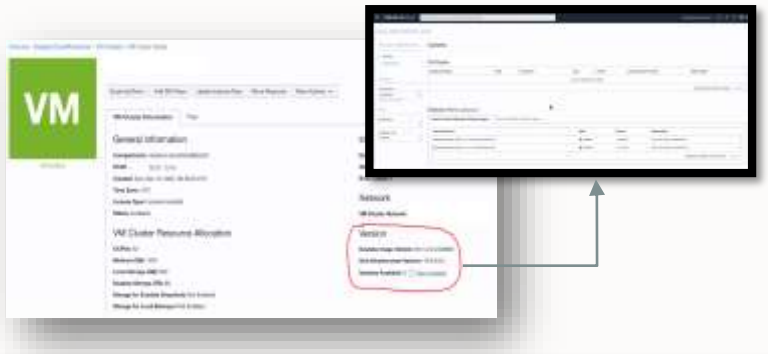
Exadata Cloud Pathing

Pathing dom0, 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.**



DOM0 - 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.**

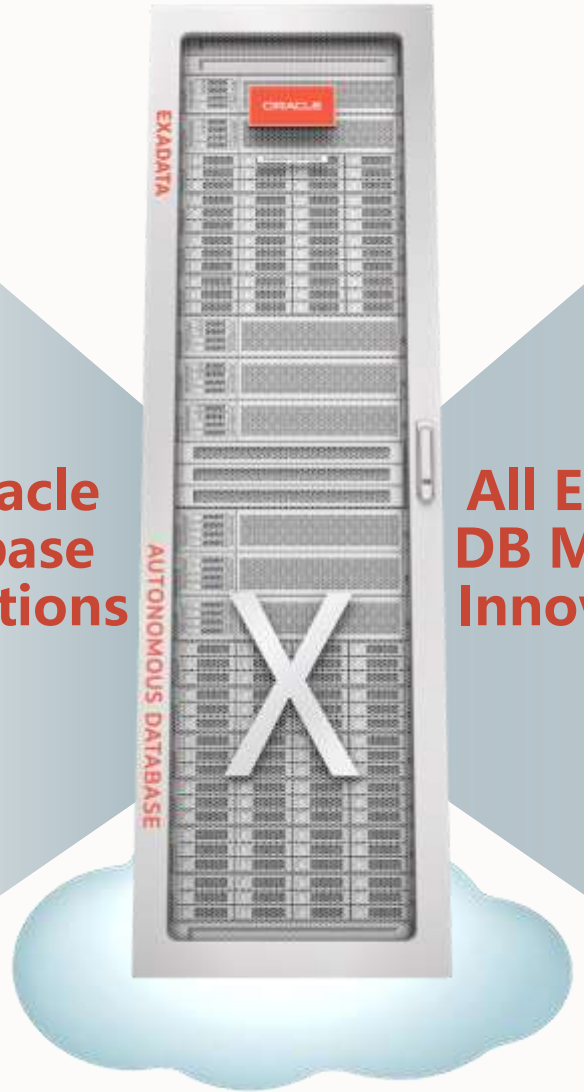
Quarterly maintenance updates may require a restart of the customer-managed guest virtual servers.

Exadata Cloud Features

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 — 100 Gbps
- XRMEM Data Accelerator
- Smart Flash Cache — PCI Flash
- Storage Indexes
- Columnar Flash Cache
- Hybrid Columnar Compression — HCC 10:1
- I/O Resource Management — I/O I/O I/O
- 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

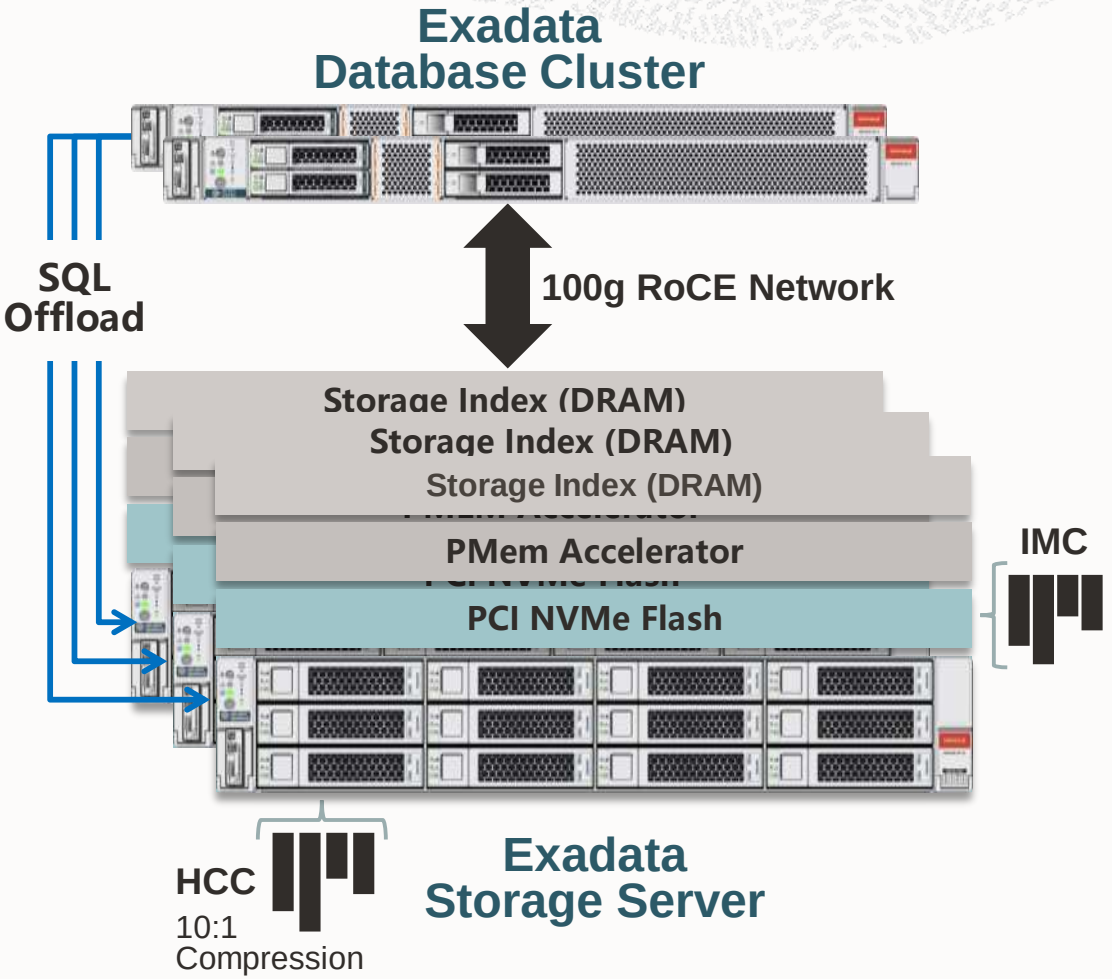
- Eliminates I/O not relevant to a particular query

Unique: Hybrid Columnar Compression (HCC)

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

Unique: In-Memory Columnar (IMC)

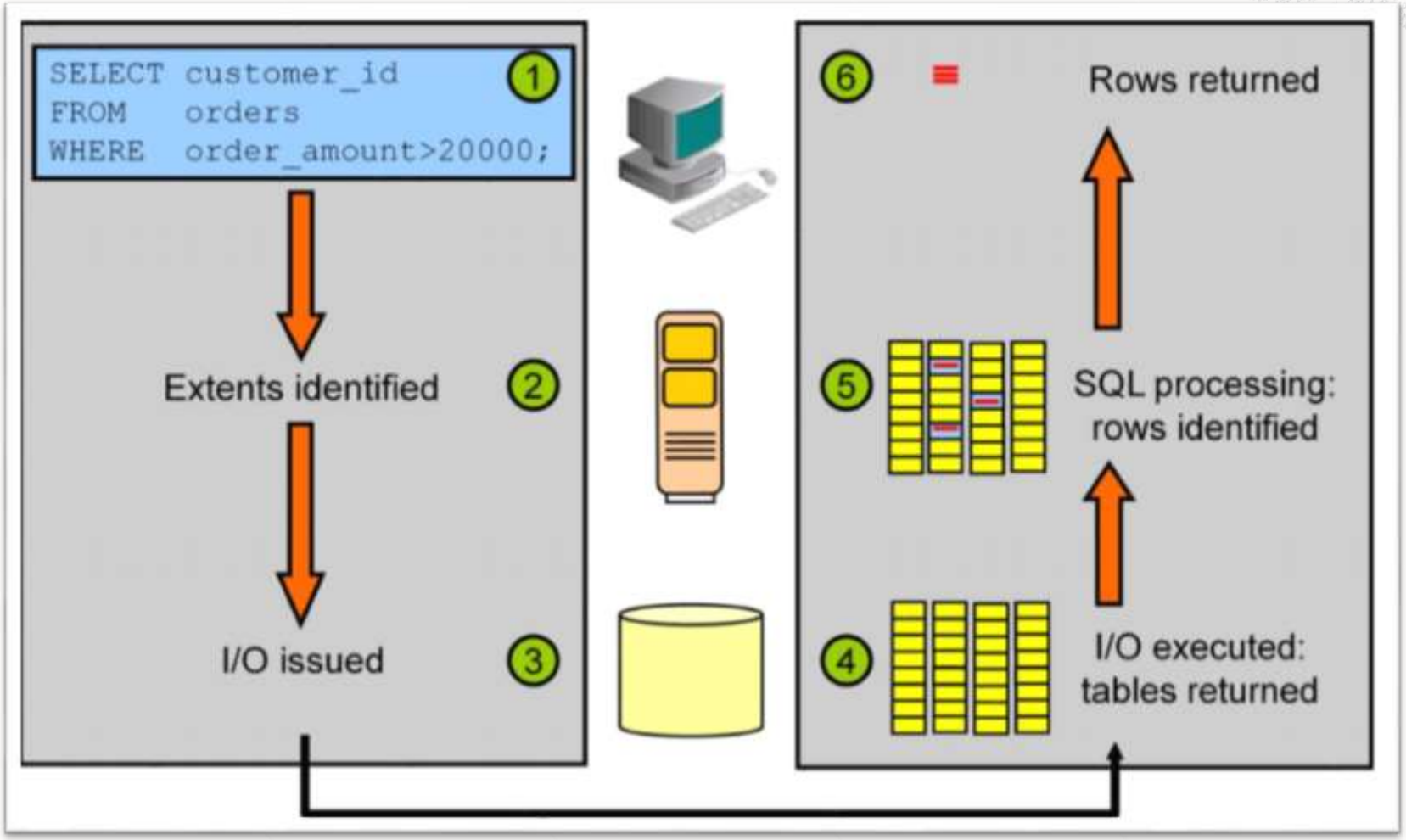
- Extends In-Memory database performance to higher capacity Flash memory in storage



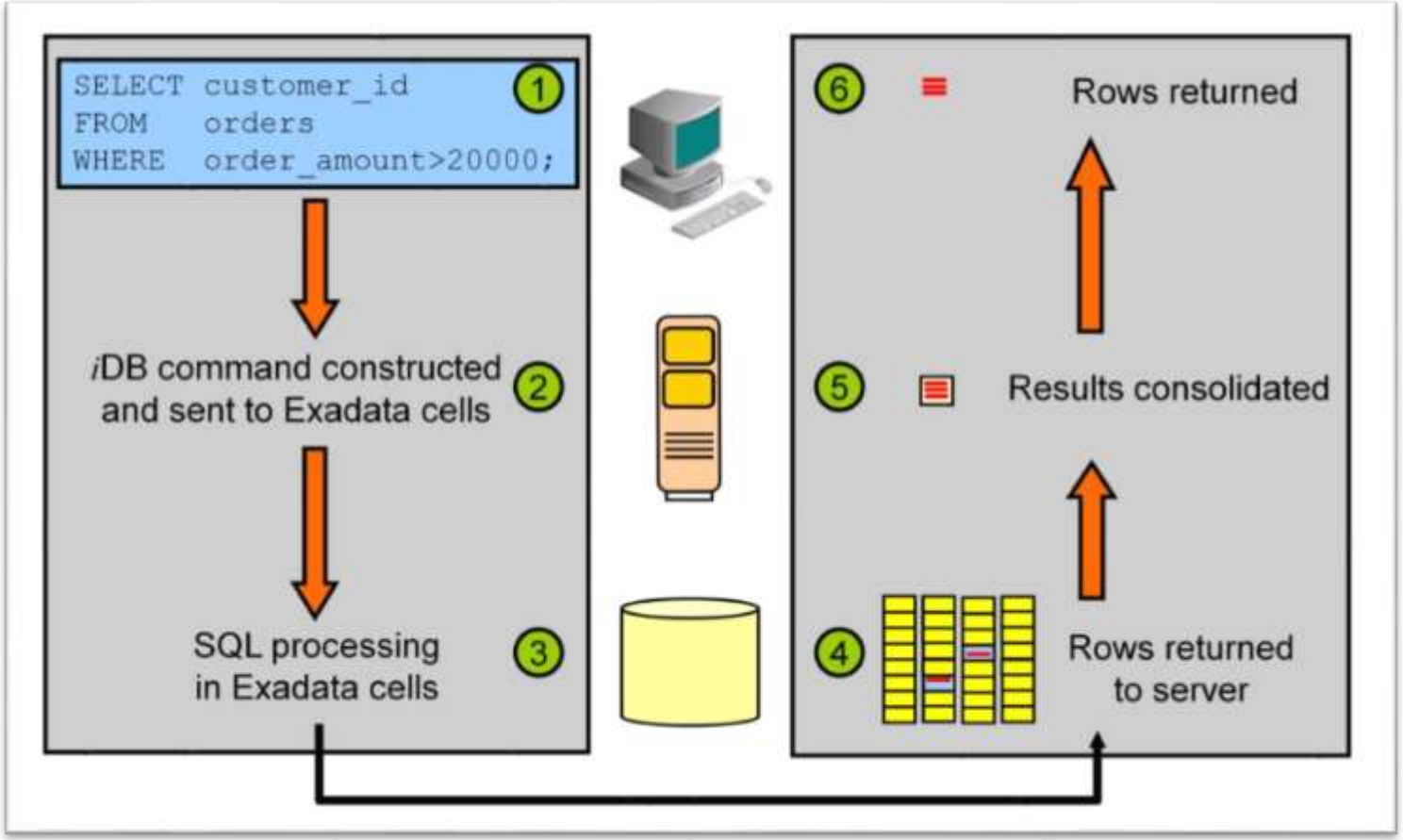
*Includes long-running SQL queries, backups, decryption, aggregation, data mining

Smart Scan

Oracle Database | No Exadata System



Exadata Cloud a Smart Scan | Off Load Querying



Query Execution plan | Traditional Database Vs Exadata System

```
SQL> select * from table(dbms_xplan.display);

PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------
Plan hash value: 970577077

-------------------------------------------------------------------------------------------------
| Id  | Operation                           | Name            | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                    |                 |   902 | 23452 |    10   (0)| 00:00:01 |
|   1 |  TABLE ACCESS BY INDEX ROWID BATCHED| CUSTOMERS       |   902 | 23452 |    10   (0)| 00:00:01 |
|*  2 |   INDEX RANGE SCAN                  | CUSTOMERS_ID_PK |   902 |       |     6   (0)| 00:00:01 |
-------------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------
```

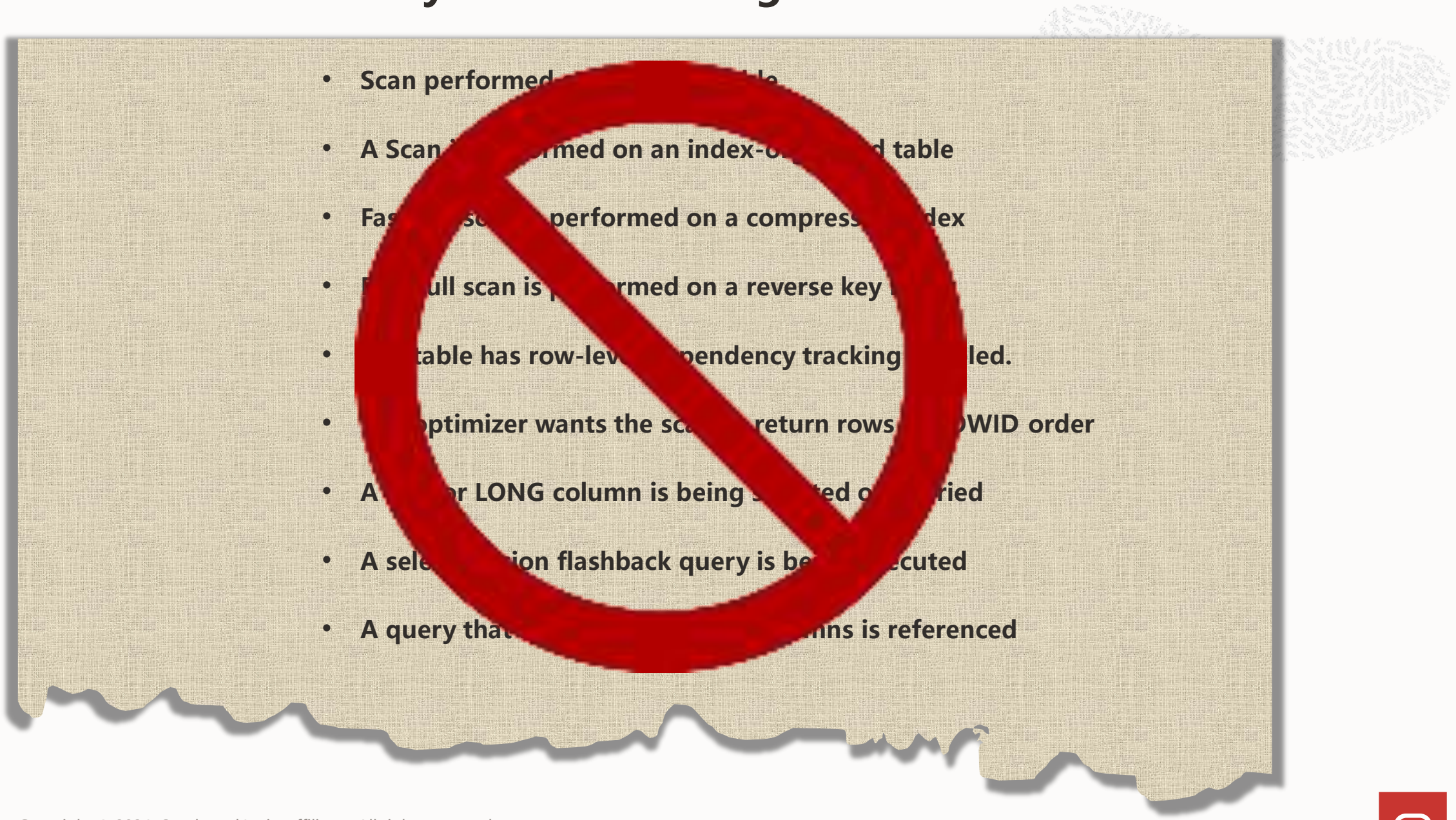

```
PLAN_TABLE_OUTPUT
--------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------
Plan hash value: 2008213504

-------------------------------------------------------------------------------------------------
| Id  | Operation                   | Name      | Rows  | Bytes | Cost (%CPU)| Time     |
-------------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT            |           |   902 | 23452 |   306K  (1)| 00:00:12 |
|*  1 |  TABLE ACCESS STORAGE FULL  | CUSTOMERS |   902 | 23452 |   306K  (1)| 00:00:12 |
-------------------------------------------------------------------------------------------------

Predicate Information (identified by operation id):
---------------------------------------------------

   1 - storage("ID"<=1000 AND "ID">=100)
       filter("ID"<=1000 AND "ID">=100)
```

Exadata Smart Scan Why it's not working?



Oracle Database backup options

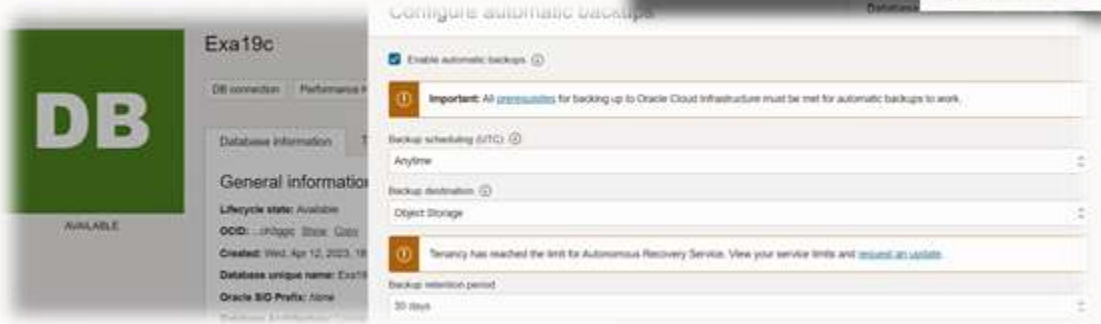
Oracle Database automatic backup

Manage backup and restore feature for VM/BM DB System

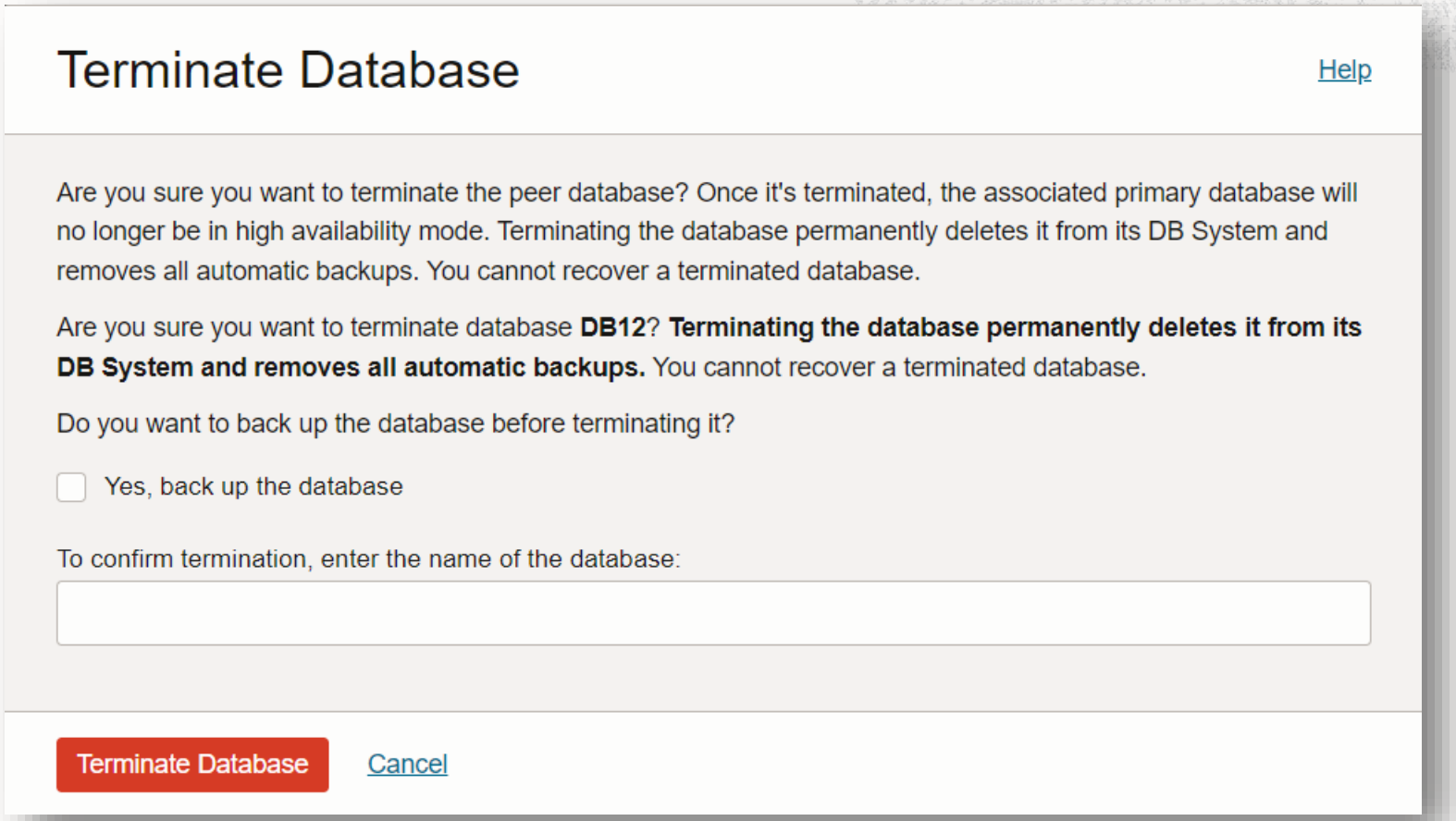
- Backup stored in Object or Local storage
- DB System in private subnets can leverage Service Gateway
- Start With 2 cores and Scale Up/Down OCPU's based on your requirement

Backup Options

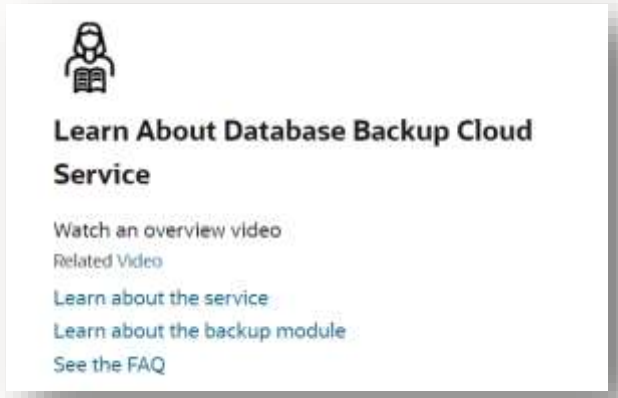
- It is not possible to create a non-CDB via the console - use dbcli

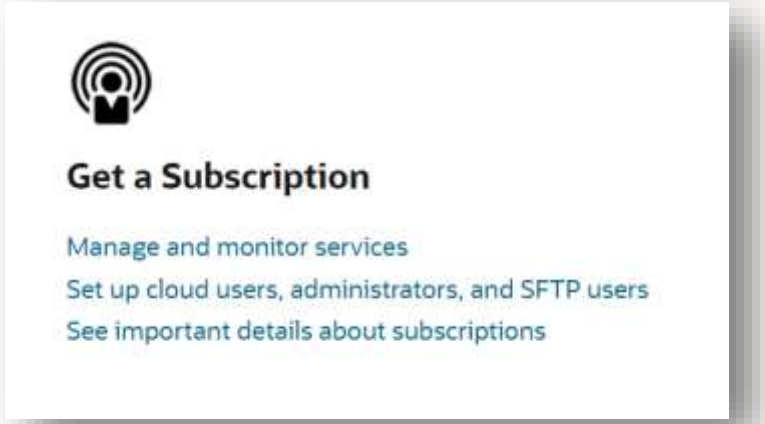


OCI Database Backup | Take Care before delete your Database



Cloud Backup | Oracle Database Backup Cloud Service page



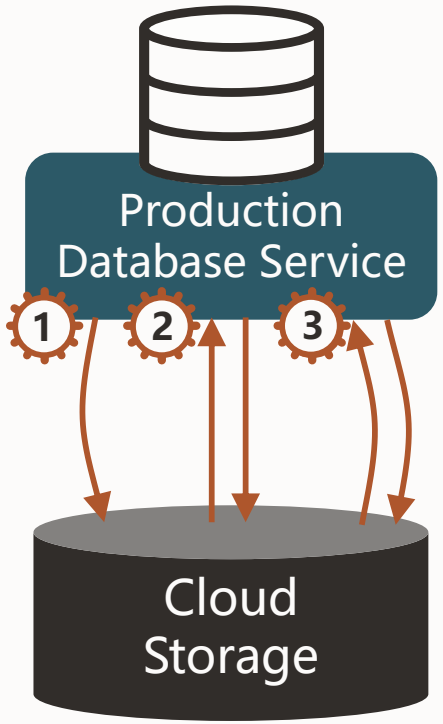


Recovery Service offloads backup validation

All backups are checked for recoverability, reducing database service overhead

Traditional cloud backup

1. Backup (full or incremental) is created on the production database service and stored in object storage
2. Production service reads the backup from object store, validates it, and fixes issues **doubling the impact on production database services**
3. Periodic revalidation **increases production database consumption**
4. Resulting in:
   a. Lower production performance if resource constrained, or
   b. Higher consumption costs if resources are unconstrained, or
   c. Decision to not validate backups or revalidate them, increasing risk



All work takes place on the production database service

Oracle Database Zero Data Loss Autonomous Recovery Service

A fully managed, automated service for continuously protecting Oracle databases in OCI

Ransomware resiliency

- Automatic and mandatory encryption to help prevent data theft
- Safeguards backups with enforced 14-day retention
- Optimizes backups in the background for fast recovery with zero data loss

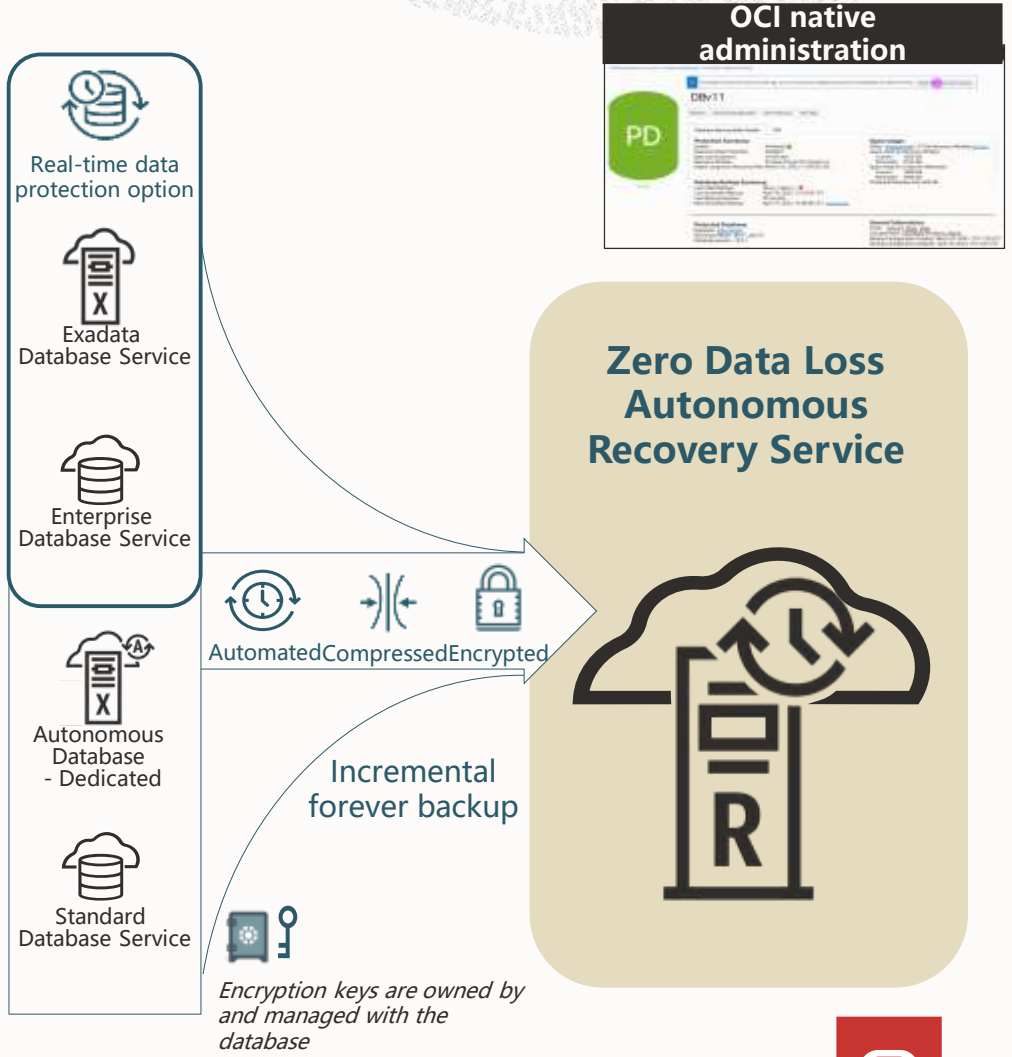
Operational efficiency

- No more weekly full backups – eliminates production database overhead
- Shorter backup windows with incremental forever strategy
- Zero-impact database recovery validation for every backup

Cloud simplicity

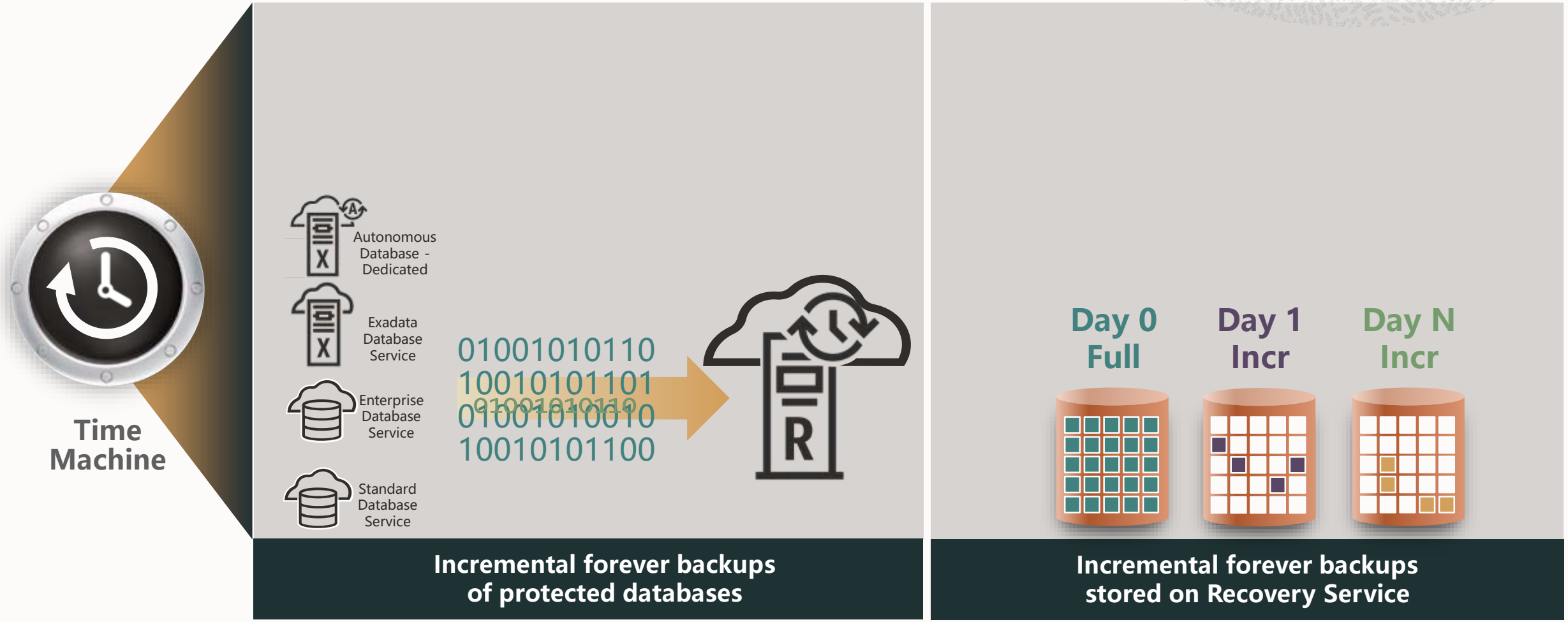
- Quickly configure database protection at scale with zero data loss
- Control costs with database-specific backup consumption metrics
- Gain deep data protection insights with granular recovery health dashboard

Using proven Recovery Appliance technology



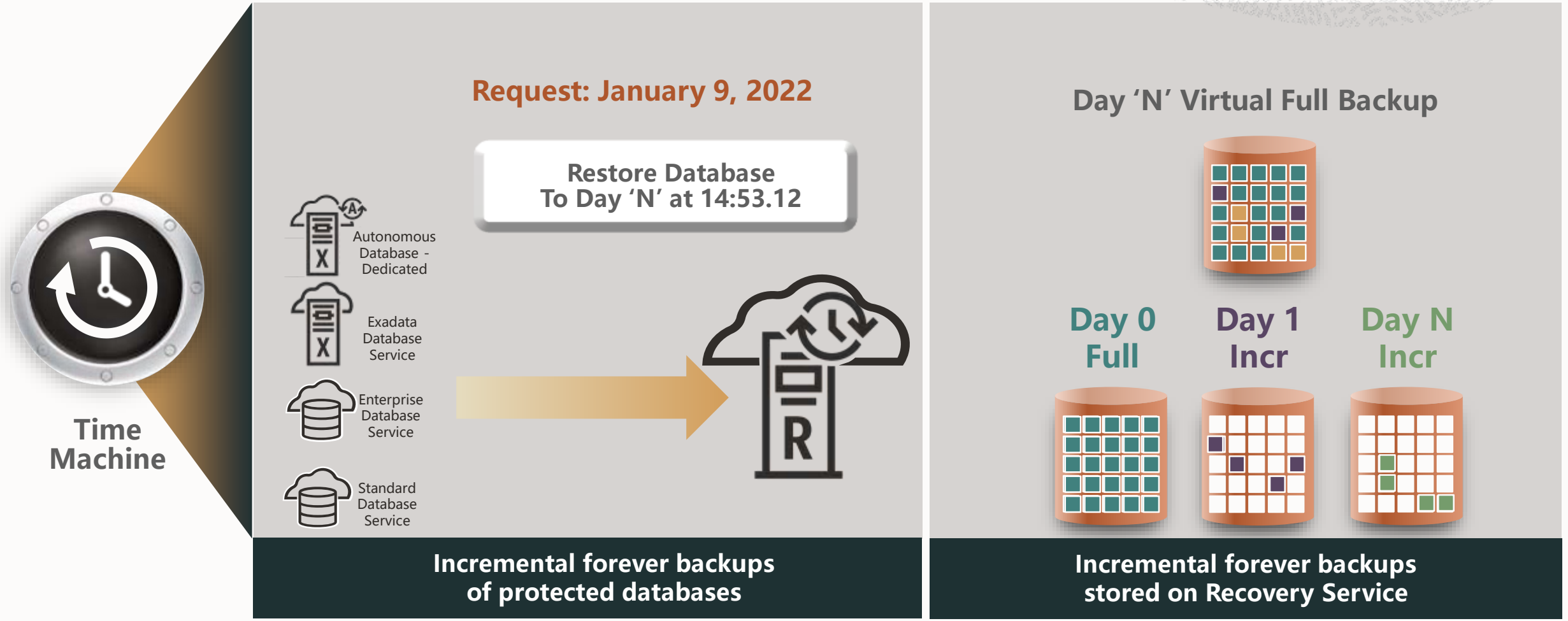
Recovery Service eliminates weekly full backups

Incremental-forever backups reduce backup overhead on production database services



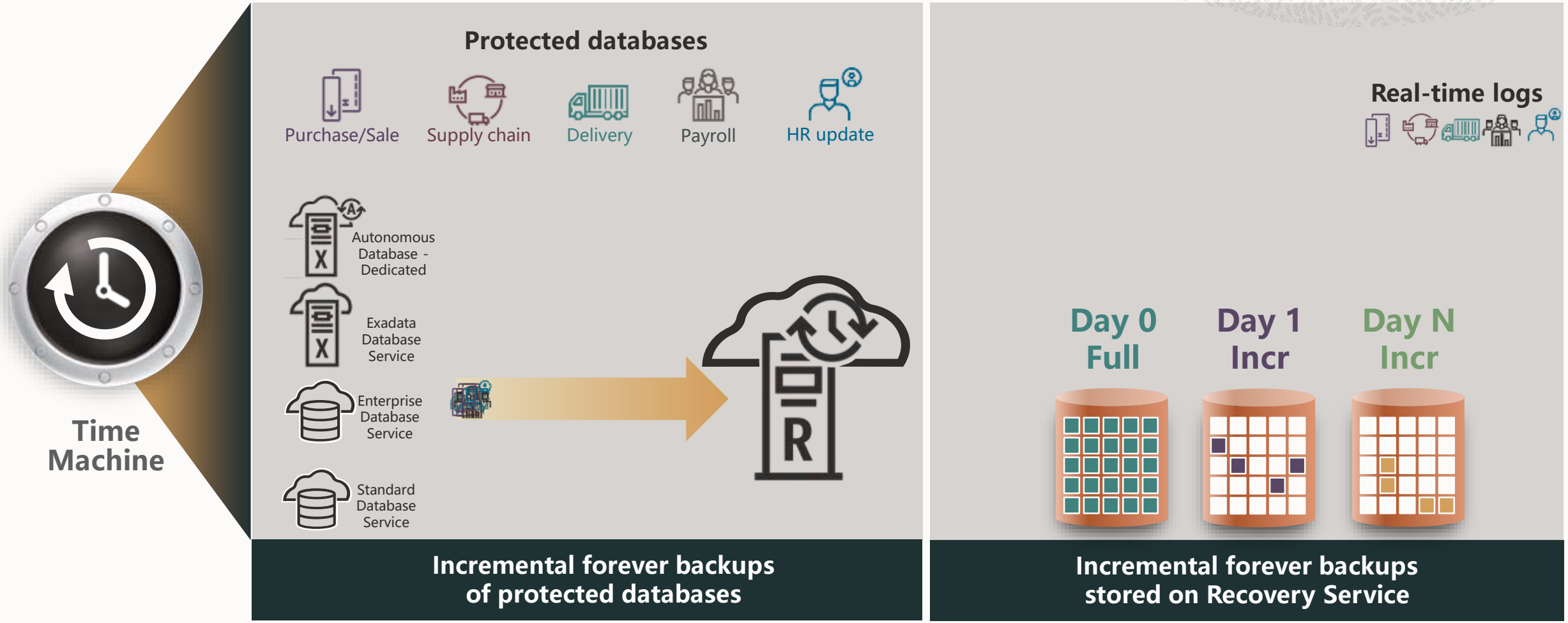
Recovery Service simplifies database restores

Creation of virtual full backups eliminates multiple incremental restore & apply cycles



Recovery Service continuously protects Oracle databases

Real-time protection of database changes increases resiliency with point-in-time recovery



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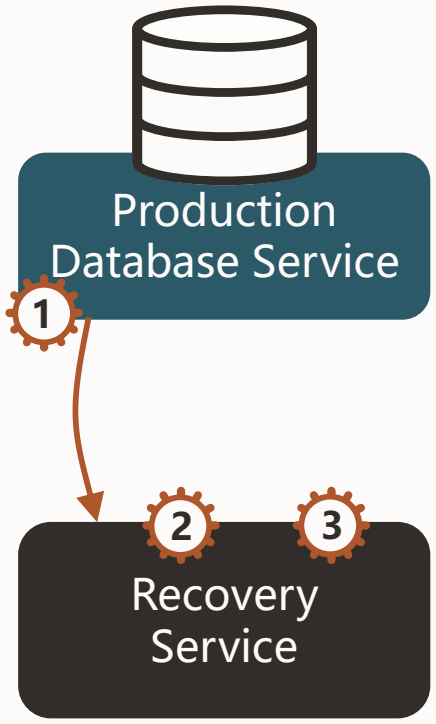


Most work takes place on the Recovery Service

Recovery Service backup

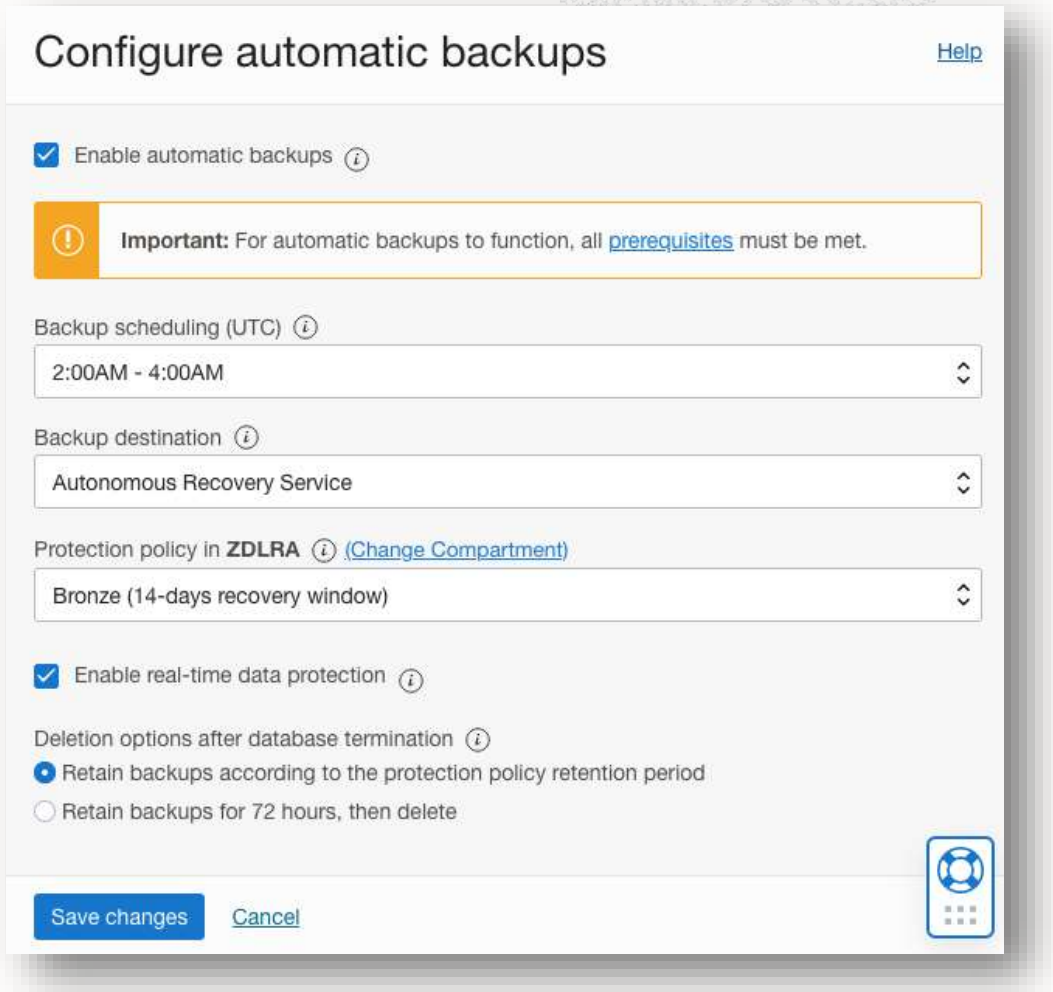
1. Incremental forever backup is created on the production database service and stored in the Recovery Service
2. The Recovery Service uses **internal Oracle Database knowledge** to check examine and fix backups when ingested, with **no impact on production databases**
3. The Recovery Service periodically revalidates backups with **no production database consumption**
4. Resulting in:
   a. **Minimal backup impact on production databases**
   b. **No additional production database service costs**
   c. **Higher recoverability & lower risk**

Recovery Service is easy to set up and use

Protect Oracle databases with less then 5 clicks in the OCI console

A fully managed OCI service with a simple UI

1. Enable automatic backups
2. Schedule daily incremental backups to meet your business schedule
3. Select Autonomous Recovery Service
4. Select protection window of 14 to 95 days
5. Enable real-time protection



Recovery Service protects against unauthorized access

Built-in security and resiliency help safeguard mission-critical data

Encryption is mandatory

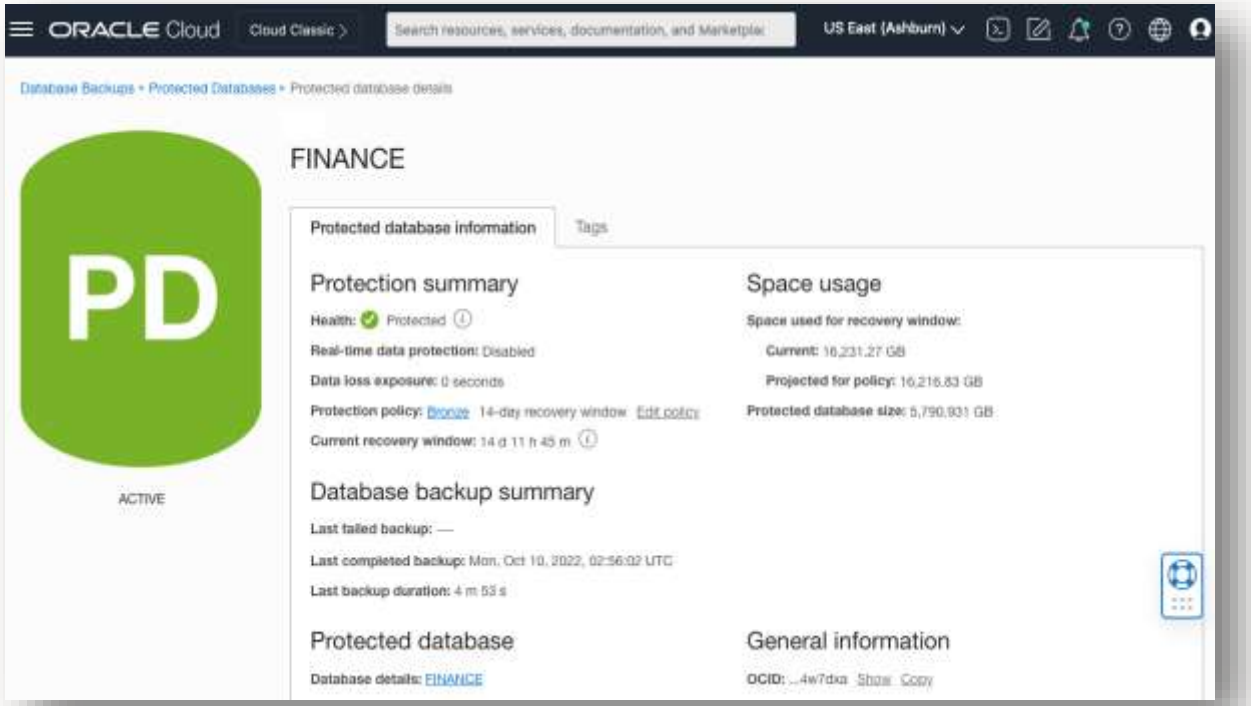
- Non-encrypted databases are rejected
- Keys are never stored in the Recovery Service

Access and management controls

- No direct user access to storage – backup only
- Access granted per protected database
- 14-day minimum retention enables recovery from human error or malicious internal actors

Resilient operations

- Fault-tolerant across all infrastructure components
- Highly available across Availability Domains and Fault Domain
- Load balanced within a region



Recovery Service provides insights into backup health and operations

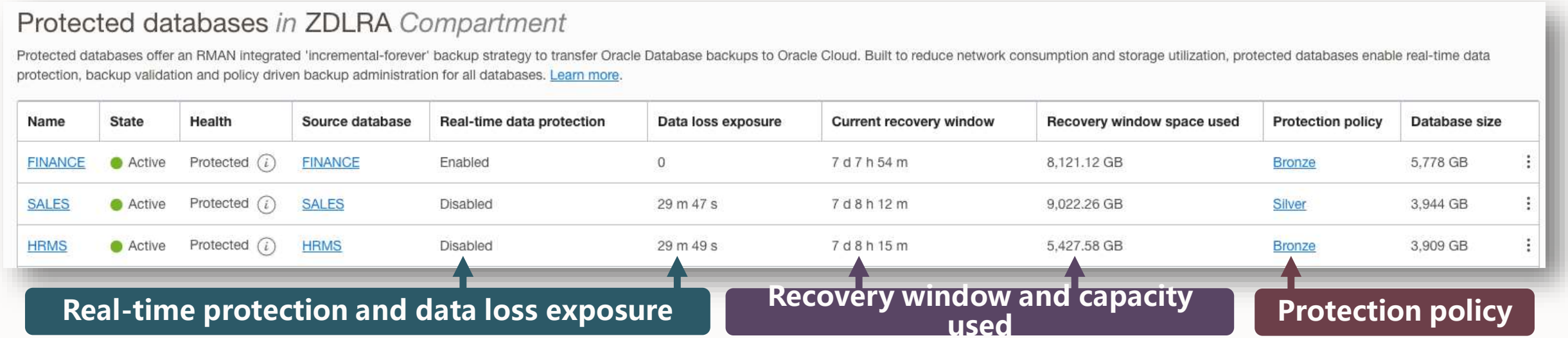
Built-in dashboards and tools simplify reporting and planning

Continuous monitoring of potential business risks

- Data loss exposure
- Recovery window

Critical data for operational planning

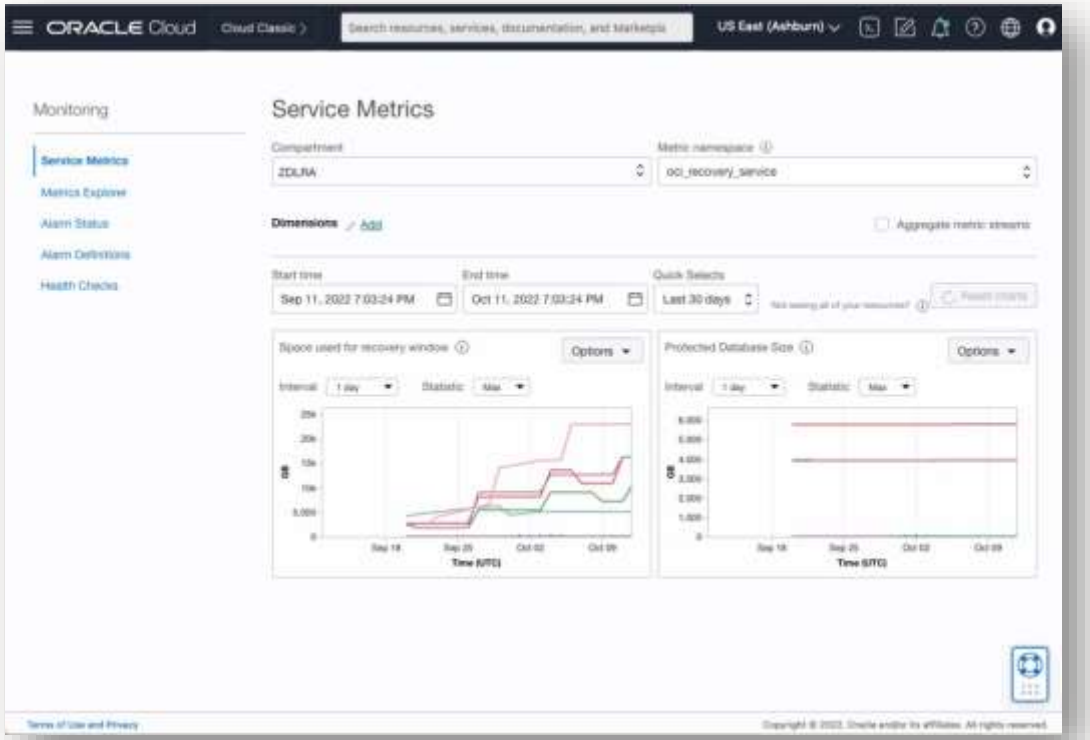
- Capacity usage
- Protection policy



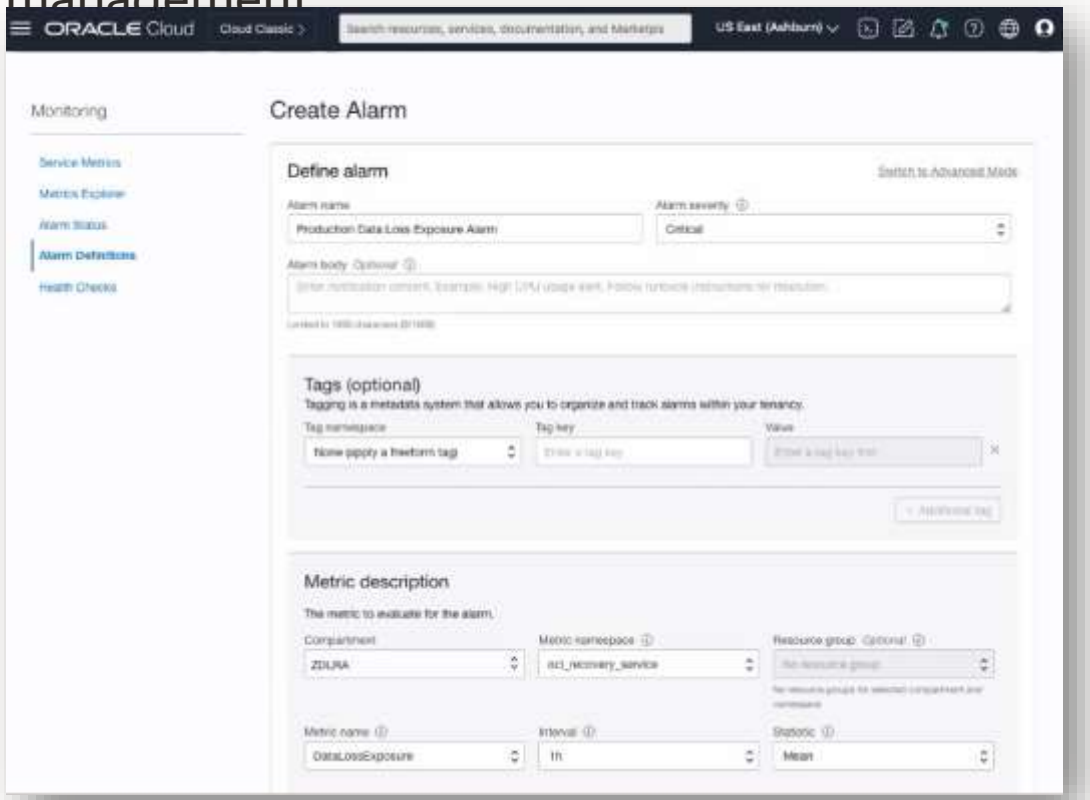
Recovery Service integrates with OCI observability and management

Comprehensive visibility across the full cloud stack

Integration with OCI Metrics Explorer provides common access to critical information



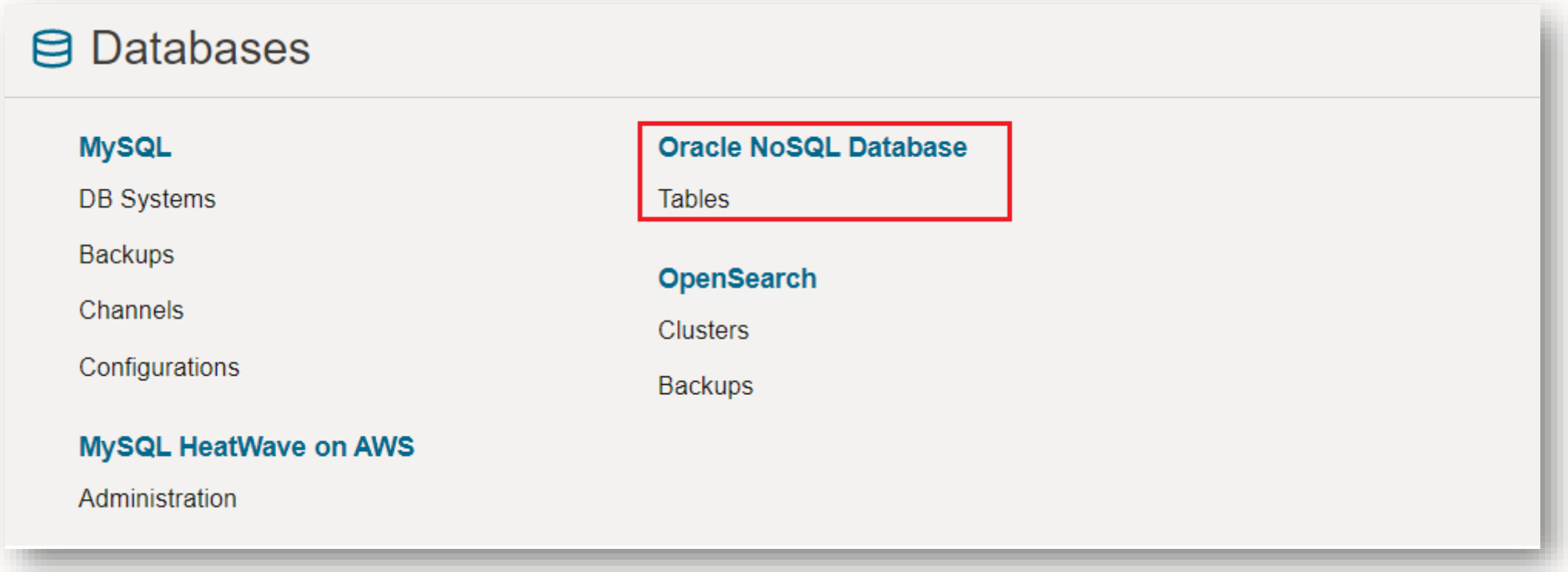
Alarms and notifications are created within OCI for consistent monitoring and management



Oracle NoSQL Database Cloud Service

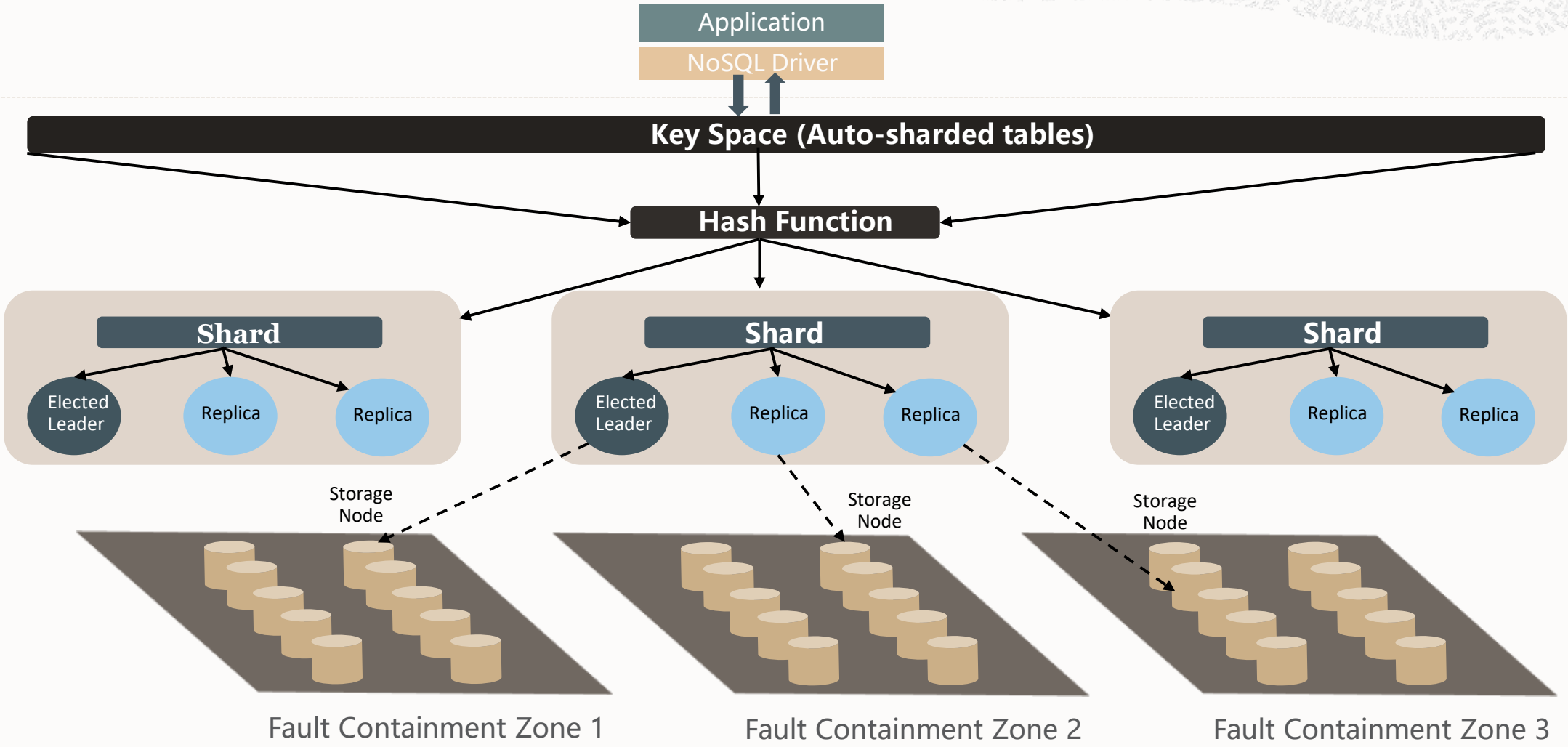
Oracle NoSQL Database Services on OCI Console

Easy provisioning and Management



Oracle NoSQL Database Architecture Overview

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



Oracle NoSQL Database Cloud Service

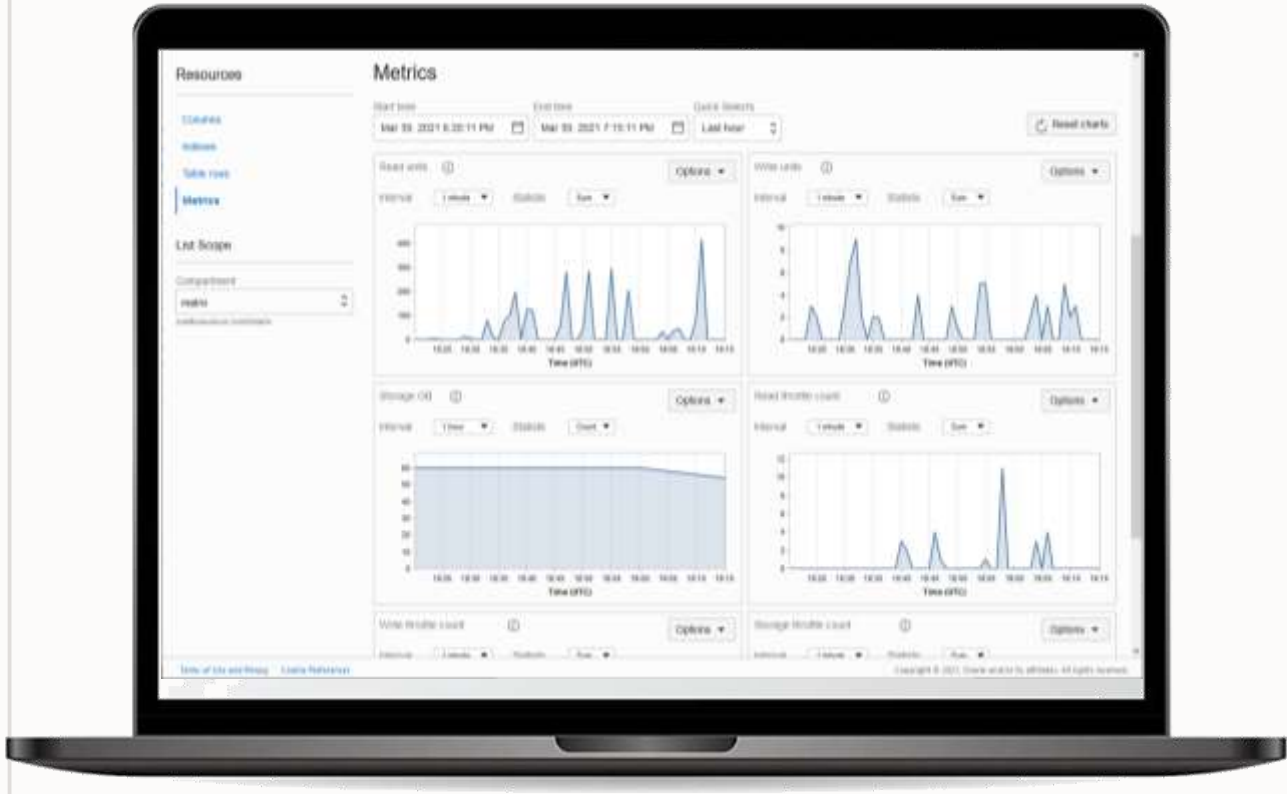
Built for extreme, dynamic workloads of today's modern applications

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

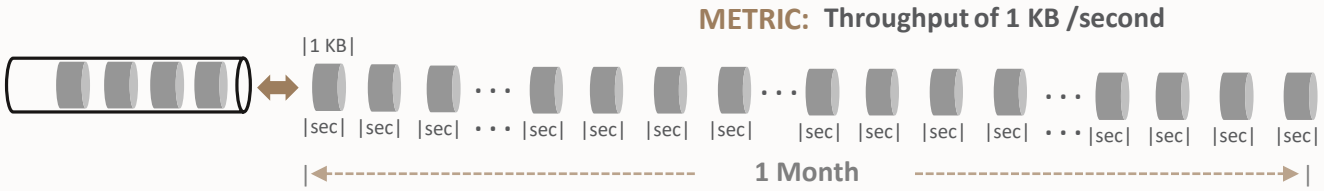
Throughput provisioning

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 KB/Hr*744 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

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);
```

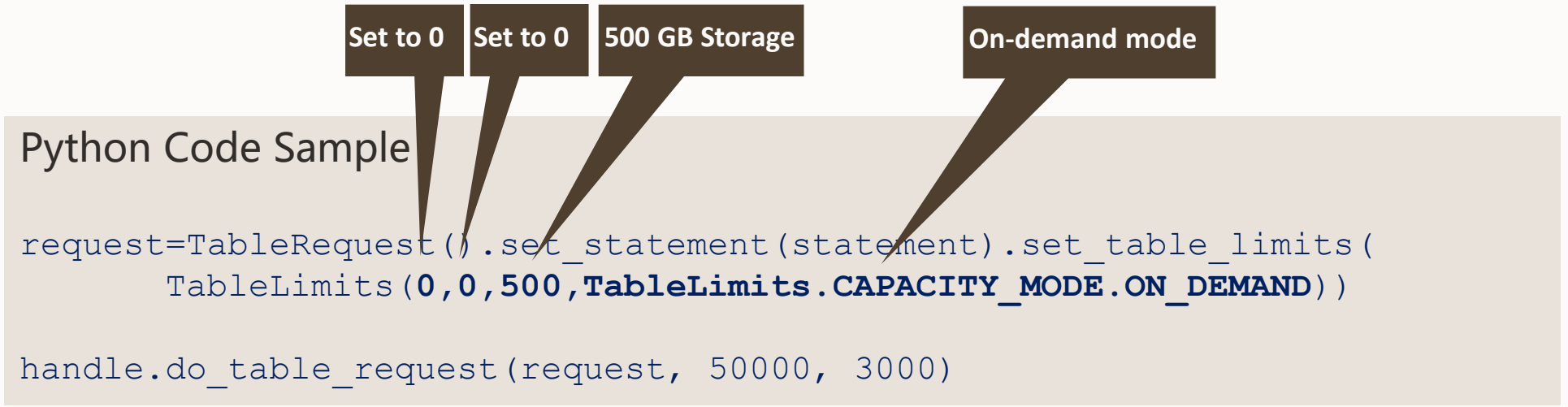
Modify the table lowering the read units to 1000

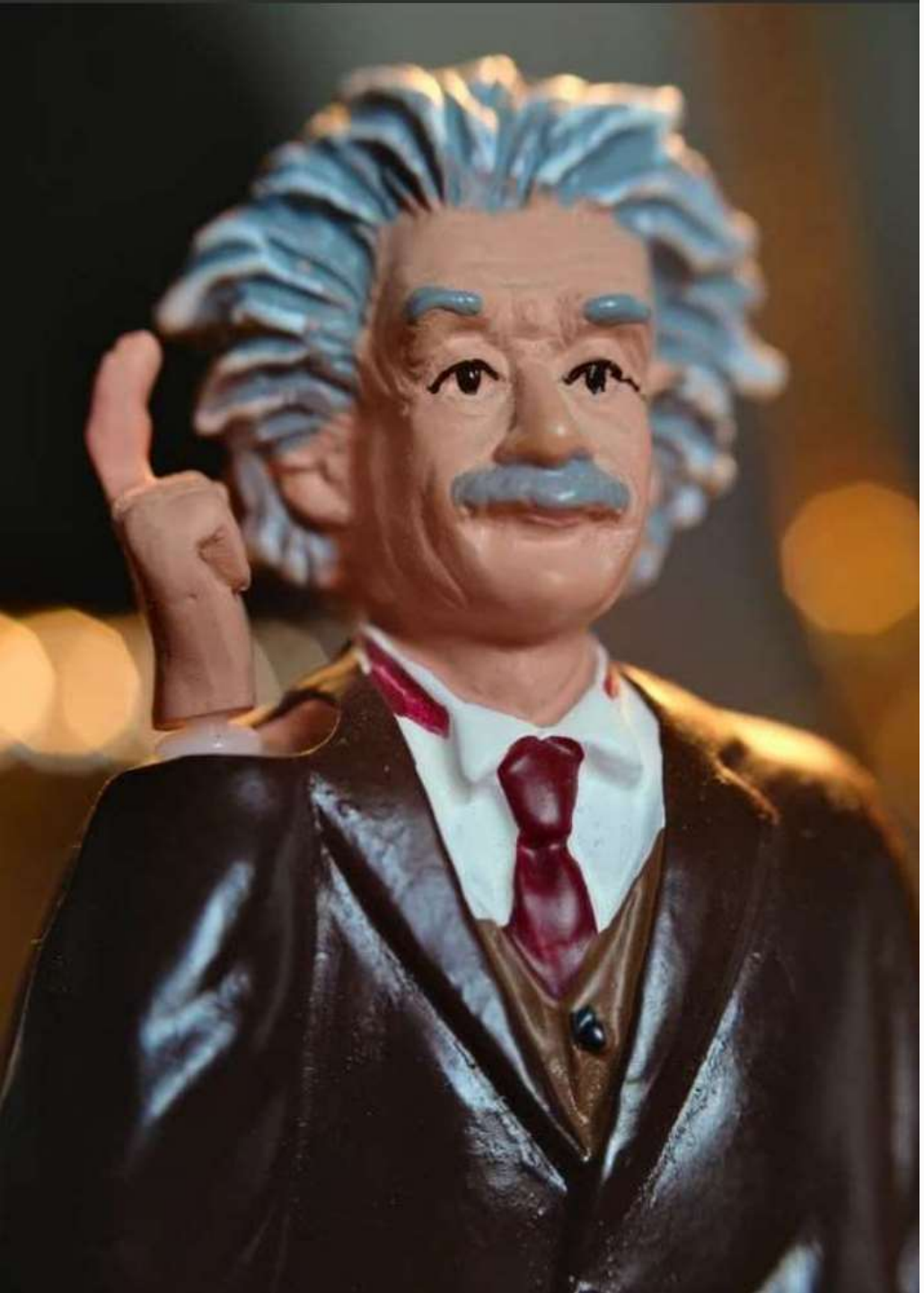
```
tableRequest.setTableLimits(new TableLimits(1000, 100, 500))
```

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

Oracle NoSQL Database Cloud Service – On-Demand Capacity

Auto-scaling throughput





Demo 1 – OCI NoSQL Services

- NoSQL Table provisioning
- NoSQL Table Insert using OCI Console

Demo 2 – Exadata Smart Scan

- Changing Table execution plan using Index
- Change index to invisible and enable Smart Scan

Resources

- **Oracle Database Backup Cloud Services**

  https://docs.oracle.com/en/cloud/paas/db-backup-cloud/

- **Oracle NoSQL Database Cloud Service**

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

- **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 X10M Cloud at Customer Datashhet**

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

- **Zero Data Loss Autonomous Recovery Service**

  https://www.oracle.com/database/zero-data-loss-autonomous-recovery-service

- **Oracle Database Backup Cloud Services**

  https://docs.oracle.com/en/cloud/paas/db-backup-cloud/

- **Oracle oci License Management Services**

https://www.oracle.com/corporate/license-management-services/

- **Exadata Cloud at Customer Documents**

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

Thank you

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