



Exadata Database Machine & Cloud

Sessão exclusiva Accenture – Day I

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Licenses and Systems

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Nossos Valores

Integridade

Compliance

Trabalho em Equipe

Satisfação do Cliente

Qualidade

Ética

Inovação

Respeito Mútuo

Justiça

Comunicação

Como empresa líder em tecnologia, abraçamos a **diversidade** em todas as suas formas. Acreditamos realmente que a **inovação** começa com a **inclusão**. E isso só pode ser alcançado com a cooperação de nossos **parceiros**. Afirmamos nosso **compromisso** em manter um **ambiente respeitoso** e **livre de discriminação** e esperamos isso dos nossos **parceiros de negócios**.

A Oracle espera que seus **parceiros** conduzam os negócios de forma **justa** e **ética**, para cumprir as leis anticorrupção em todo o mundo, para cooperar com os pedidos de informação da Oracle e evitar envolver-se em qualquer atividade que envolva até mesmo a aparência de impropriedade.

É vital que os nossos parceiros sejam aderentes aos valores do **Código de Ética e Conduta Empresarial da Oracle**, que baseia-se e implementa os valores que são essenciais para o nosso sucesso como empresa. Nossos valores são a base de tudo o que fazemos e todos nós devemos viver esses valores todos os dias.



Utilize o QR code para acessar o Código de Ética e Conduta Empresarial da Oracle.





MARCEL LAMARCA

Exadata Cloud Specialist

Upgrade, Utilities, Patching, Performance & Migrations

Exadata X9M Implementation Certified Specialist

and more 14 Oracle Certifications



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Agenda

Exadata Database Machine – Overview

Exadata Cloud at Customer - Overview

Exadata Features - Overview

Exadata Cloud at Customer - Patching

Exadata Smart Scan – Deep Dive

Demo – Smart Scan explain Plan

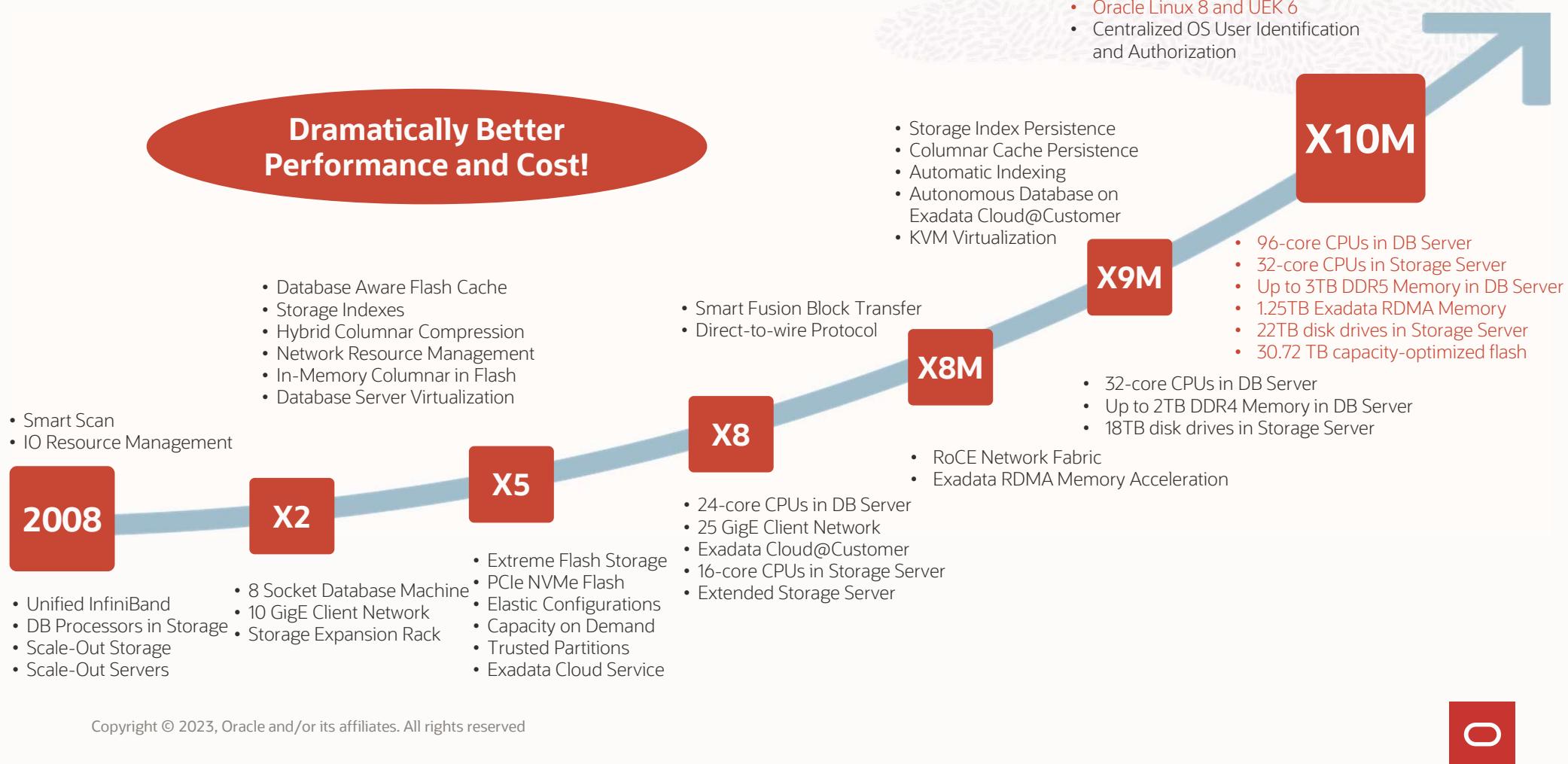
Demo – Smart Scan Monitoring

Exadata History

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Exadata Advantages Increase Every Year



Exadata runs everywhere

Identicality across deployments improves IT agility and reduces costs

On-premises



Exadata Database
Machine

Public Cloud



Exadata in Oracle
Cloud Infrastructure
(OCI)

Hybrid Cloud



Exadata
Cloud@Customer

Multicloud



Exadata through
Oracle Database
Service for Azure

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Exadata Database Machine - Overview

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Exadata X9M Extreme performance Scale-out Database platform



- Scale-Out 2 Socket Database Servers
 - Latest 2 x 32-core Intel Ice Lake CPUs per server
 - Up to 2TB Memory
 - 8-socket database server for SMP workload
- Ultra-fast 100Gb/s RDMA over Converged Ethernet (RoCE) Internal Fabric
- Scale-Out **intelligent** 2-Socket Storage Servers
 - Latest 2 x 16-core Intel Ice Lake CPUs per server
 - 1.5 TB Persistent Memory per storage server
 - Three tiers of storage: PMem, NVMe Flash, HDD

Exadata X9M-2 Database Machine Database Node



Memory

- **512 GB** (factory option)
- **1024 GB** (factory option and field upgrade)
- **1536 GB** (field upgrade from 512 GB only)
- **2048 GB** (factory option and field upgrade, max)

Network

- Client/backup adapter **1: 4 x 10 Gb copper** Ethernet ports
or 2 x 10/25 Gb optical Ethernet ports
- Client/backup adapter **2 (optional): 4 x 10 Gb copper** Ethernet ports
or 2 x 10/25 Gb optical Ethernet ports
- Client/backup adapter **2 (optional): 4 x 10 Gb copper** Ethernet ports
or 2 x 10/25 Gb optical Ethernet ports
- **1 x 1 Gb copper** Ethernet port (mgmt)
- **2 x 100 Gb QSFP28 RoCE** Fabric ports

CPU's

- 2 x 32-core Intel® Xeon® 8358 processors (2.6 GHz)

Local Disk's

- **2 x 3.84 TB NVMe Flash SSD** (hot swappable)
- Upgradeable to **4 x 3.84 TB** (Optional)

Exadata X9M-8 Database Machine Database Node



Memory

- **3 TB** (Default)
- **6 TB** (Upgrade optional)

Local Flash Disk's

- **2 x 3.84 TB NVMe Flash SSD** (hot swappable)
- Upgradeable to **4 x 3.84 TB** (Optional)

Network

- **8 x 10/25 Gb copper** Ethernet ports (client)
- **8 x 1/10 Gb copper** Ethernet ports (1 used for host ADMIN)
- **8 x 100 Gb QSFP28** RoCE Fabric ports
- **1 x ILOM** Ethernet port

CPU's

- **8 x 24-core** Intel® Xeon® 8268 processors (2.9GHz)



Exadata X9M Storage Types HC, EF and XT

High-Capacity (HC) Storage



Extreme Flash (EF) Storage



Extended (XT) Storage



Flash

- 4 x 6.4 TB NVMe PCIe4.0 Flash cards

Network (For All Storage Types)

- 2 x 100 Gb QSFP28 RoCE Fabric ports
- 1 x 1 Gb copper Ethernet port (mgmt)
- 1 x ILOM Ethernet port

Flash

- 4 x 6.4 TB NVMe PCIe4.0 Flash cards

Disk

- None

Flash

None

Disk

- 12 x 18 TB 7,200 RPM disks

CPU

- 2 x 16-core Intel® Xeon® 8352Y processors (2.2 GHz)

Disk

- 12 x 18 TB 7,200 RPM disks

Memory

- 256 GB
- 1.5 TB Persistent Memory

CPU

- 2 x 16-core Intel® Xeon® 8352Y processors (2.2 GHz)

Memory

- 256 GB
- 1.5 TB Persistent Memory

CPU

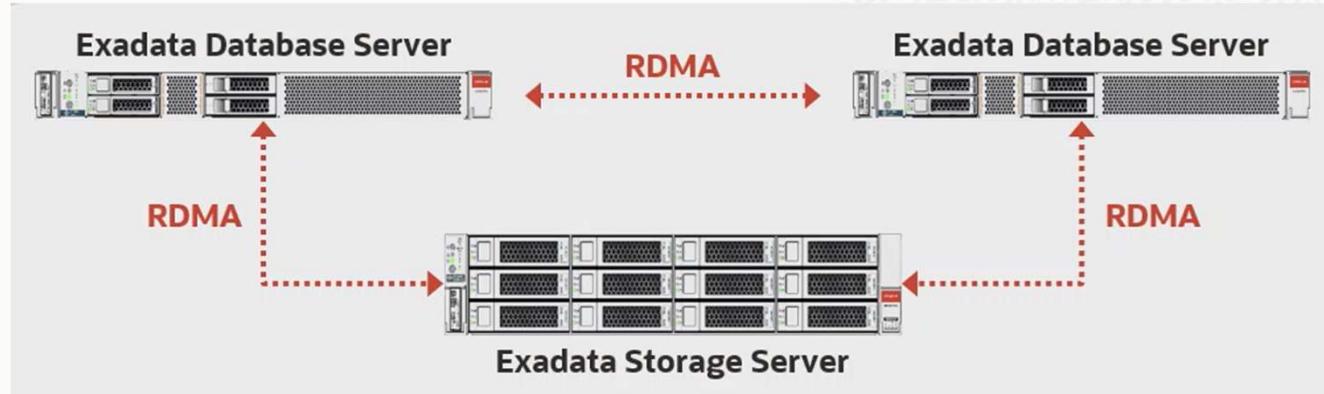
- 2 x 16-core Intel® Xeon® 8352Y processors (2.2 GHz)

Memory

- 96GB



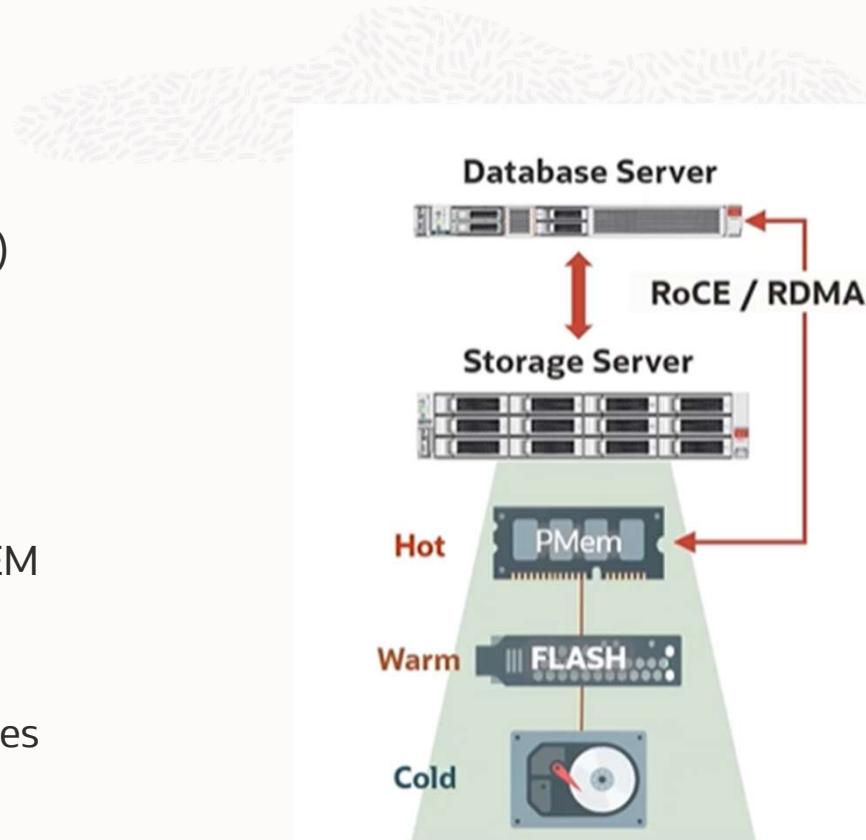
Remote Direct Memory Access (RDMA) for extreme performance



- RDMA provides high throughput and low CPU usage for large data transfers
- Direct-to-Wire Protocol delivers 3x faster inter-node OLTP cluster messaging
- Smart Fusion Block Transfer eliminates log write on inter-node block move
- RDMA Protocol coordinates transaction between nodes

Persistent Memory Data Accelerator

- Intel Optane™ Persistent Memory (X8M and X9M only)
- Transparently add PMEM in front of Flash memory
- Database Uses RDMA instead of I/O to read remote PMEM
- PMEM is automatically tiered and shared across Databases
- PMEM is mirrored automatically across storage servers for fault tolerance

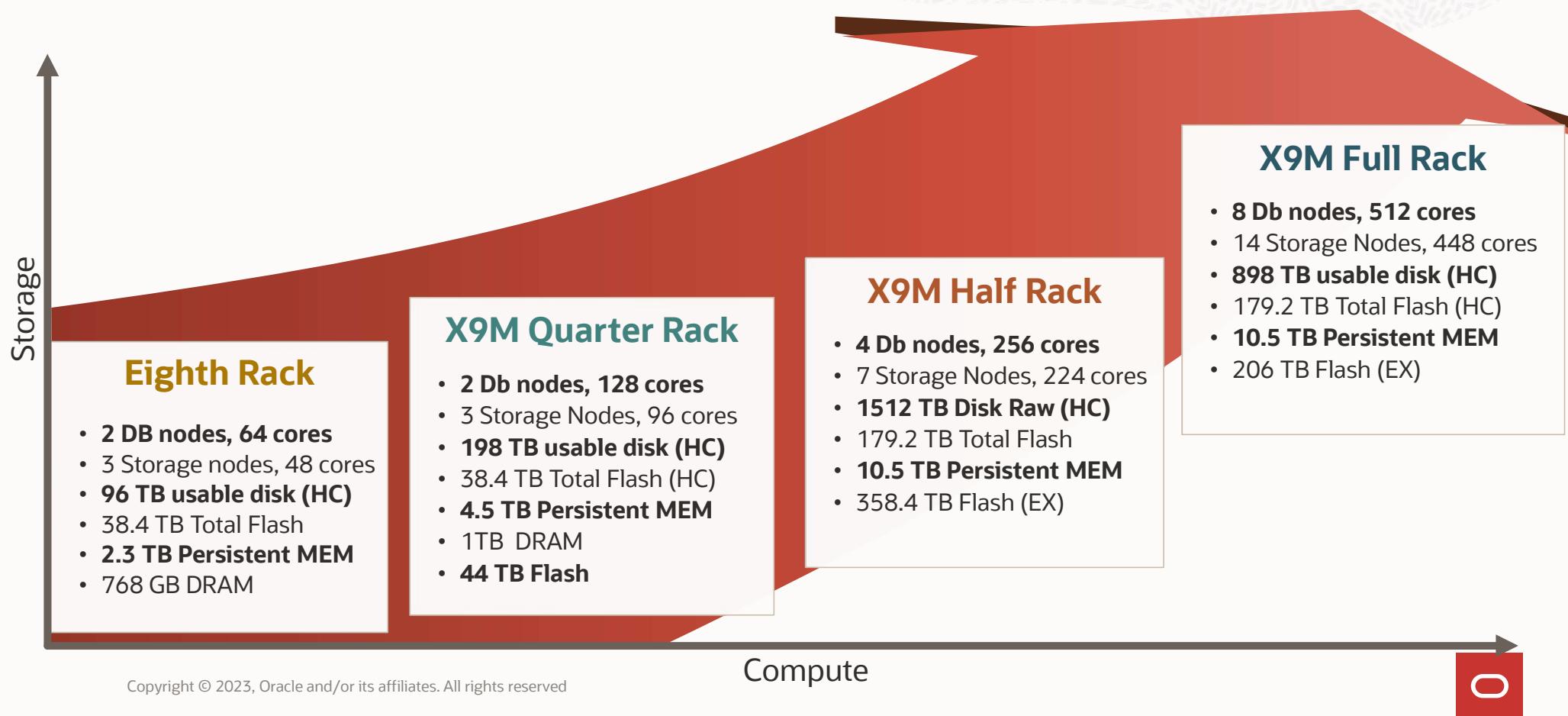


Exadata Smart Flash Cache - Overview

- High-performance cache for frequently accessed objects
- Write-through and write-back modes available :
 - Write-through mode is excellent for absorbing repeated random reads
 - Write-back mode is best for write intensive workloads
- Allows optimization by application tables using cold disks and PMEM
- Tens of thousands of I/Os per second



Exadata Database Machine X9M-2 Shapes





SCAN ME

Exadata Database Machine X9M-2 Datasheet

Oracle Exadata Database Machine X9M-2

The Oracle Exadata Database Machine is engineered to deliver dramatically better performance, cost effectiveness, and availability for Oracle databases. Exadata features a modern cloud-enabled architecture with scale-out high-performance database servers, scale-out intelligent storage servers with state-of-the-art PCIe leading-edge storage cache using persistent memory, and closed RDMA over Converged Ethernet (RoCE) internal fabric that connects all servers and storage. Unique algorithms and protocols in Exadata implement database intelligence in storage, compute, and networking to deliver higher performance and capacity at lower costs than other platforms, for all types of modern database workloads including:

SERVER TYPE	CPU	MEMORY	DISK	FLASH	NETWORK
Database Server	2 x 32-core Intel® Xeon® 8358 processors (2.6 GHz)	512 GB (factory option) 1024 GB (factory option and field upgrade) 1536 GB (field upgrade from 512 GB only) 2048 GB (factory option and field upgrade, max)	None	2 x 3.84 TB NVMe Flash SSD (hot swappable), (upgradeable to 4 x 3.84 TB)	<ul style="list-style-type: none">Client/backup adapter 1: 4 x 10 Gb copper Ethernet ports or 2 x 10/25 Gb optical Ethernet portsClient/backup adapter 2 (optional): 4 x 10 Gb copper Ethernet ports or 2 x 10/25 Gb optical Ethernet portsClient/backup adapter 3 : 4 x 10 Gb copper Ethernet ports or 2 x 10/25 Gb optical Ethernet ports1 x 1 Gb copper Ethernet port (mgmt)1 x iLOM Ethernet port2 x 100 Gb QSFP28 RoCE Fabric ports
Storage Server High Capacity (HC)	2 x 16-core Intel® Xeon® 8352Y processors (2.2 GHz)	256 GB 1.5 TB Persistent Memory	12 x 18 TB 7,200 RPM disks	4 x 6.4 TB NVMe PCIe4.0 Flash cards	<ul style="list-style-type: none">2 x 100 Gb QSFP28 RoCE Fabric ports1 x 1 Gb copper Ethernet port (mgmt)1 x iLOM Ethernet port



Exadata Database Machine X9M-8 Datasheet



SCAN ME

ORACLE

Oracle Exadata Database Machine X9M-8

The Oracle Exadata Database Machine is engineered to deliver dramatically better performance, cost effectiveness, and availability for Oracle databases. Exadata features a modern cloud-enabled architecture with scale-out high-performance database servers, scale-out intelligent storage servers with state-of-the-art PCIe flash, leading-edge storage cache using persistent memory, and cloud scale RDMA over Converged Ethernet (RoCE) internal fabric that connects all servers and storage. Unique algorithms and protocols in Exadata implement database intelligence in storage, compute, and networking.

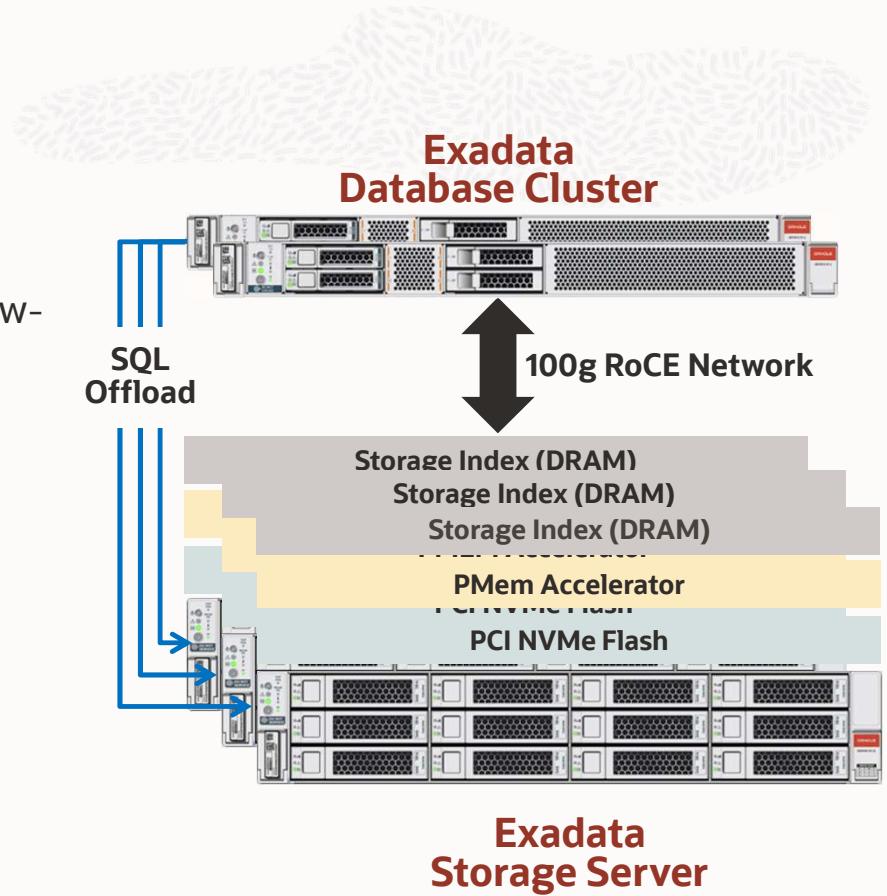
Exadata Server Hardware 1, 2

SERVER TYPE	CPU	MEMORY	DISK	FLASH	NETWORK
Database Server	8 x 24-core Intel® Xeon® 8268 processors (2.9GHz)	3 TB (default) to 6 TB (max)	None	2 x 6.4 TB NVMe Flash cards	<ul style="list-style-type: none">8 x 10/25 Gb copper Ethernet ports (client)8 x 1/10 Gb copper Ethernet ports (1 used for host ADMIN)8 x 100 Gb QSFP28 RoCE Fabric ports1 x ILOM Ethernet port
Storage Server High Capacity (HC)	2 x 16-core Intel® Xeon® 8352Y processors (2.2 GHz)	256 GB 1.5 TB Persistent Memory	12 x 18 TB 7,200 RPM disks	4 x 6.4 TB NVMe PCIe4.0 Flash cards	<ul style="list-style-type: none">2 x 100 Gb QSFP28 RoCE Fabric ports1 x 1 Gb copper Ethernet port (mgmt)1 x ILOM Ethernet port
Storage Server Extreme Flash (EF)	2 x 16-core Intel® Xeon® 8352Y processors (2.2 GHz)	256 GB 1.5 TB Persistent Memory	None	8 x 6.4 TB NVMe PCIe4.0 Flash cards	
Storage Server	1 x 16-core Intel® Xeon®	96 GB	12 x 18 TB	None	



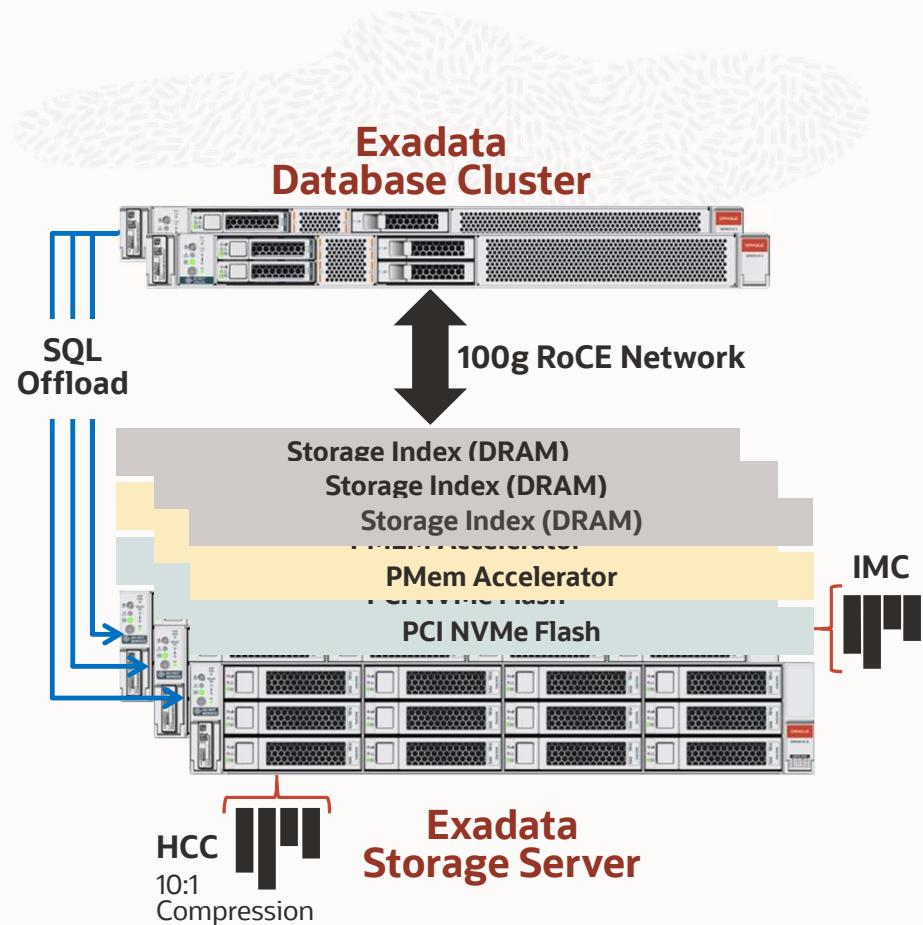
Faster OLTP Database

- Innovative, modern technologies tuned for high-volume, low-latency random I/O
- Elimination od DB cluster coordination bottlenecks
- Instant detection, handling of failed/failing components



Faster Analytics Database

- Smart Scan (SQL Offload)
- Tiered Flash Cache
- Storage Indexes
- Hybrid Columnar Compression (EHCC)
- In-Memory Columnar (IMC)
- Best Platform For consolidation (Multitenant)



Exadata Cloud Overview

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Database Cloud Service | Exadata

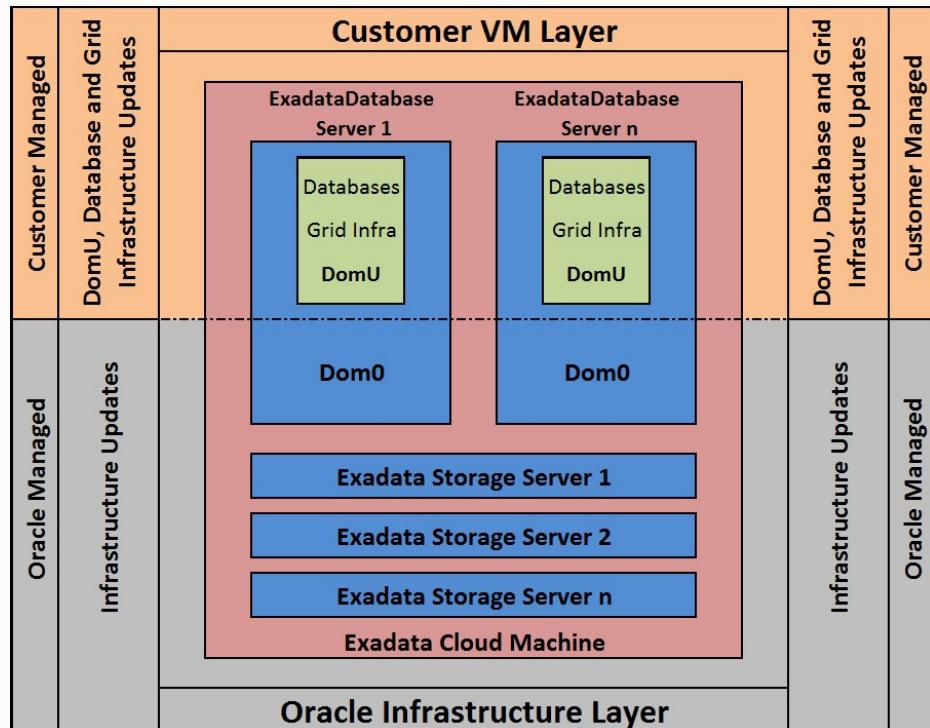


World's Best Database Performance Machine

- 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 workload
- Only Oracle Database Enterprise Editions allowed.
- Exadata Cloud X9M Shapes (Base, Quarter, Ralf and Full Rack)
- Works with Autonomous Database on Dedicated Infrastructure



Exadata Cloud at Customer - Dom0 and DomU



About *Dom0* Oracle Responsibilities

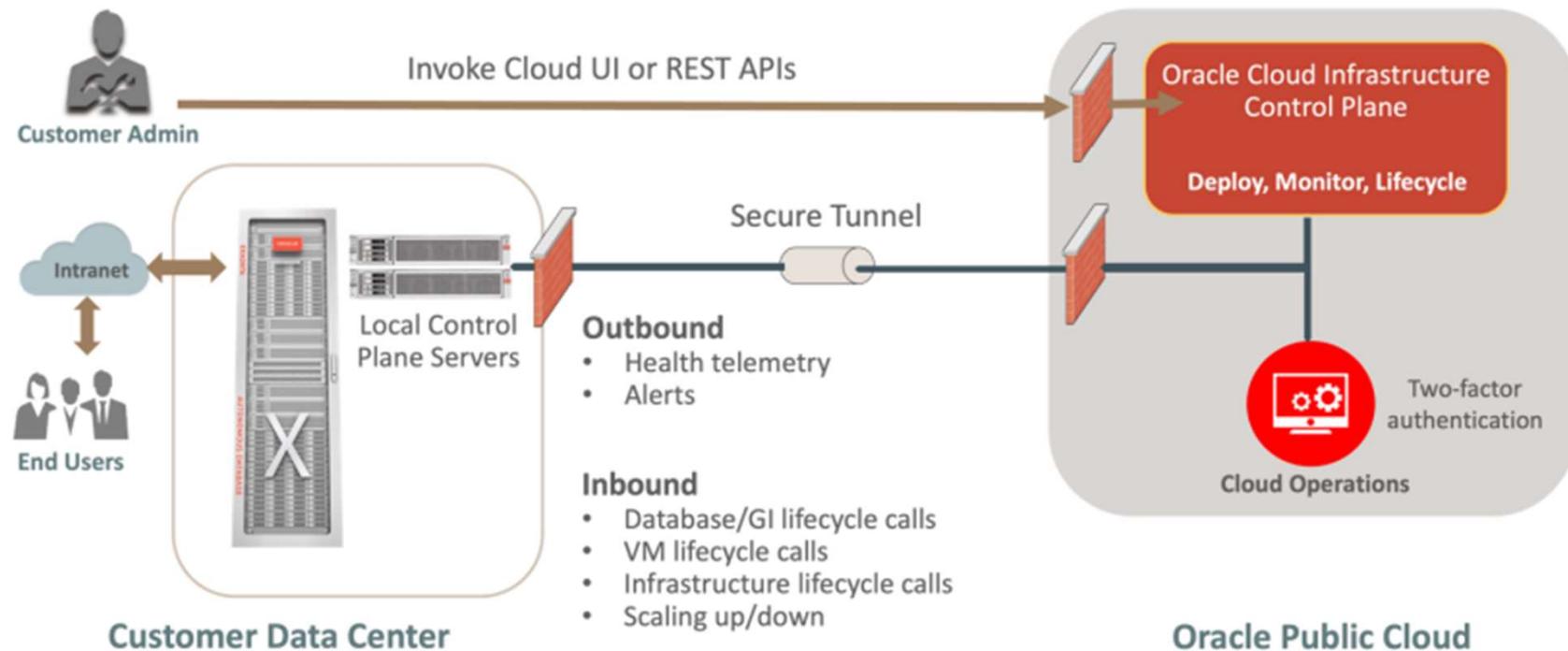
- Oracle Cloud Ops manage Exadata infrastructure (hardware, system software) & hypervisor (dom0);
- Oracle Support is responsible for update any version;
- Customer is responsible for scheduling Dom0 maintenance and must provide at least 4 dates per year;

About *DomU* Customer Responsibilities

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

Exadata Console Management and Control Plane Diagram

Exadata Cloud@Customer – Management Flow



Exadata Cloud X9M Flexible Shapes



SCAN ME

Storage ↑

Base System

Ideal for small-scale consolidation and the lowest cost

- Total Flash 3.8 TB
- **2 DB Servers 3 Storages**
- 48 CPUs
- 73 TB usable storage

X9M Quarter Rack

Ideal for large databases, small-scale consolidation, and petabyte-scale analytics

- Total Flash 76.8 TB
- **2 Db Servers 3 Storages**
- 124 OCPUs
- 190 TB usable storage, expandable to 763 TB
- **4.5 TB PMEM**

X9M Half Rack

Ideal for very large databases and medium-scale consolidation

- Total Flash 153.6 TB
- **4 Db Servers 6 Storages**
- 248 OCPUs
- 381 TB usable storage, expandable to 763 TB
- **9.0 TB PMEM**

X9M Full Rack

Ideal for large-scale consolidation for all type of database workloads

- Total Flash 307.2 TB
- **8 Db Servers 12 Storages**
- 496 OCPUs
- 763 TB usable storage
- **18 TB PMEM**

Compute →



Find me on OCI Console

 Oracle Database

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



Exadata Cloud Management Tools

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Exadata Cloud Automation on OCI Console

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: XBMDB1

Database version: 19c

PDB name: Optional

Database Home: Select an existing Database Home or Create a new Database Home.

Database Home display name: XBMDBHome1

Create administrator credentials

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

Scale VM Cluster

Configure the VM cluster

Specify OCPU count per virtual machine: 10

Requested OCPU count for the Exadata VM cluster: 40

Current allocation: 10. Minimum allocation: 0. Available OCPUs (including the current allocation): 30.

Current Exadata storage: 150.528 TB

[Update](#) [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: Maximum Performance

Transport type: Read-Only

Asynchronous

Select Peer VM Cluster

Peer region: Read-Only

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-dbheme



Exadata Features

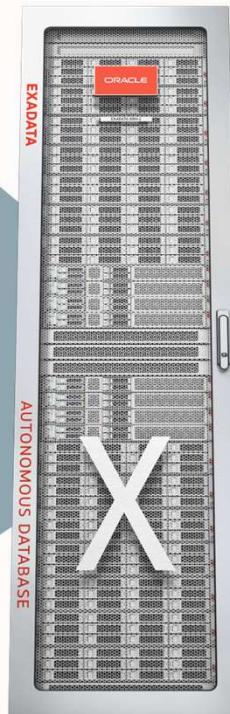
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Oracle Exadata Database and Platform Innovations

- 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 Innovations

- Offload SQL to Storage
- RoCE Fabric
- PMEM Commit and Data Accelerators
- 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

Exadata Smart Scan

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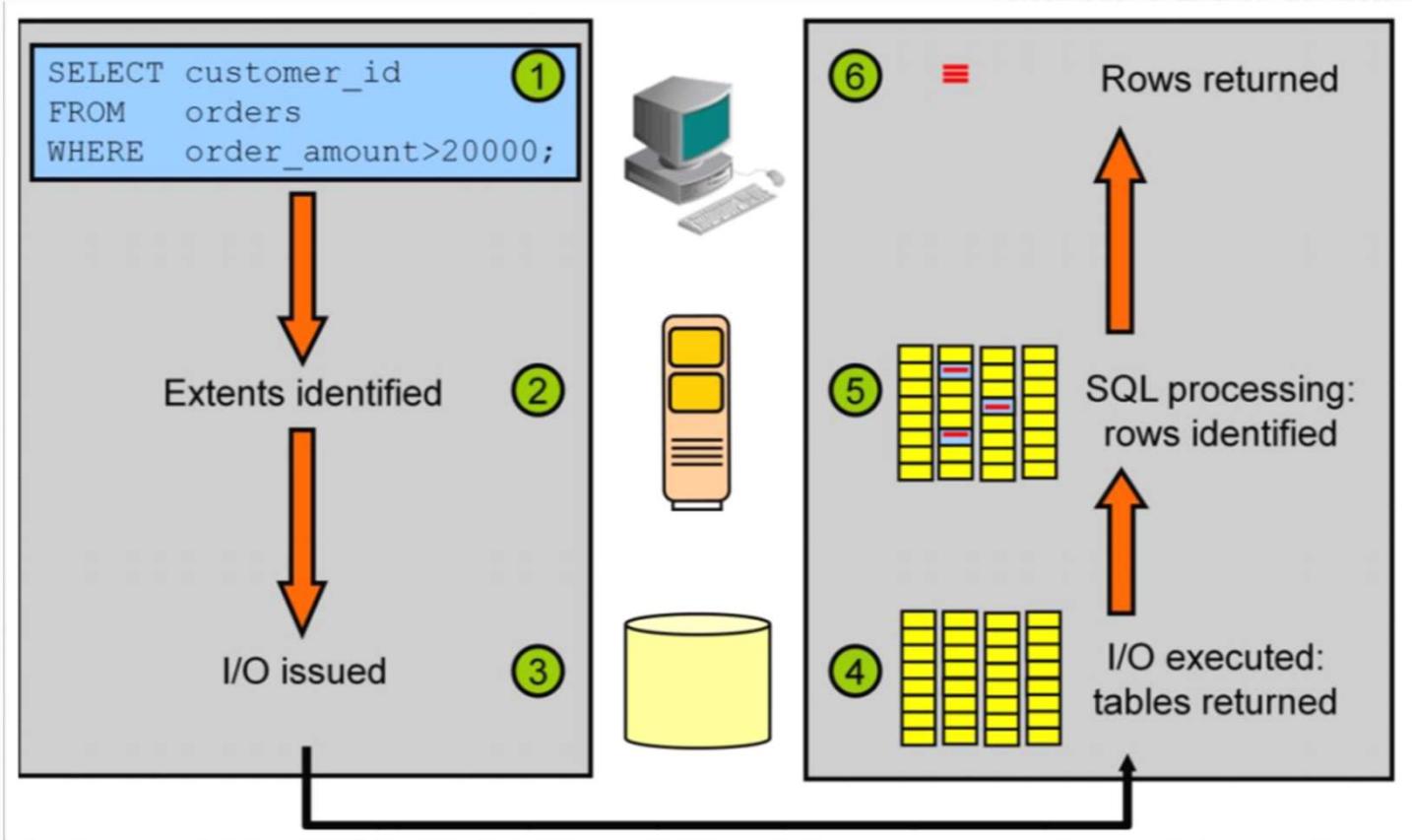


What Exadata Smart Scan Is?

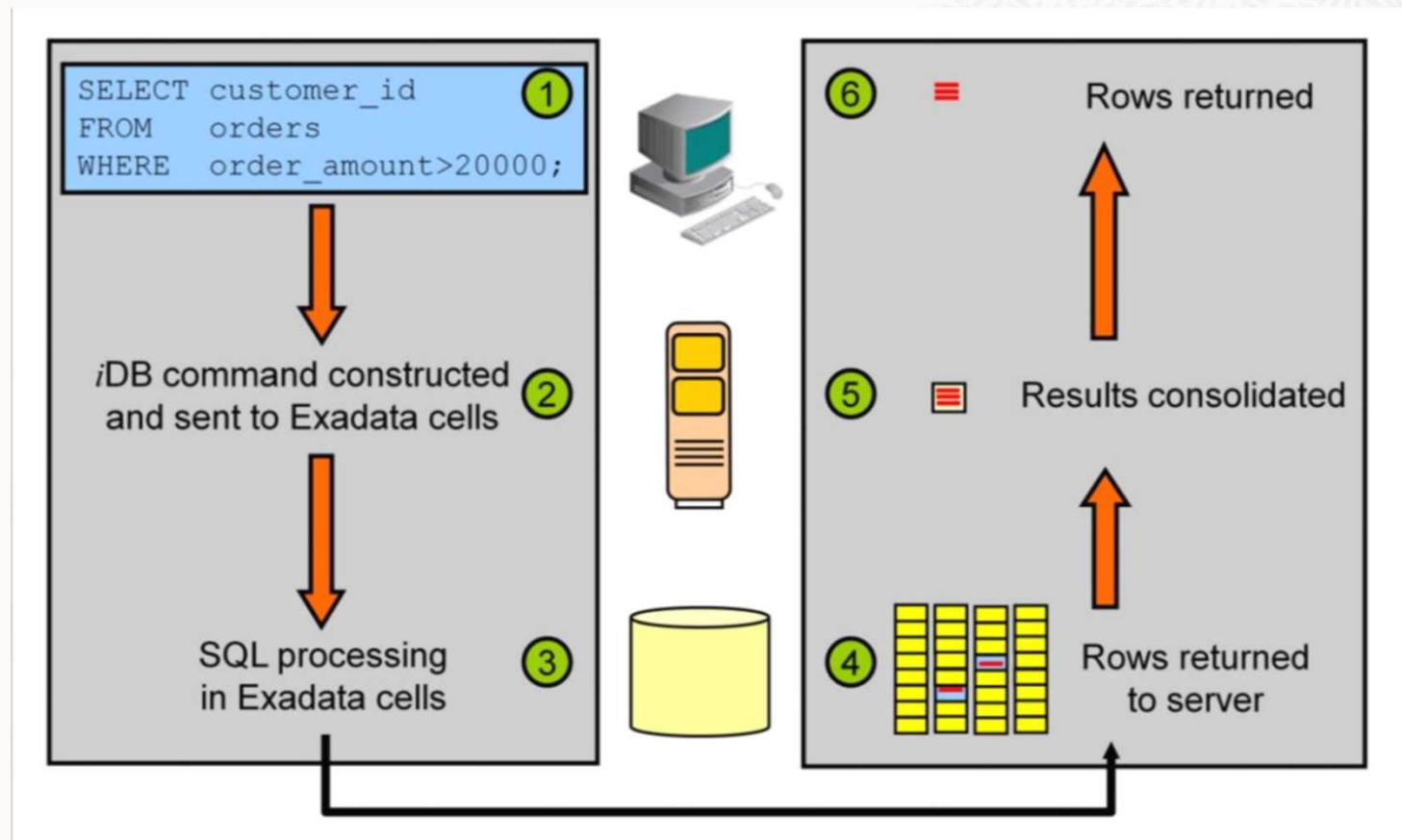


“Smart Scan is one of the great feature in Oracle Exadata. With this technology storage send only required rows to database node from **storage instead of entire Oracle Block**. Multiple rows are stored in one Oracle Block but non-exadata system return entire block even only one rows is required. On the other hand, Exadata Storage returns only **interested rows but not entire block**. “

Oracle Database | No Exadata System



Exadata Cloud a Smart Scan | Off Load Querying



When Exadata Smart Scan Happens



- Full Table Scans
- Direct-path reads
- Not used by default for serial scans of small tables Can be forced via _serial_direct_read=TRUE at either session or system level
- Full Index Scans
- Direct-path reads are automatically used for parallel queries

Exadata Smart Scan Why it's not working?

- Scan performed on a compressed table
- A Scan is performed on an index partitioned table
- Full scan is performed on a compressed index
- A full scan is performed on a reverse key index
- The table has row-level dependency tracking enabled.
- The optimizer wants the scan to return rows in ROWID order
- A BLOB or LONG column is being selected or queried
- A self-relation flashback query is being executed
- A query that references LOB columns is referenced

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)
```



Monitoring Smart Scan in SQL Execution Plan

- Relevant Initialization Parameters:
 - CELL_OFFLOAD_PROCESSING
 - TRUE | FALSE
 - Enables or disables Smart Scan and others smart storage capabilities
 - Dynamically modifiable at session or system level using ALTER SESSION or ALTER SYSTEM
 - CELL_OFFLOAD_PLAN_DISPLAY
 - NEVER | AUTO | ALWAYS
 - Allows execution plan to show offloaded predicates
 - Dynamically modifiable at session or system level using ALTER SESSION or ALTER SYSTEM



Others Stituations Affecting Smart Scan

- Seeing STORAGE in the execution plan does not guarantee that the query is satisfied using Smart Scan
- Even when Smart Scan is indicated by the execution plan, other block I/O might also :
 - If Exadata Storage Server is not sure that a block is current, it transfers that block read to the buffer cache
 - If chained or migrated rows are detected additional non-Smart Scan block reads may be required
 - I/O for dynamic sampling does not use Smart Scan
 - If Exadata Storage Server CPU utilization is significantly greater than CPU utilization on the database server, smart scan may send additional data to the database server
 - If all the required data already resides in the database buffer cache, the buffer cache copy is used and no disk I/O is performed
 - Smart Scan may de disabled if a statement is affected by a storage server quarantine
- Statistics and wait events can be used to confirm what is happening



Exadata Storage Server Statistics | Overview

```
SQL> select s.name, m.value/1024/1024 mb from v$mystat m, v$sysstat s
  where m.statistic#=s.statistic#
    and (s.name like '%physical IO%' or s.name like '%optimized%'
    or s.name like 'physical%total bytes');
V$SQL
```

NAME	MB
- SQL_Text	
----- PHYSICAL_READ_BYTES -----	
physical read_total_bytes	19.2192383
physical write_total_bytes	0
cell physical_IO_interconnect_bytes	19.5942383
cell physical_IO_BYTES_saved_during_optimized_file_creation	0
cell physical_IO_BYTES_saved_during_optimized_RMAN_file_restore	0
cell physical_IO_CELL_OFFLOAD_RETURNED_BYTES_load	0
cell physical-IOPYIMIZED_BYTES_READREQUEST	0
cell physical_IO_bytes_saved_by_columnar_cache	0
cell physical_IO_bytes_saved_by_storage_index	0
cell physical_V\$SYSSTAT sent directly to DB node to balance CPU	0
cell physical_IO_NAME processed for IM capacity	0
cell physical_IO_VALUE bytes processed for IM query	0
cell physical_IO bytes processed for no memcompress	0
cell physical_IO interconnect bytes returned by smart scan	0
cell physical_write_bytes saved by smart file initialization	0
cell IO_uncompressed_bytes	0
cell physical_write_IO_bytes_eligible_for_offload	0
cell physical_write_IO_host_network_bytes_written_during_offload	0



Exadata Smart Scan statistics sample

```
SQL> select count (*) from erp.orders where CUST_ID > 1;
```

Elapsed: 00:00:02.27

```
SQL> select s.name, m.value/1024/1024 mb from v$mystat m, v$sysstat s
      where m.statistic#=s.statistic#
        and (s.name like '%physical%total bytes' or s.name like '%cell phys%'
          or s.name like 'cell IO%');
```

NAME	MB
physical read total bytes	19.2192383
physical write total bytes	19.5942383
cell physical IO interconnect bytes	150.876445
cell physical IO bytes saved during optimized file creation	0
cell physical IO bytes saved during optimized RMAN file restore	0
cell physical IO bytes eligible for predicate offload	150.876445
cell physical IO bytes eligible for smart IOs	0
cell physical IO bytes saved by columnar cache	0
cell physical IO bytes saved by storage index	0
cell physical IO bytes sent directly to DB node to balance CPU	0
cell physical IO bytes processed for IM capacity	0
cell physical IO bytes processed for IM query	0
cell physical IO bytes processed for no memcompress	0
cell physical IO interconnect bytes returned by smart scan	150.876445
cell physical write bytes saved by smart file initialization	0



Extreme concurrent Transaction | Example

Exadata Wait events | Example

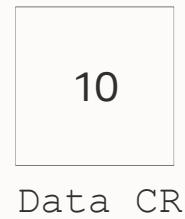
```
SQL> select count (*) from erp.orders where CUST_ID > 1;
```

Elapsed: 00:00:23.00

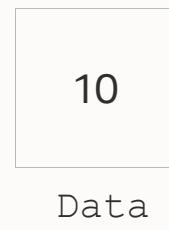
NAME	MB
SQLE> select distinct event, total_waits, time_waited/100 wait_secs, ----- avg_time_waited/100 total_gb_secs from v\$session, v\$event_name, v\$statistic where physical IO interconnect bytes.sid	19.2192383 19.5942383 150.876445
cell physical IO bytes saved during optimized file creation	0
cell physical IO bytes saved during RMAN WAIT SECTION AVG_WAIT_CEC\$	0
--cell-physical-IO-bytes-eligible-for-predicate-offload-----	150.876445
Cell list physical IOs by physical eligible for smart IOs 1	.00000
Cell single block physical read by columnar 1349704	683.94
Cell single physical IO bytes saved by storage index 191	3.29
cell physical IO bytes sent directly to DB node to balance CPU	0
cell physical IO bytes processed for IM capacity	0
cell physical IO bytes processed for IM query	0
cell physical IO bytes processed for no memcompress	0
cell physical IO interconnect bytes returned by smart scan	150.876445
cell physical write bytes saved by smart file initialization	0



Session 1
Update 10 -> 20
Select 20

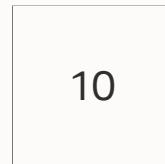


Session S2
Select 10 (CR)



Database Node (buffer cache)

Storage Cell



I/O Sent Directly to database Server to balance CPU usage sample

```
SQL> select count (*) from erp.orders where CUST_ID > 1;

SQL> select s.name, m.value/1024/1024 mb from v$mystat m, v$sysstat s
      where m.statistic#=s.statistic#
        and (s.name like '%physical%total bytes' or s.name like '%cell phys%'
        or s.name like 'cell IO%');

NAME                                     MB
-----
physical read total bytes              19.2192383
physical write total bytes             19.5942383
cell physical IO interconnect bytes    0
cell physical IO bytes saved during optimized file creation 0
cell physical IO bytes saved during optimized RMAN file restore 0
cell physical IO bytes eligible for predicate offload 0
cell physical IO bytes eligible for smart IOs 0
cell physical IO bytes saved by columnar cache 0
cell physical IO bytes saved by storage index 0
cell physical IO bytes sent directly to DB node to balance CPU 2396.9877
cell physical IO bytes processed for IM capacity 0
cell physical IO bytes processed for IM query 0
cell physical IO bytes processed for no memcompress 0
cell physical IO interconnect bytes returned by smart scan 0
cell physical write bytes saved by smart file initialization 0
cell IO uncompressed bytes 0
cell physical write IO bytes eligible for offload 0
cell physical write IO host network bytes written during offload 0
```



Exadata Storage Server Wait events | Overview

Connected to:

Oracle Database 19c EE Extreme Perf Release 19.0.0.0.0 -
Production
Version 19.19.0.0.0

```
SQL> select distinct event, total_waits, time_waited/100 wait_secs,  
average_wait/100 avg_wait_secs  
from V$session_event e, v$mystat s  
where event like 'cell%' and e.sid = s.sid
```

WAIT EVENT	DESCRIPTION
cell interconnect retransmit during physical read	Database wait during retransmission for an I/O of a single-block
cell list of block physical read	Cell equivalent of db file parallel read
cell single block physical read	Cell equivalent of db file sequential read
cell multiblock physical read	Cell equivalent of scattered read
cell smart table scan	Database wait for table scan to complete
cell smart index scan	Database Wait for index or IOT full scan
cell smart file creation	Database wait for file creation operation
cell smart incremental backup	Database wait for incremental backup operation
cell smart restore from backup	Database wait during file initialization for restore



Troubleshooting Smart Scan operations

Connected to:

Oracle Database 19c EE Extreme Perf Release 19.0.0.0.0 - Production
Version 19.19.0.0.0

```
SQL> alter session set tracefile_identifier='10046';  
  
SQL> alter session set timed_statistics = true;  
  
SQL> alter session set statistics_level=all;  
  
SQL> alter session set max_dump_file_size = unlimited;  
  
SQL> alter session set events '10046 trace name context forever,level 12';
```

Run the sql query that is giving low performance.==> we need trace file to be uploaded.

```
SQL> alter session set up_cell_offload_processing=false;
```

Run the sql query that is giving low performance.==> we need trace file to be uploaded.



- **Exadata Smart Scan FAQ (Doc ID 1927934.1)**

APPLIES TO:

Exadata Database Machine V2 - Version All Versions to All Versions [Release All Releases]
Information in this document applies to any platform.

PURPOSE

This document addresses the frequently asked questions related to Exadata Smart Scan.

QUESTIONS AND ANSWERS

What is Smart Scan ?

The data search and retrieval processing can be offloaded to the Exadata Storage Servers. This feature is called Smart Scan. Using this Smart Scan, Oracle Database can optimize the performance of operations that perform table and index scans by performing the scans inside Exadata Storage Server, rather than transporting all the data to the database server.

Smart Scan capabilities includes :-

- 1) Predicate Filtering
- 2) Column filtering
- 3) Join Processing



- **Queries Generating High "Cell Single Block Physical Read" Wait Messages** ([Doc ID 2119510.1](#))

APPLIES TO:

Oracle Database Backup Service - Version N/A and later
Oracle Database - Enterprise Edition - Version 11.2.0.4 and later
Oracle Database Cloud Schema Service - Version N/A and later
Gen 1 Exadata Cloud at Customer (Oracle Exadata Database Cloud Machine) - Version N/A and later
Oracle Cloud Infrastructure - Database Service - Version N/A and later
Information in this document applies to any platform.

SYMPTOMS

Symptoms of this issue will appear as follows:

- Trace file entries that look similar to the following:

```
WAIT #5: nam='cell single block physical read' ela= 672 cellhash#=2520626383 diskhash#=1377492511 bytes=16384 obj#=63
tim=1280416903276618
```

- The "Top 10 Foreground Events by Total Wait Time" section of the AWR report shows an exceedingly high number of waits but few to no average wait time. For example:

Event	Waits	Total Wait Time (sec)	Wait Avg(ms)	% DB time	Wait Class
cell single block physical read	19,654,319	4847,1	0	9.7	User I/O

- All or most of the events in the "Top SQL with Top Events" section of the ASH report are INDEX - STORAGE FAST FULL SCAN.



- **Support Policy for Generic SQL Performance Issues** (Doc ID 1198303.1)

DETAILS

The following document outlines the policies that Oracle Support follows in order to provide the best Support experience and the shortest resolution time. Support will always strive to assist you in your efforts to make queries perform at their best and this document outlines what we can and cannot do to achieve this.

ACTIONS

Oracle Support Diagnoses Issues Relating to a Query's Performance

One of Oracle Support's roles is to assist its customers in the identification and resolution of SQL Performance Issues.

This is a complete cycle of activity within which, diagnosis is a key component.

Oracle Support can help with this diagnosis.

- If the diagnosis identifies RDBMS defects then Oracle Support will make efforts to provide workarounds and patches according to standing Oracle Support Policies.
- Additionally, Tuning the Query is a potential Solution to many SQL Performance issues.
If the diagnosis indicates that the query needs manual tuning it will be the customer's responsibility to take the appropriate steps to do the tuning. Manual tuning includes setting hints, using SQL Profiles generated by the SQL Tuning Advisor (if the license has been purchased), creating proper indexes or using other database features to improve the query.

Oracle Support does not provide a Query Tuning Service

Oracle Support does not provide an alternative to one of the advanced services that Oracle Support has available to execute a complete performance analysis on your system or to help you to tune your query.

See 'Limitations of Support under support policies tab' section in:



Exadata Cloud Patching

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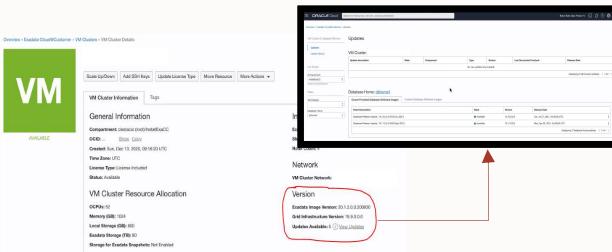
Exadata Cloud at Customer Pathing Overviwew

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.

Quarter 1

- JANUARY
- FEBRUARY
- MARCH

Quarter 2

- APRIL
- MAY
- JUNE

Quarter 3

- JULY
- AUGUST
- SEPTEMBER

Quarter 4

- OCTOBER
- NOVEMBER
- DECEMBER

Exadata Cloud Patching Tooling

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Lear how to keep your dbaascli up to date [Doc ID 2350471.1](#)

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

In this Document

[Goal](#)

[Solution](#)

[Steps to Upgrade the Cloud Tooling using dbaascli](#)

[References](#)

APPLIES TO:

Oracle Database Cloud Service - Version N/A to N/A [Release 1.0]

Information in this document applies to any platform.

GOAL

This document covers the steps to upgrade dbaas cloud tooling using dbaascli

SOLUTION

Cloud tooling include the fixes for existing issues and new features so it is highly recommended to upgrade the cloud tooling once new version or release is available. Steps given below help to upgrade it to the higher version.

Note: When updating the cloud tooling on database deployments hosting a Data Guard configuration, you must perform the following steps on both nodes; that is, on the one hosting the primary database and on the one hosting the standby database.

Steps to Upgrade the Cloud Tooling using dbaascli

1. Connect as the opc user to the compute node. Check [Connecting to a Compute Node Through Secure Shell \(SSH\)](#)
2. Start a root user command shell

```
sudo -s
```

```
#
```



Exadata Patching Oracle Home

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Appling Oracle Home bundle Patch in or Out-Of-Place [MOS Note 2701789.1](#)

★ How to Apply Database Quarterly Patch on Exadata Cloud Service and Exadata Cloud at Customer Gen 2 (Doc ID 2701789.1)

In this Document

[Goal](#)

[Solution](#)

[Prerequisites](#)

[Option 1 - Patching Individual Databases - Out of Place Patching](#)

[Option 2 - Patching a Database Home - Image Based Patching](#)

[Troubleshooting](#)

[References](#)

APPLIES TO:

Oracle Database Cloud Exadata Service - Version N/A to N/A [Release 1.0]

Information in this document applies to any platform.

GOAL

Patch an Exadata Cloud Services or Exadata Cloud at Customer Gen 2 Database

SOLUTION

This document should be used to apply a higher quarterly Release Update to the databases and database homes of either an Exadata Cloud@Customer Gen 2 (ExaC@C) service or Exadata Cloud Service (ExaCS) service.

For Data Guard configurations, the primary and standby database must be patched separately and the standby database patching should be completed before patching the primary.

See Document [1265700.1 Oracle Patch Assurance - Data Guard Standby-First Patch Apply](#) for full details on standby first patching.

It is supported to run with the standby database at a higher patch level for up to a month.



Patchin Oracle Home using OCI Console

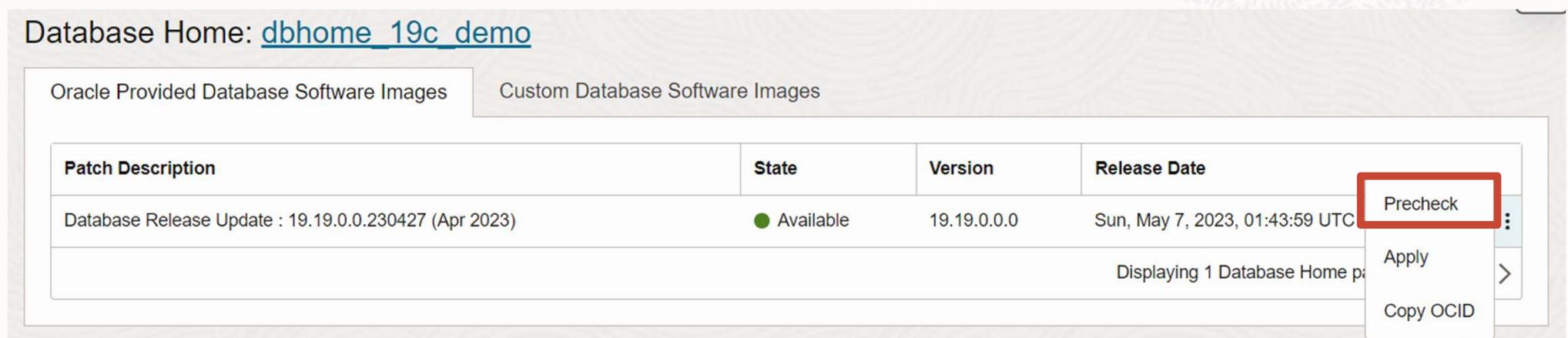
Database Home: dbhome_19c_demo

Oracle Provided Database Software Images Custom Database Software Images

Patch Description	State	Version	Release Date
Database Release Update : 19.19.0.0.230427 (Apr 2023)	● Available	19.19.0.0.0	Sun, May 7, 2023, 01:43:59 UTC

Displaying 1 Database Home patch

Precheck Apply > Copy OCID



Confirm precheck

Are you sure you want to perform a precheck operation on the Database Home?

[Run Precheck](#)

[Cancel](#)



Patching Oracle Home Using OCI Console

The image displays two screenshots of the OCI Console interface, illustrating the process of patching Oracle Home using the OCI Console.

Screenshot 1 (Top): Precheck DbHome Patch - IN PROGRESS

This screenshot shows a work request in progress. The status bar on the left indicates "IN PROGRESS". The main panel title is "Precheck DbHome Patch". It includes a "Work request information" section and a progress bar for the "Precheck DbHome Patch" operation. The progress bar is 15% complete and labeled "In progress".

Details:

- Operation:** Precheck DbHome Patch
- Accepted:** Mon, Jul 10, 2023, 20:06:12 UTC
- Started:** Mon, Jul 10, 2023, 20:06:34 UTC
- OCID:** ...qkztaa [Show](#) [Copy](#)

Screenshot 2 (Bottom): Precheck DbHome Patch - SUCCEEDED

This screenshot shows the same work request after it has completed successfully. The status bar on the left indicates "SUCCEEDED". The main panel title is "Precheck DbHome Patch". The progress bar is now 100% complete and labeled "Succeeded".

Details:

- Operation:** Precheck DbHome Patch
- Accepted:** Mon, Jul 10, 2023, 20:06:12 UTC
- Started:** Mon, Jul 10, 2023, 20:06:34 UTC
- Finished:** Mon, Jul 10, 2023, 20:13:12 UTC
- Compartments:** (Progress bar shown)
- OCID:** ...qkztaa [Show](#) [Copy](#)



Patching Oracle Home Using OCI Console

Database Home: [dbhome_19c_demo](#)

The screenshot shows the OCI Console interface for managing database software images. At the top, there are tabs for "Oracle Provided Database Software Images" and "Custom Database Software Images". Below the tabs, a table displays a single patch entry:

Patch Description	State	Version	Release Date
Database Release Update : 19.19.0.0.230427 (Apr 2023)	Available	19.19.0.0.0	Sun, May 7, 2023, 01:43:59 UTC

On the right side of the table, a context menu is open with options: "Precheck", "Apply" (which is highlighted with a red box), and "Copy OCID". A tooltip at the bottom of the menu indicates "Displaying 1 Database Home".

Apply Database Home Patch

This operation patches the Database Home on the nodes of the VM cluster, one node at a time.

The instances for following databases may be restarted on the nodes as they get patched:
Demo19c

Are you sure you want to patch this Database Home?



Last successful precheck was run at Sun, Jul 23, 2023, 16:31:49 UTC.

[Apply Patch](#)

[Cancel](#)



Exadata Patching Grid Home

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Patching Grid Home using dbaascli : [Click here](#)

Patching Oracle Grid Infrastructure and Oracle Databases Using dbaascli

Learn to use the `dbaascli` utility to perform patching operations for Oracle Grid Infrastructure and Oracle Database on an Exadata Cloud Infrastructure system.

- [Patching Databases using dbaascli](#)

Using `dbaascli`, you can choose to patch a database by patching Oracle home, or by moving the database to an Oracle home with the desired patch level.

- [Patching Oracle Grid Infrastructure](#)

To apply a patch to Oracle Grid Infrastructure, use the `grid patch` command.

- [Listing Available Software Images and Versions for Database and Grid Infrastructure](#)

To produce a list of available supported versions for patching, use the `dbaascli cswlib showImages` command.

- [Performing a Precheck Before Patching Databases and Grid Infrastructure](#)

You can perform a prerequisites-checking operation (also called a "precheck") for the commands in this topic using the applicable precheck flag.



Pathing Grid Home using Patching DomU

VM Cluster: [REDACTED]						
Update description	State	Component	Type	Version	Last Successful Precheck	Release Date
Grid Infrastructure Release Update : 19.19.0.0.230427 (Apr 2023)	Available	Grid Infrastructure	Patch	19.19.0.0.0	-	<div style="border: 2px solid red; padding: 2px;">Precheck</div> Apply Grid Infrastructure Patch Copy OCID

Confirm precheck

Are you sure you want to perform a precheck operation on VM cluster?

[Run Precheck](#)

[Cancel](#)



Oracle Home Prechk via OCIU Console

The screenshot shows two work requests in the OCIU console:

- Work Request 1 (Top):** Status: In progress. Task: Precheck VM Cluster GI Patch. Progress: 0% complete.
- Work Request 2 (Bottom):** Status: Succeeded. Task: Precheck VM Cluster GI Patch. Progress: 100% complete. Details:
 - Operation:** Precheck VM Cluster GI Patch
 - OCID:** ...2ldqya [Show](#) [Copy](#)
 - Compartment:** [REDACTED]
 - Accepted:** Sun, Jul 23, 2023, 17:03:58 UTC
 - Started:** Sun, Jul 23, 2023, 17:04:15 UTC
 - Finished:** Sun, Jul 23, 2023, 17:08:40 UTC



Pathing Grid Home using OCI Console

VM Cluster: [REDACTED]

Update description	State	Component	Type	Version	Last Successful Precheck	Release Date	
Grid Infrastructure Release Update : 19.19.0.0.230427 (Apr 2023)	● Available	Grid Infrastructure	Patch	19.19.0.0.0	Sun, Jul 23, 2023, 17:15:39	Precheck	More
Grid Infrastructure Release Update : 19.18.0.0.230117 (Jan 2023)	● Available	Grid Infrastructure	Patch	19.18.0.0.0	-	Apply Grid Infrastructure Patch	Copy OCID More

Apply VM Cluster Patch

During patching, lifecycle operations on the VM cluster and its resources are temporarily unavailable.

Are you sure you want to patch VM cluster [REDACTED] running version 19.10.0.0.0 with version 19.19.0.0.0?



Last successful precheck was run at Sun, Jul 23, 2023, 17:10:49 UTC.

[Apply Patch](#)

[Cancel](#)



Patching Linux Image

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Updating Exadata Database Server Software using the patchmgr [Doc ID 1553103.1](#)

The screenshot shows the Oracle Patch Search interface. At the top, there is a navigation bar with links: Knowledge, RCA, Customer Exceptions, CMS, Service Requests, Patches & Updates (which is highlighted in blue), Certifications, Systems, Collector, Settings, and XNS. Below the navigation bar, a search bar contains the text "Patch: 21634633 >". The main content area is titled "Patch Simple Search Results" and shows a single patch entry for "Patch 21634633: DBSERVER.PATCH.ZIP ORCHESTRATOR PLUS DBNU - ARU PLACEHOLDER". The patch details include:

Patch Name	Description
21634633	DBSERVER.PATCH.ZIP DBNU - ARU PLACEHOLDER

Information about the patch:

- Last Updated: 16-Jun-2023 07:30 (1+ month ago)
- Product: Oracle Exadata Storage Server Software ([More...](#))
- Release: Oracle Exadata Storage Server 23.1.3.0.0
- Platform: Linux x86-64
- Size: 536.4 MB
- Download Access: Software
- Classification: General
- Patch Tag:

Bugs Resolved by This Patch:

List of bugs fixed is not available. Consult the Readme.

View Related Knowledge to this Patch

On the right side of the patch details, there is a summary box with the following information:

Release: Oracle Exadata Storage Server 23.1.3.0.0
Platform: Linux x86-64
Language: American English

Buttons for "Read Me", "Download", "Add to Plan", and "Analyze with OPatch..." are available. Below the summary box, it says "All-time Downloads 366" and "View Trends". A link "Discuss this patch in the community" is also present.

Step – 1 Download the most recent *patchmgr* version



Exadata Cloud Service Software Versions [MOS Note: 2333222.1](#)

DETAILS

Current Software Versions for Exadata Cloud Deployments

The versions in the table below represent the latest certified and available VM software for updating Exadata and Grid Infrastructure/Database software on systems already provisioned. Customers may update systems already provisioned to the latest certified version as desired. Certified versions for new provisioning revise less frequently, hence **systems newly provisioned may deploy with an earlier certified release** than what is shown in the table.

Note: Date code fields in version numbers (e.g. 180717) are in YYMMDD format.

Cloud Platform	Latest Certified Exadata Version	Latest Certified GI/DB Version
Exadata Database Service on Dedicated Infrastructure	22.1.11.0.0.230516	19.19.0.0.230418 18.22.0.0.230418 12.2.0.1.230418 12.1.0.2.230418 11.2.0.4.230418
Exadata Database Service on Cloud@Customer ¹	22.1.11.0.0.230516	19.19.0.0.230418 18.22.0.0.230418 12.2.0.1.230418 12.1.0.2.230418 11.2.0.4.230418
Gen 1 Exadata Cloud at Customer ¹ (Oracle Exadata Database Cloud Machine)	22.1.11.0.0.230516	19.19.0.0.230418 ² 18.22.0.0.230418 12.2.0.1.230418 12.1.0.2.230418 11.2.0.4.230418

Step 2 – Download the Image /iso version you chose for the upgrade



How to update the Exadata Image (OS) Linux [Doc ID 2391164.1](#)

[How to update the Exadata Image \(OS\) in Exadata Cloud at Customer \(Doc ID 2391164.1\)](#)

In this Document

[Goal](#)

[Solution](#)

[Gather Requirements](#)

[Decide and Configure the Driving System](#)

[Prechecking the Environments](#)

[Backing Up the OS](#)

[Patching the OS](#)

[Rolling back the Update](#)

[References](#)

APPLIES TO:

Oracle Exadata Storage Server Software - Version 12.1.2.3.4 and later

Oracle Database Exadata Cloud Machine - Version N/A and later

Information in this document applies to any **platform**.

GOAL

The goal of this document is to guide a user of the Exadata Cloud at Customer in the patching of the Exadata Image (OS)

SOLUTION

Exadata Cloud:

Updating the Database Compute Nodes

Introduction

Updating the Exadata Database Compute nodes is a process that entails patching the entire OS rather than just updating single packages. Updating the OS does not use a traditional "yum update" command but uses a cli tool called patchmgr. Through patchmgr, you can update the Exadata Database Compute nodes with an ISO image staged locally on the database compute node or on a separate infrastructure instance.

Update Steps

The following steps will go through updating the Exadata Database Compute nodes from 12.x.x.x to 18.1.4.

Step 3 - Follow the steps described on this MOS note



Patching DomU Linux Image via OCI Console

VM Cluster Details

General Information

VM Cluster Resource Allocation

Updates

VM Cluster Network

Version

Exadata Image Version: 20.12.0.0.200930
Grid Infrastructure Version: 19.9.0.0.0
Updates Available: 5 [View Updates](#)

Updates in atpmgmt (root) Compartment

VM Cluster: scaqr01adm0304-clu7

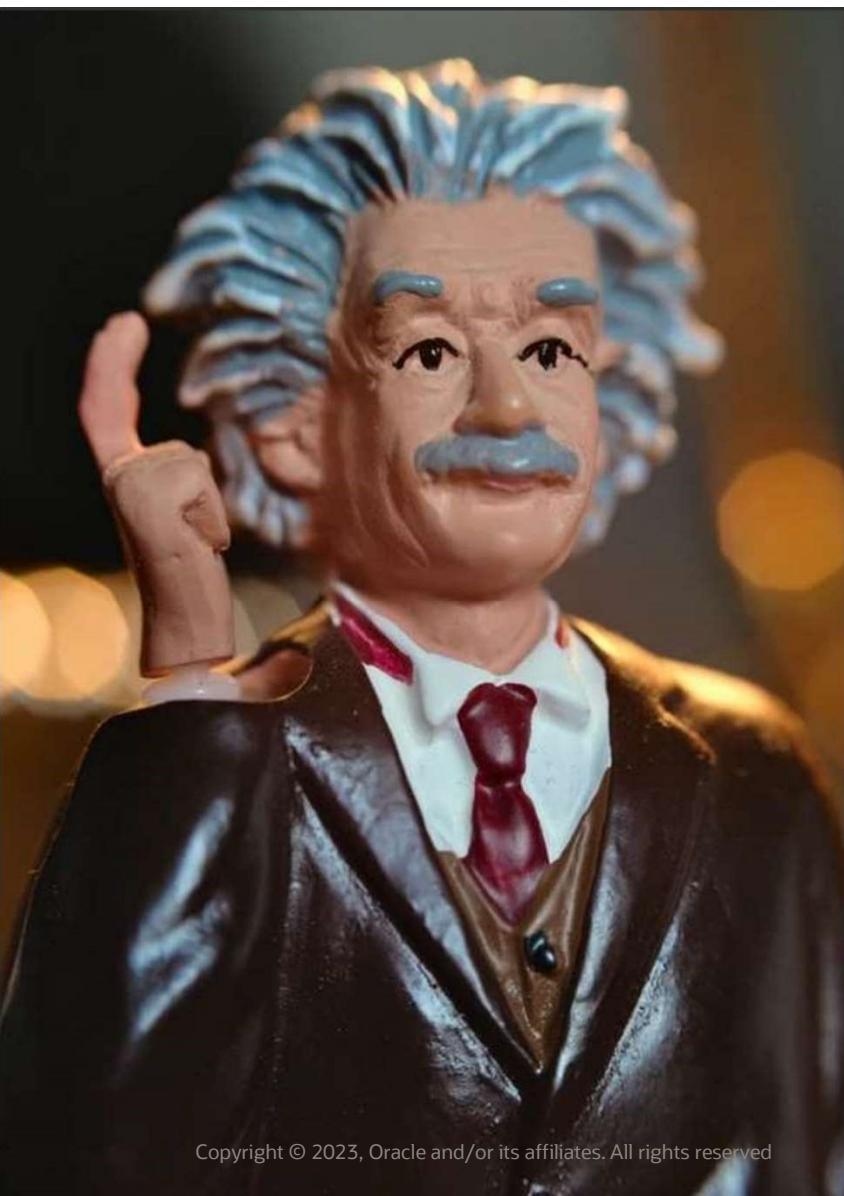
Update description	State	Component	Type	Version	Last Successful Precheck	Release Date
Virtual Machine OS Update to 21.2.0.0.0.210524	Available	Exadata Image	Update	21.2.0.0.0.210524	-	Tue, Jul 27, 2021, 14:30:00 UTC

Precheck

Apply Exadata OS Image Update

Copy OCID





Demo 1 – Optimizer Smart Scan (No Exadata)

- Configuring parameter CELL_OFFLOAD_PLAN_DISPLAY
- Explain plan query report
- Changing index visibility
- Explain plan report part 2

Demo 2 – Monitoring Smart Scan

- Execution no Smart Select using hint
- Getting Dictionary Statistics
- Executing query with no hint
- Compare both results



Resources

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Exadata Cloud Oracle on Architecture Center



The screenshot shows the Oracle Architecture Center homepage. At the top, there is a navigation bar with a magnifying glass icon, the text "Architecture Center", and a search input field containing "exadata cloud at customer". A red box highlights the search input field. Below the navigation bar, the page title is "Oracle Architecture Center" with a subtitle: "Design, develop, and implement your cloud, hybrid, and on-premises workloads with guidance from Oracle architects, developers, and other experts versed in Oracle technologies and solutions." A "Contact a Cloud Expert" button is visible. The main content area features a large image of a colorful abstract painting. Below the image, there is a section titled "Try our free hands-on labs and tutorials" with a "Learn more" button. To the right, there is a sidebar with a "Reference Architecture" section and a "Deploy a containerized Jenkins CI/CD pipeline by using Terraform on Oracle Cloud Infrastructure" section, both with "Automation Available" buttons.

[Click here](#)

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SCAN ME

Exadata Cloud on Oracle **Live Labs**

Oracle Autonomous Database Dedicated for Fleet Administrators



As fleet administrator, set up your dedicated ADB platform in the OCI and on Exadata Cloud@Customer.

⌚ 7 hrs

5463 Views

Oracle Exadata Platform Performance Features



Get hands-on with Oracle Exadata, Exadata Database Service on Cloud@Customer, and Exadata Database (..)

⌚ 1 hr, 20 mins

717 Views

Get Started with Oracle Exadata Database Service on Cloud@Customer



Explore getting started with Oracle Exadata Database Service on Cloud@Customer.

⌚ 1 hr

[Click Here](#)





Time to test your skill!
Are you ready?



SCAN ME

Exadata Cloud at Customer on Up to Dezember, 2023

The screenshot shows a video player interface for a course titled "Oracle Base Database Services Professional Workshop". The video is titled "Mission-critical cloud database capabilities where you need them" and is currently at 28:56 / 30:20. The video content discusses "Exceptional Performance, Availability, and Security" with bullet points: Superior architecture with unique software optimizations, Full-stack redundancy and integrated disaster recovery, and Defense in-depth security.

Course: Oracle Base Database Services Professional Workshop

Mission-critical cloud database capabilities where you need them

1

Exceptional Performance, Availability, and Security

- Superior architecture with unique software optimizations
- Full-stack redundancy and integrated disaster recovery
- Defense in-depth security

Database Services
Oracle Base Database Services Professional (2023)

Data Architect

The screenshot shows the course playlist for "Oracle Base Database Services Professional (2023)". The course duration is 7h 41m. The playlist includes the following items:

- Exadata Database Service Overview (30m) - marked as completed
- Exadata: Network, Infrastructure, VM Cluster Overview (28m)
- Exadata Infrastructure and VM Cluster Management (28m)
- Database Lifecycle Management (New 38m)
- Management Tools (New 21m)

Playlist **Student Guides** **About**

Course 7h 41m

SEARCH SKILL CHECKS AUTOPLAY

2 : Exadata Database Service

- Exadata Database Service Overview 30m
- Exadata: Network, Infrastructure, VM Cluster Overview 28m
- Exadata Infrastructure and VM Cluster Management 28m
- Database Lifecycle Management New 38m
- Management Tools New 21m





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Thank You ☺

Questions / Feedback / Training Suggestions

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Ask for help ☺

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ORACLE

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