Oracle Database Exadata Cloud Service: Technical Deep Dive

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Oracle Database Exadata Cloud, Your Way
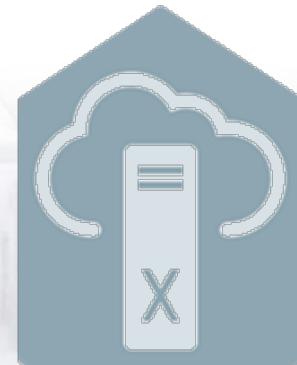
Private Cloud	Cloud at Customer	Public Cloud
Exadata Database Machine	**Exadata Cloud Machine**	**Exadata Cloud Service**
Customer Data Center	Customer Data Center	**Oracle Cloud**
Purchased	**Subscription**	**Subscription**
Customer Managed	**Oracle Managed**	**Oracle Managed**

Exadata Cloud Service Overview

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Oracle Database **Exadata Cloud Service**

The only cloud platform engineered to run the Oracle Database

- **Full Oracle Database with all advanced options**
  - **Oracle Cloud Exclusive** options like RAC and Active Data Guard

- **On fastest and most available database cloud platform**
  - **Highly available** and redundant hardware for maximum uptime
  - **Complete Isolation** of tenants with no overprovisioning

- **All Benefits of Public Cloud**
  - **Fast, Elastic, Web Driven** Provisioning
  - **Oracle Experts Deploy and Manage** Infrastructure
  - **No Capex** Monthly Subscription
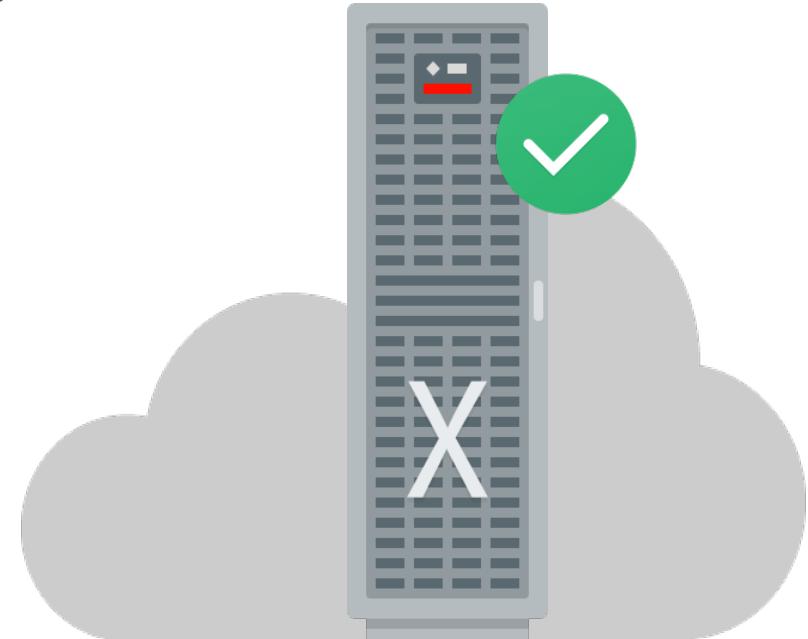
Oracle Database **Exadata Cloud Service** Overview

- Customer requests Exadata Service on Oracle Cloud Portal
  - Provides system size; Database names, sizes, versions, etc.

- Start with a minimal number of cores within a Quarter Rack Shape
  - Minimum: 22 cores, enable additional cores on demand
  - Access to all storage, 900K IOPs
  - Can expand to 100s of Cores, 100s of TB storage, Millions of IOPs

- Exadata System automatically provisioned for customer
  - Assured hardware resources: no server or storage over-provisioning

- Databases requested by customer prebuilt and ready to run
 - Oracle Database 11.2.0.4, 12.1.0.2 and 12.2.0.1 available

| Quarter Rack Shape X6-2	
OCPUs (min-max) [1]	22 - 84
Total Memory	1.5 TB
Compute Nodes	2
PCIe Flash	38.4 TB
Max DB size[2]	34.2/68.3 TB

1. OCPU = Oracle CPU = 1 usable compute core
2. After provisioning DATA and RECO disk groups, actual space depends on space needed for local backups

Exadata Cloud: Compatible – Scalable – Available – Secure

Decades of Database Innovation Proven at Millions of Mission-Critical Deployments
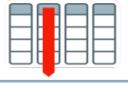
	Multitenant
	In-Memory DB
	Real Application Clusters
	Active Data Guard
	Partitioning
	Advanced Compression
	Advanced Security, Label Security, DB Vault
	Real Application Testing
	Advanced Analytics, Spatial and Graph
	Management Packs for Oracle Database
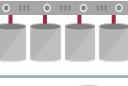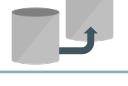
All Oracle Database Innovations

All Exadata DB Machine Innovations
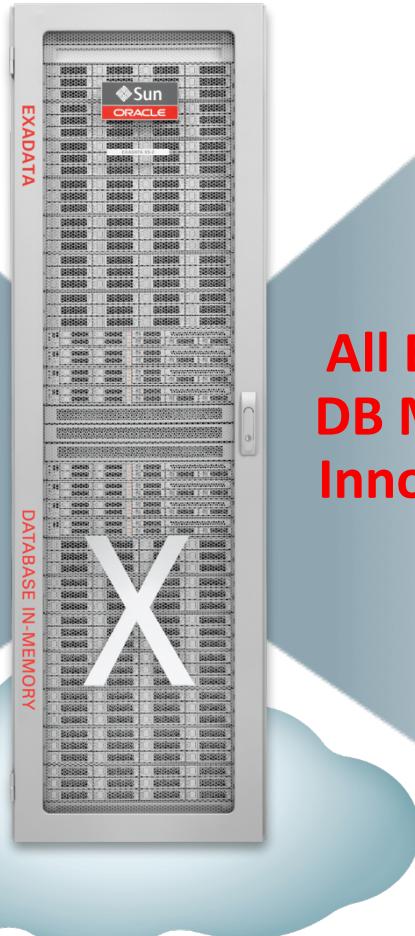
Offload SQL to Storage	
InfiniBand Fabric	
Smart Flash Cache, Log	PCI Flash
Storage Indexes	
Columnar Flash Cache	
Hybrid Columnar Compression	
I/O Resource Management	
Network Resource Management	
In-Memory Fault Tolerance	
Exafusion Direct-to-Wire Protocol	
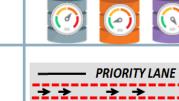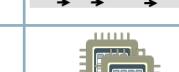
Management & Maintenance

- Oracle manages underlying infrastructure

  – Facilities

  – Servers

  – Storage hardware

  – storage software

  – Networking

  – Firmware

  – Hypervisor, etc.

- Customers control and manage software that directly affects their databases

  – Database

  – OS

  – Clusterware

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Infrastructure

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Management & Maintenance

- Exadata Cloud Enables High Availability and Disaster Recovery
    - Exadata Storage is triple mirrored
    - Bonded Network Connections
    - Backup Power Distribution Units
    - Instances RAC enabled for server HA
    - Deployed in Regions within multiple Availability Domains for isolation and fast replication
    - Provides Disaster Recovery across multiple regions (geographically separated)
- Exadata Hardware Enables Zero Downtime Patching
    - RAC Enabled Databases
    - Rolling Patching of Storage Cells

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Infrastructure

Options for Migrating Databases to Cloud

- 100% Oracle Database compatibility makes migration easy and low risk

- Logical Migration: allows reorganization and optimization
  - Data Pump, GoldenGate Replication

- Physical Migration: simplest, byte-to-byte copy
  - RMAN backup, Transportable technologies, Data Guard
  - Restore from backup on Oracle Public Cloud

- Data Movement Options:
  - Use public internet
  - Private high bandwidth virtual network (FastConnect)
  - Data Transfer Services

- MAA Migration Best Practices "Best Practices for Migrating to Exadata Database Machine"
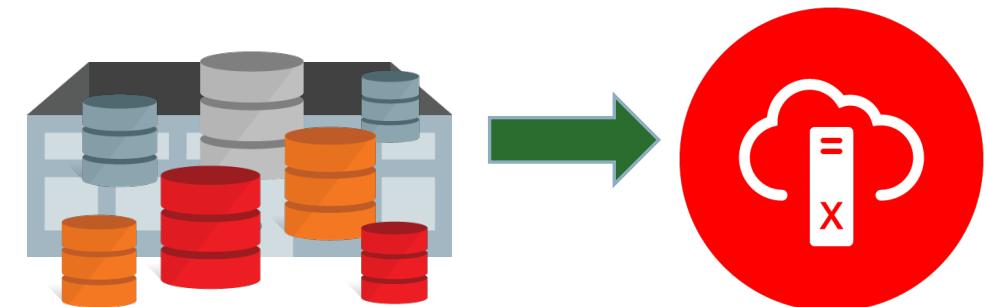
Options for Migrating Databases to Cloud

- SQL*Loader
- Import/export (5+)
- Oracle Data Pump Export/Import Utility (10.2+)
- Transportable Tablespaces (8i+)
- GoldenGate Cloud Service
- Data Guard
- Pluggable Databases (PDBs) (12c)
  - Remote Cloning
  - Lift and Shift
- APEX/SQL Developer Data Loaders
- External Tables

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Access and Security

- Identity and Access Management Service with security rules

- Secure Access through Virtual Cloud Network (VCN)
  - Dynamic Routing Gateway for secure connection to customer's private network
  - Internet Gateway for access from/to public Internet
  - Private subnets with VPN, public and private subnets
- Secure InfiniBand partition/tenant for complete isolation within Exadata storage fabric
- Database Tablespaces and SQL*Net encrypted by default
- Strict security list config upon creation – customer open ports and sets access rules
- 2 separate Networks via separate bonded interfaces on Exadata
  - Client Network   – Application Connectivity via client subnet
  - Backup Network – Separate sub network for DB backup traffic

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Exadata Cloud Tooling Makes it Easy

- Tooling enables the following from the Cloud Portal or REST API
  - Database and Grid Patching
  - One Click Backup and Recovery
  - Automatic Data Guard Setup
  - Database and PDB Lifecycle Management
  - Sparse Cloning
  - IO Resource Management
  - CPU Bursting
  - DB Compute Node Control
  - RAC Node Subsetting
  - Create Database from a Backup

Patching

Available Patches

PSU Update 12.1.0.2.170418   **Release Date:** Apr 18, 2017 1:40:00 AM UTC

Readme   **Affected Component:** Exadata Database

✅ Precheck results   **Requires Restart:** Yes

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REST Based Interfaces

- All Database Cloud provisioning and lifecycle operations are exposed through Web Interfaces and RESTful APIs

  - Activate/Deactivate Service

  - Grow compute or storage

  - Manage Virtual Network and Security Lists

  - Manage access keys

  - Start/Stop Compute

  - Create Database (RAC, Active Dataguard, PDB)

  - Patch Database

  - Clone Database

  - Configure IO Resource Management

  - Backup and Recovery

- Allows integration with customer's existing automation infrastructure

  - Service Now, Open Stack, Cloud Foundry

Patch Database

```
curl –i –X PUT –u serviceadmin:Password –H "X–ID–TENANT–NAME:usexample" –H "Content-Type:application/json" –d '{ "additionalNote" : "Patch applied

using REST API" }' https://dbaas.oraclecloud.com/paas/api/v1.1/instancemgmt/usexample/services/dbaas/instances/db12c/patches/24968615
```

Delete Database

```
curl –i –X DELETE –u serviceadmin:Password –H "X–ID–TENANT–NAME:usexample"

https://dbaas.oraclecloud.com/paas/service/dbcs/api/v1.1/instances/usexample/db12c
```

Create Snapshot Master

```
curl –i –X POST–u serviceadmin:Password –H "X–ID–TENANT–NAME:usexample" –H "Content-Type:application/json" –d '{ "description" : "Snapshot Master

created using REST API" , "name" : "SnapMstr12c" , "sid" : "SM12C" , "adminPassword" : "Pa55_word" }'

https://dbaas.oraclecloud.com/paas/api/v1.1/instancemgmt/usexample/services/dbaas/instances/db12c/snapshots
```

Exadata Cloud Service Networking

- State-of-the-art network

  – provides predictable and consistent throughput

  – High bandwidth, micro-second latency network with very low latency and jitter.

- End-to-End Security

  – Packet encapsulation, In-Flight encryption

  – IPSec VPN connectivity

- FastConnect – dedicated, private and high bandwidth connection to the Oracle cloud

- Multiple Availability Domains per Region

- Customizable Virtual Cloud Networks

  – Fully configurable IP addresses, subnets, routing

  – Firewalls to set security access rules

  – Supports new or existing private networks.

Exadata Cloud Service Networking Topology
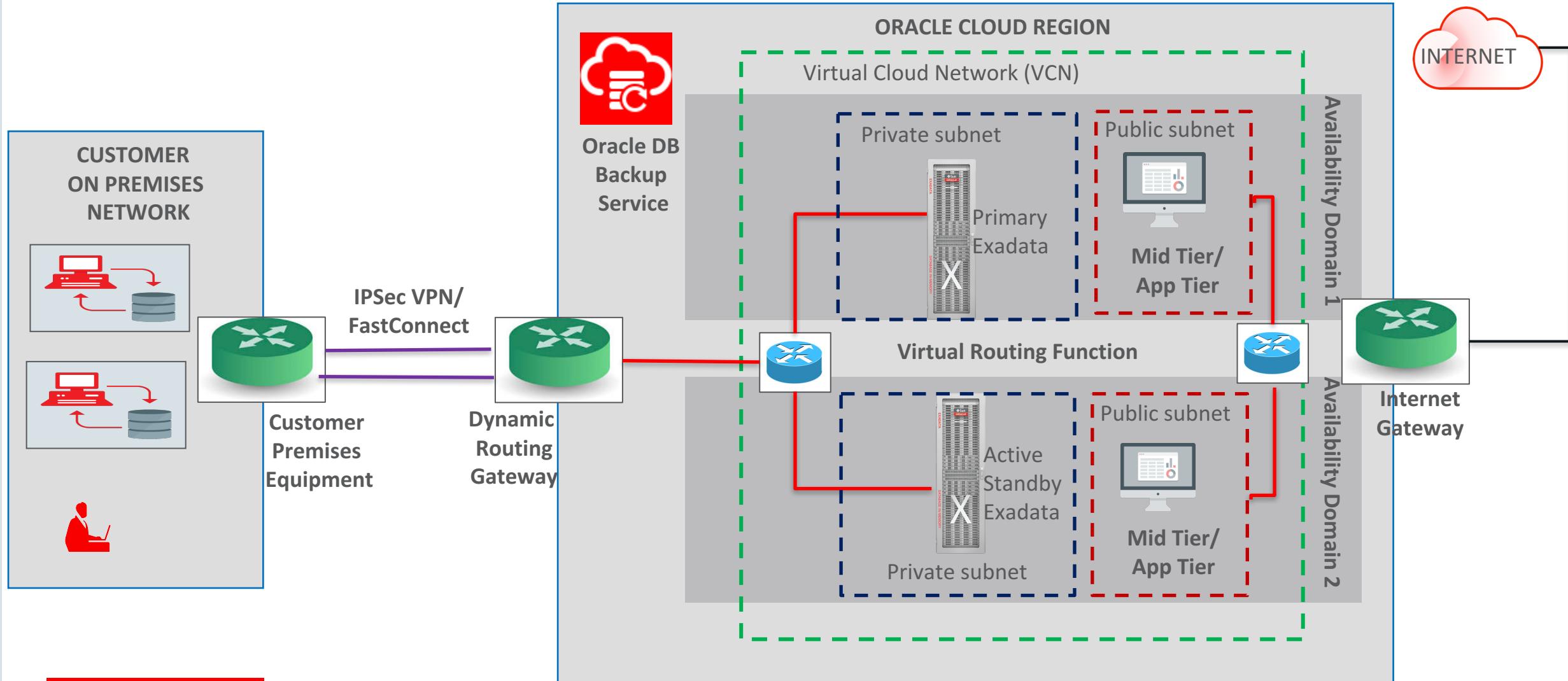
Exadata Cloud Service – Features Coming soon

- Shared Oracle Home
  - Ability to create a database using an existing Oracle Home
  - Single Oracle Home Patching across multiple databases
  - Out of place patching for independent patching of databases on Oracle Homes
- Multi-VM
  - Create up to 8 VMs on your Exadata Cloud Instance isolating workloads/tenants
  - VM clusters can be part of separate virtual networks
- Elastic Compute and Storage
  - Expand storage cells, DB Compute nodes or both

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Exadata Cloud Service – Features Coming soon

- Hybrid Disaster Recovery (DR) configuration for Exadata Instances
  - Automated provisioning of "standby in the cloud" across regions
- Fleet Patching for Database and Grid Infrastructure
  - Out of Place Patching
  - Patching of multiple DB and GI deployments
- Autonomous Database Cloud Service

Oracle Autonomous Cloud Service Overview

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Oracle Autonomous Database Cloud Service

- Exadata Cloud Service enables Oracle to deliver a Fully Autonomous Database

  – Extended Database Automation

  – Integrated with complete infrastructure automation

  – With additional automation for operations, HA, security, etc.

Oracle Cloud

World's Best Database is Now World's Simplest

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Traditionally DBAs are Responsible for:

- **Generic Tasks**
  - Configuration and tuning of systems, network, storage
  - Database provisioning, patching
  - Database backups, H/A, disaster recovery
  - Database optimization

- **Tasks Specific to Business**
  - Architecture, planning, data modeling
  - Data security and data lifecycle management
  - Application related tuning
  - End-to-End service level management

Autonomous Database Removes Generic Tasks

- **Freedom from Drudgery** for DBA: More Time to **Innovate** and Improve the Business

- ~~**Generic Tasks**~~
  - ~~Configuration and tuning of systems, network, storage~~
  - ~~Database provisioning, patching~~
  - ~~Database backups, H/A, disaster recovery~~
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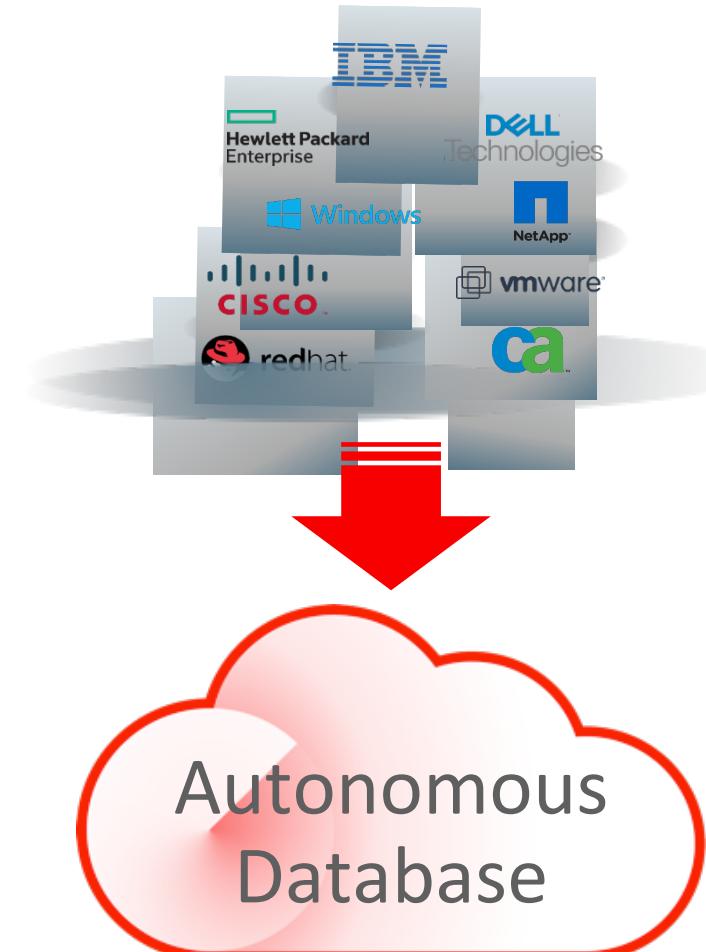
One Autonomous Database – Optimized by Use Case

2017	2018	Now
Data Warehousing	**Enterprise OLTP, Mixed Workloads**	**Departments, Developers**

Oracle Autonomous Database

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Autonomous Database Cloud For Data Warehouse

- **Easy**
  - Automatically optimizes Analytic workloads
  - Simply "load and go"
  - Database tunes itself - No need to define indexes, partitions, materialized views, etc.
  - Works with any BI analytics tool

- **Fast**
  - Based on Exadata technology
  - Performance matches or exceeds most hand-tuned Data Warehouses

- **Elastic**
  - **Instant** scaling of compute or storage with no downtime
  - Pay for compute when in use only

Expected CY 2017

Autonomous Database Cloud For OLTP or Mixed Workloads

- **Easy**
  - Configured for **Mission Critical** workloads
    - Full Maximum Availability Architecture with scale-out clustering and disaster recovery
  - Or Configured for **Low Cost**
    - Single server for non-critical workloads or test/dev
- **Fast**
  - Based on Exadata technology
- **Elastic**
  - Instant scaling of compute or storage with no downtime

Expected CY 2018

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Autonomous Database Cloud For Departments or Developers

- **Easy**
  - Ideal entry level service for running Oracle Database in cloud
  - Packed with tools for modern app development
  - Built-in Application Express low code development environment

- **Fast**
  - Based on Exadata technology

- **Elastic**
  - Choose from simplified all-inclusive shapes

Available Now
(Exadata Express)

Provisioning

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Provisioning an Exadata Cloud Service

Exadata Storage Cells

Database Compute Nodes

InfiniBand Switches

Database Compute Nodes

Exadata Storage Cells
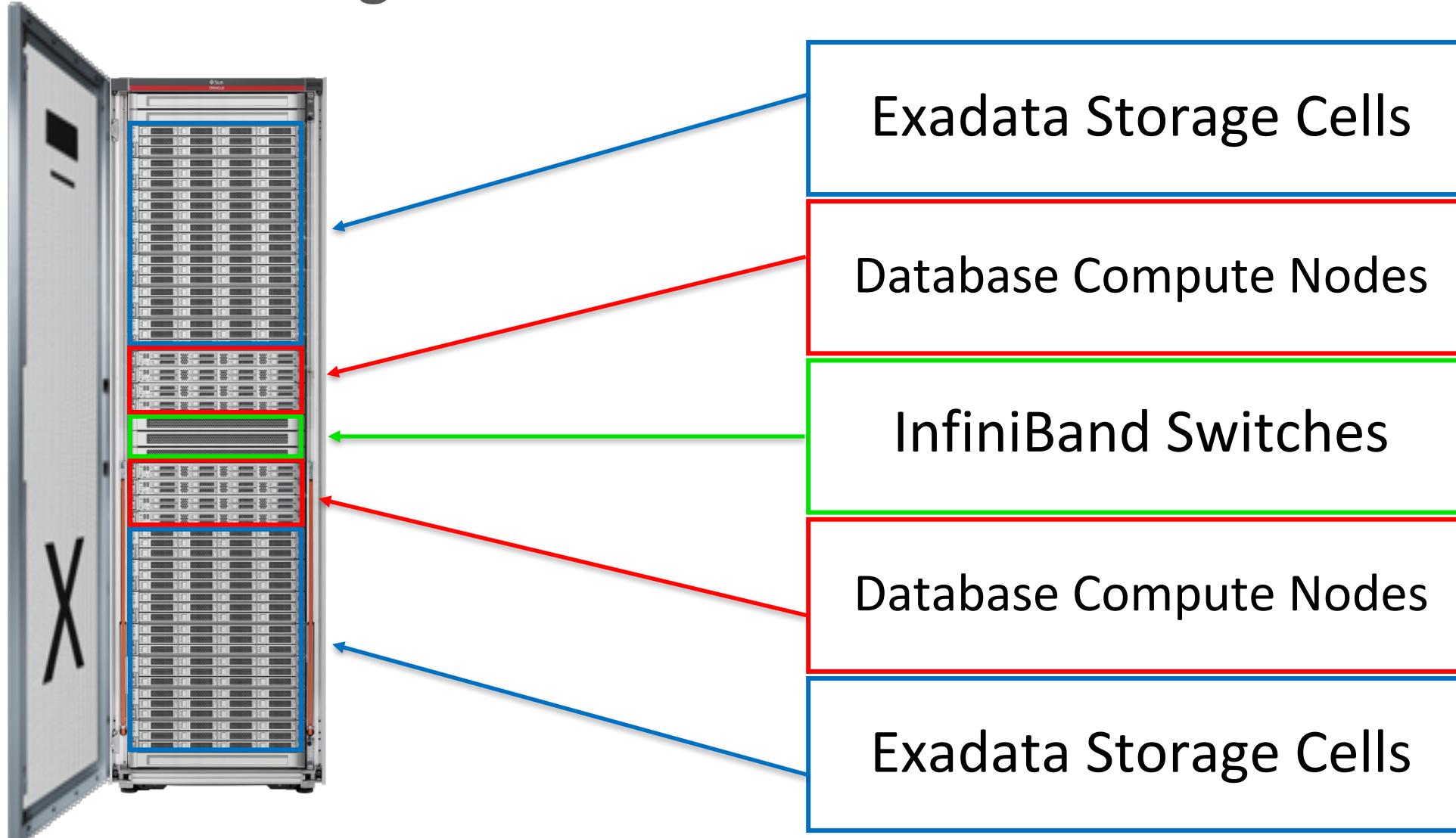
Provisioning an Exadata Cloud Service
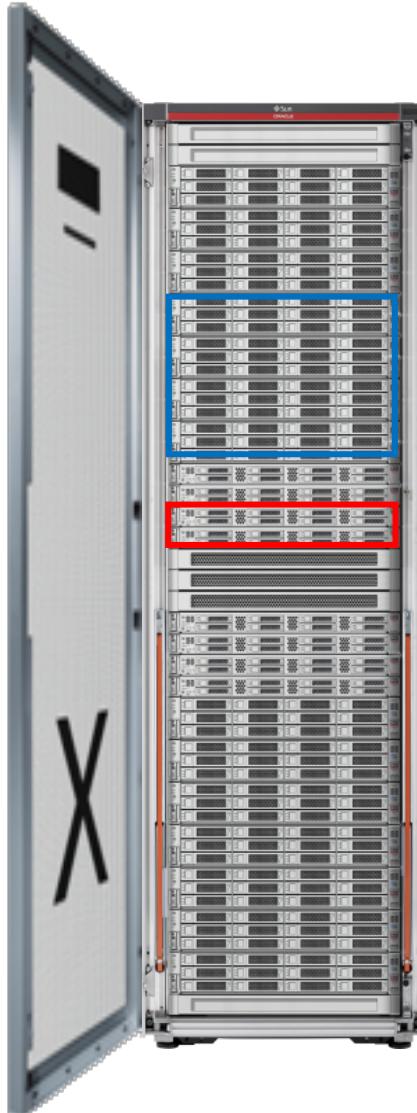
A Quarter Rack Shape has 2 Database Compute Nodes and 3 Storage Cells

Exadata Storage Cells

Database Compute Nodes

X6 Quarter Rack Shape
Up to 84 CPUs
1,440 GB of Memory
68.3 TB of Database Storage

Provisioning an Exadata Cloud Service
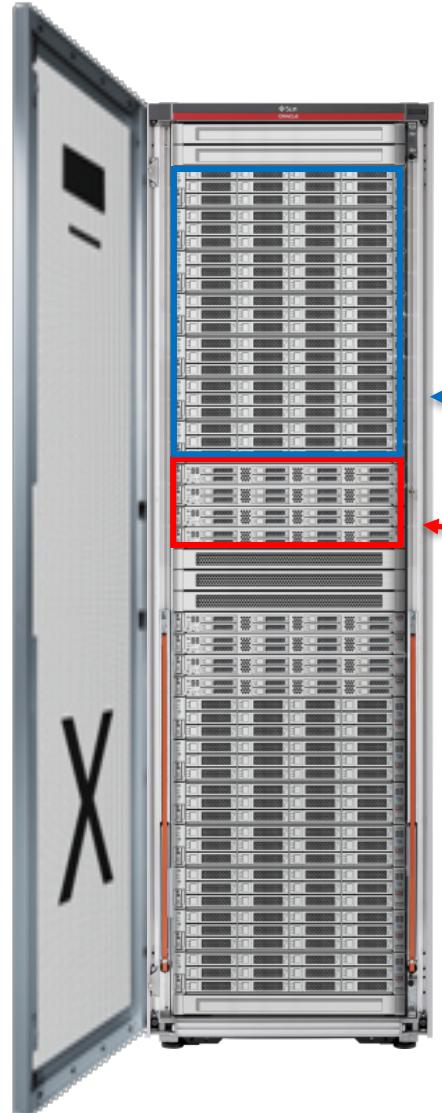
A Half Rack Shape has 4 Database Compute Nodes and 6 Storage Cells

Exadata Storage Cells

Database Compute Nodes

X6 Half Rack Shape
Up to 168 CPUs
2,880 GB of Memory
136.7 TB of Database Storage

Provisioning an Exadata Cloud Service
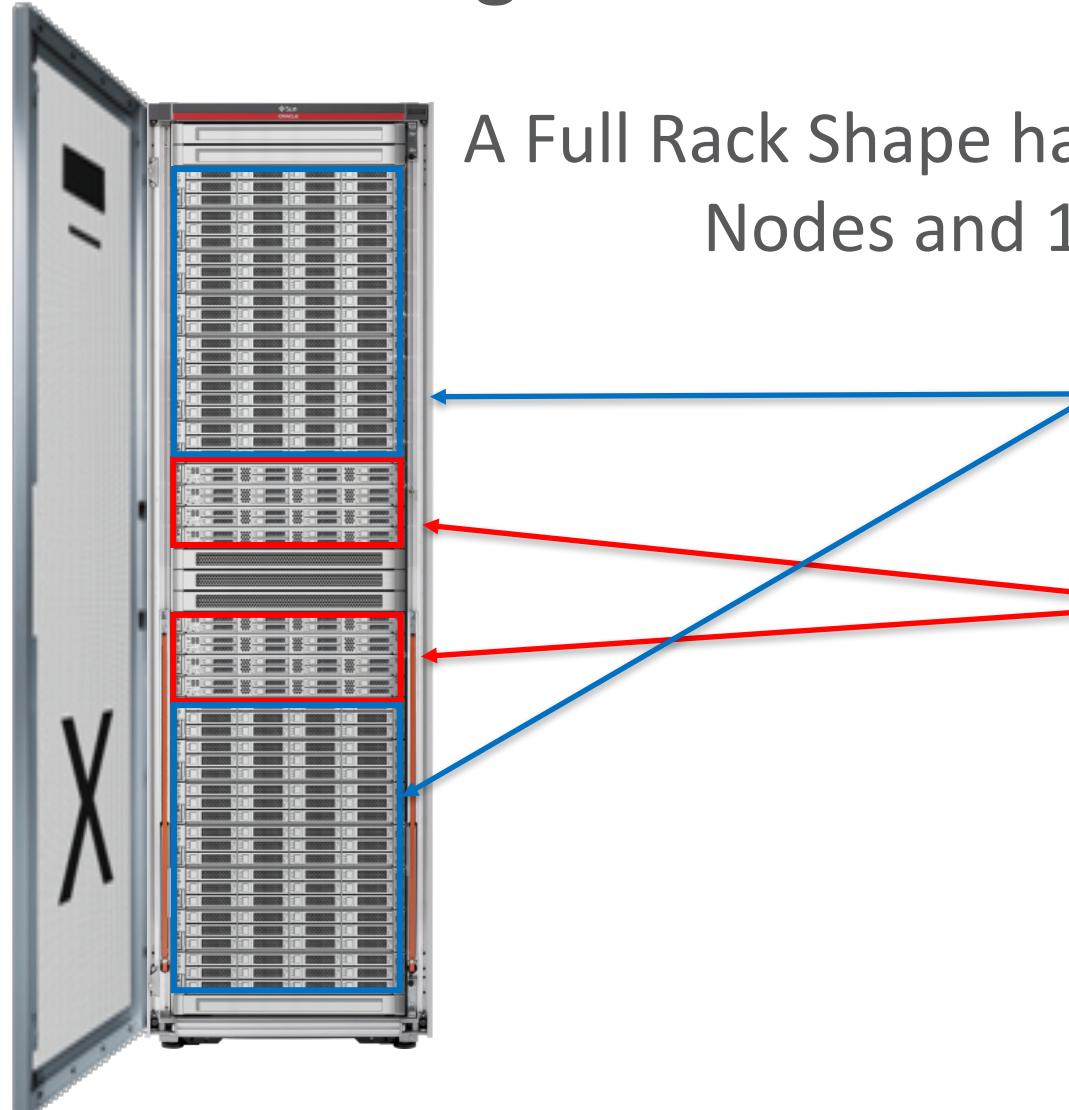
A Full Rack Shape has 8 Database Compute
Nodes and 12 Storage Cells

Exadata Storage Cells

Database Compute Nodes

X6 Full Rack Shape
Up to 336 CPUs
5,760 GB of Memory
273.4 TB of Database Storage

Karl S Jonsson
Senior Enterprise Architect Reinhart Foodservice, LLC

Application Topology

- Fusion Middleware
- Master Data Repository
- Manhattan
  - Warehouse Management
  - Sales Orders
  - Demand Forecast

- Effiser

- Office 365
- Internally Developed .net apps
  - Portal
  - Business Intelligence
  - Master Data Management
  - Tracs Direct

- EBS Channel Revenue Mgmt

AWS

OCI-C

IBM

Azure

Co-Location Site(s)

Internet

Cloud On-Ramp

- Domain Name Services
- Active Directory
- Alpha 1.5

MPLS

- Alpha
- Lawson
- BizTalk

Corp Data Center

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Network Architecture

Reyes Data Center

Cloud On-Ramp
Equinix/Elk Grove/CH3

"Internal" VPN

Palo Alto VPN

Internet

Oracle FastConnect

MA India
MA ATL
RH

VPN Tunnel [Inside]

VPN Tunnel [Internet]

VPN Gateway
10.157.0.1

10.157.0.0/25

10.157.0.128/25

10.157.1.0/24

10.157.2.0/24

System

Manhattan – Non Production

Manhattan – Production

Future Use/Other

Fusion Middleware

10.157.3.0/25
SOA/OSB Cluster
ICS Cluster
ODI/JCS Cluster
Non Production

10.157.3.128/25
SOA/OSB Cluster
ICS Cluster
ODI/JCS Cluster
Production

Bastion
(win/linux)

SCAN IP   129.152.209.198
           129.152.209.199
           129.152.209.200

Host Name: cfcldv05B6m.us2.oraclecloud.com
Client IP: 129.152.209.196
Virtual IP: 129.152.209.197

Host Name: cfcldv05B6m.us2.oraclecloud.com
Client IP: 129.152.209.197
Virtual IP: 129.152.209.197

STFMWNPDB-121   SPFMWNPDB-121

Fusion Non-Prod   Fusion Production

FMWNP FMWPD WMSCore WMSNP WMSSH01 WMSSH02 WMSSH03 WMSSH04 WMSSH05 WMSSH06 WMSSH07 WMSSH08

Exadata Cloud Service

Oracle Cloud Infrastructure - Classic

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Cloud On-Ramp

Manhattan Database design – phase 1
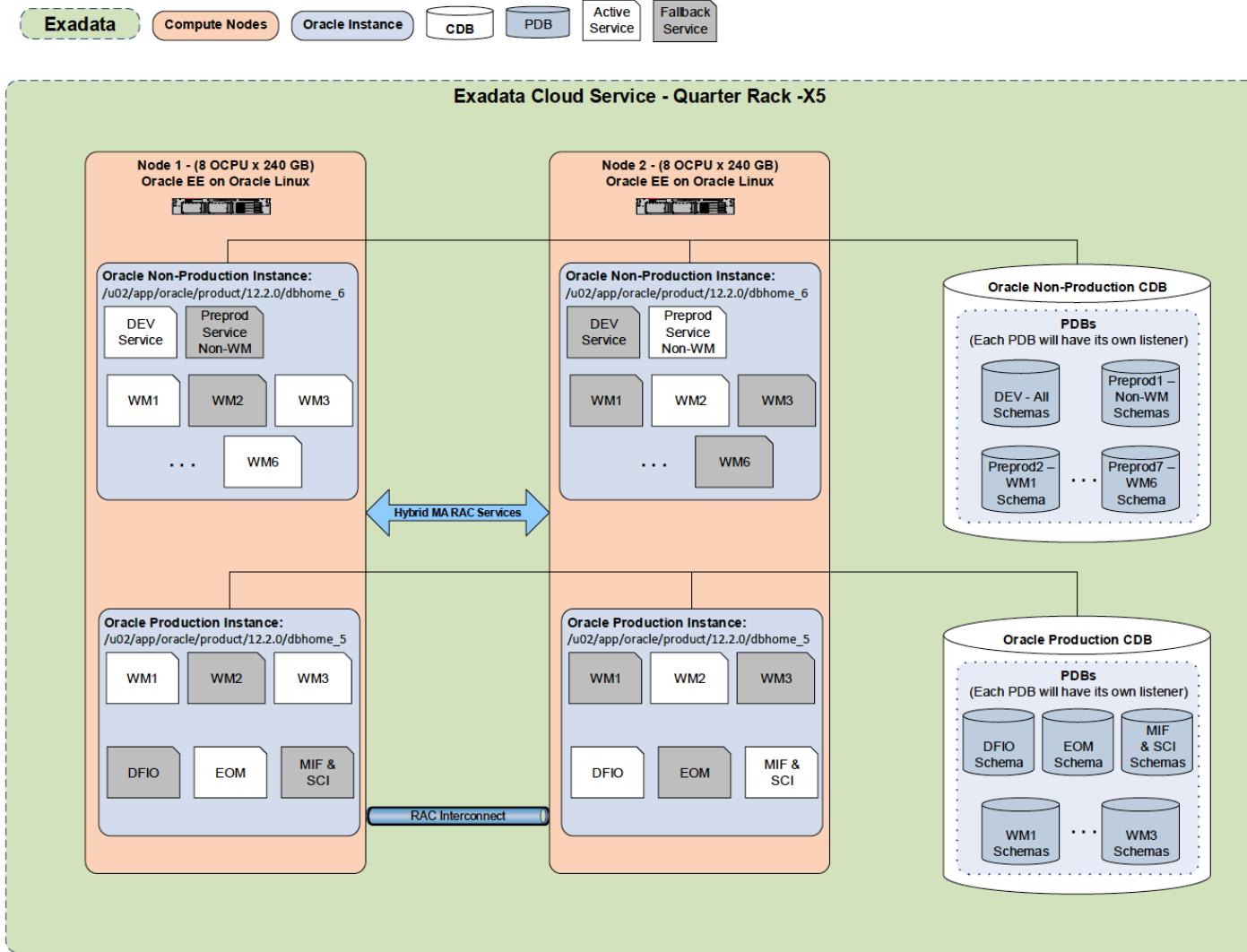
Fusion Database Architecture
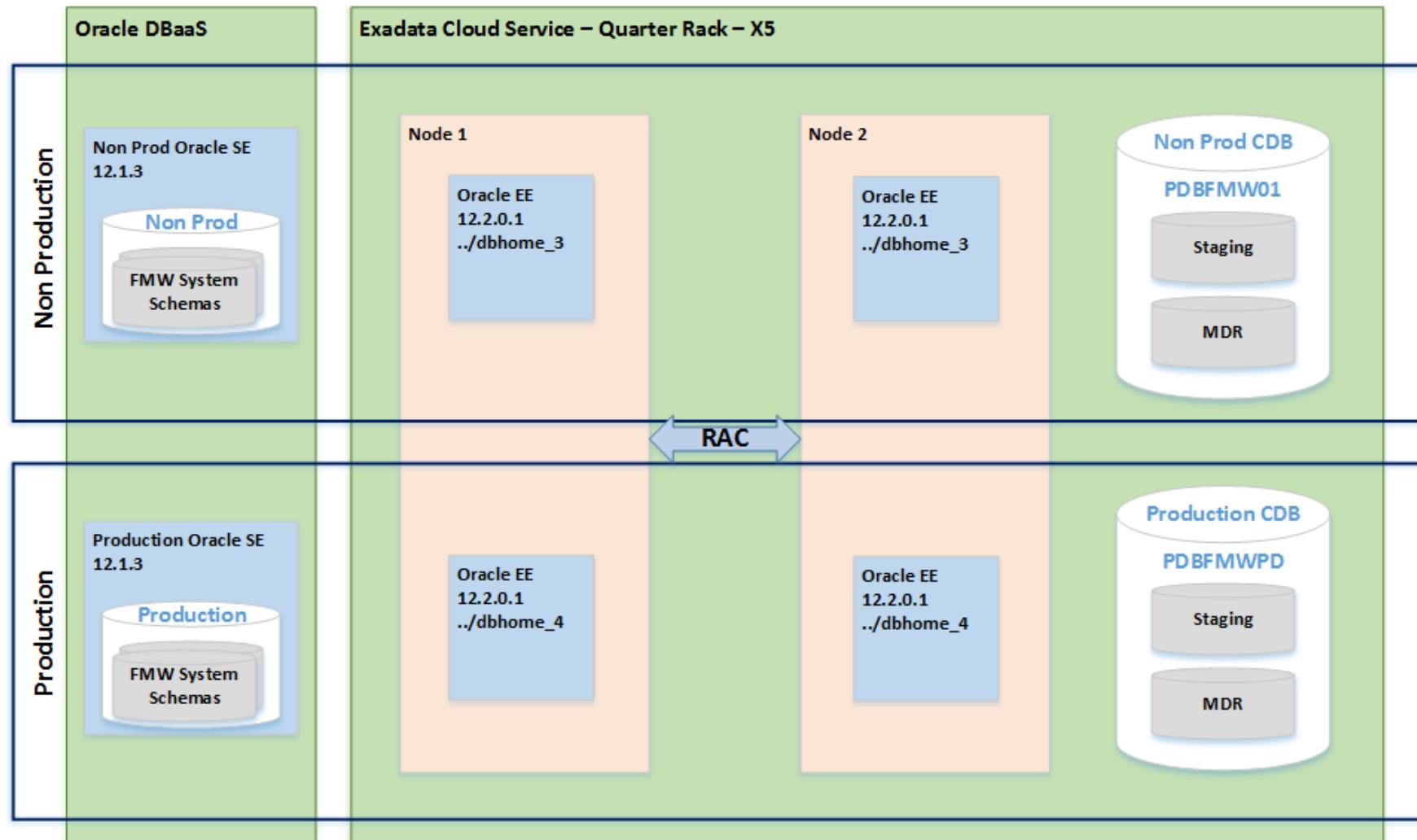
Fusion Middleware Architecture
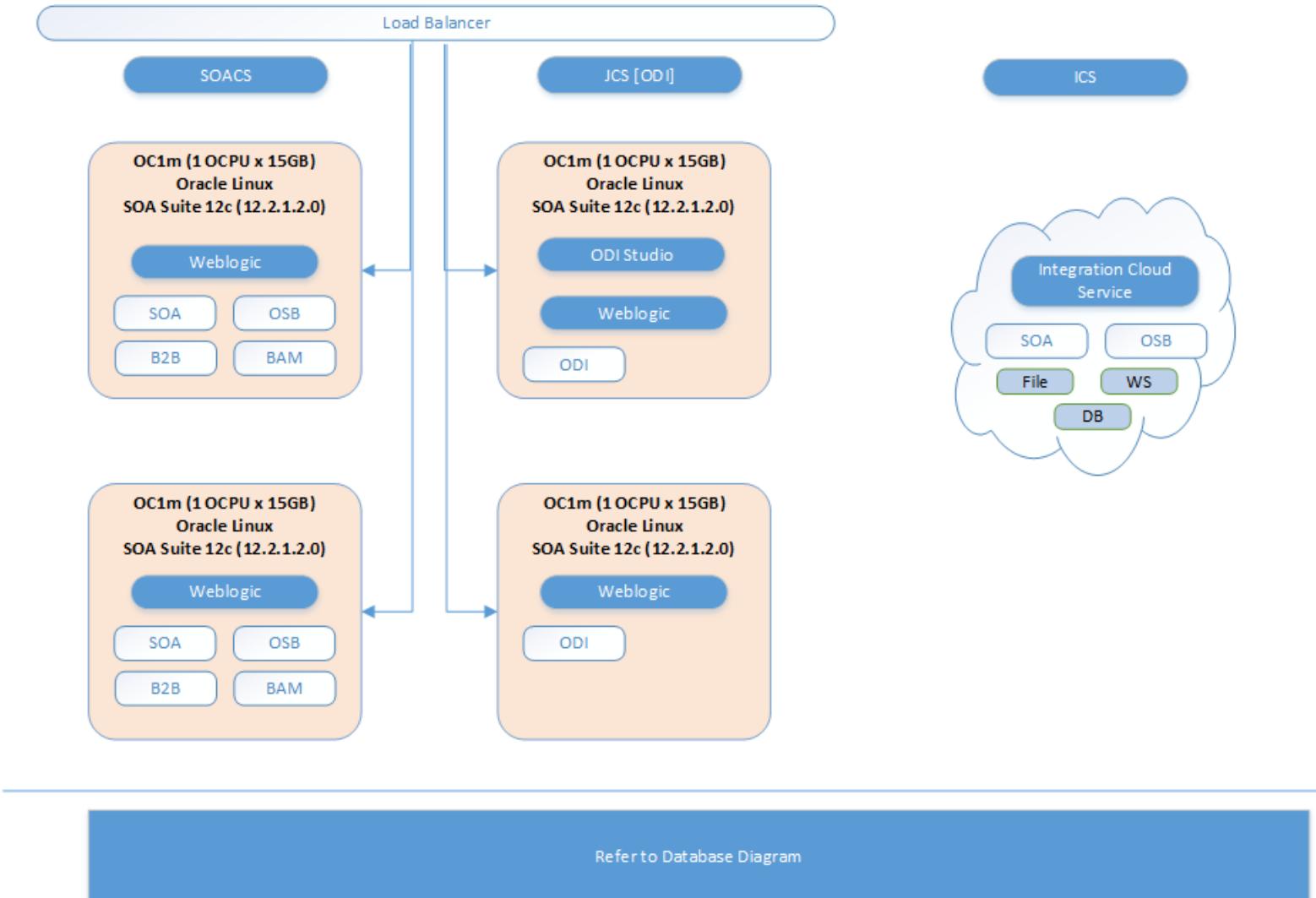
Continuous Integration Developer Cloud Services

- Source Control/Git
- Fully Integrated with jDeveloper
- Automated Builds
- Automated Testing
- Scripted Deployment [Ant/Maven]
- No Manual Configuration in higher environments

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