

Gen 2 Exadata Cloud at Customer

Technical Overview

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Safe Harbor

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Exadata Vision

Dramatically Better Platform for All Database Workloads



- **Ideal Database Hardware** – Scale-out, database optimized compute, networking, and storage for fastest performance and lowest cost
- **Smart System Software** – specialized algorithms vastly improve all aspects of database processing: **OLTP, Analytics, Consolidation**
- **Simple** – Automation and optimization of configuration, updates, performance, and management culminating in **Fully Autonomous Infrastructure and Database**

Thousands of Critical Deployments Since 2008

Financial Services, Telecoms, Healthcare, Retail, Public Sector, Travel, Manufacturing, Professional Services, Consumer Goods, Education, Utilities, ...

Best for ALL workloads

- Petabyte Warehouses
- Super Critical Systems
 - Financial trading
 - Process manufacturing
 - E-commerce
- Packaged Applications
 - SAP, Oracle, Siebel, PSFT, ...
- Database Consolidation

77% of Fortune Global 100 Run Exadata



Exadata in **Public Cloud** - Exadata Cloud Service

- Oracle Database as a Service running on Exadata
 - With All Advanced Database Options or Bring Your Own License
 - **100% compatible** with existing applications that use Oracle Database
- With **Simplicity and Elasticity** Benefits of Public Cloud:
 - Web and API driven lifecycle operations
 - Provisioning, updates, backup, etc.
 - Oracle experts manage all infrastructure
 - Elastically scale enabled capacity up and down online
 - Subscription model with hourly pay-per-use



Production
since 2016



Some Customers Cannot Move to Public Cloud

- **Regulations**
 - Regulations or policies require data to be local
- **Latency**
 - Applications require performance of local LAN
- **Integration**
 - Databases tightly-coupled with on-premises applications
- **Risk**
 - Concerns about quality of service or corporate security standards



Exadata Cloud at Customer Addresses These Concerns

Introducing: Gen 2 Exadata Cloud at Customer

Exadata Public Cloud Simplicity and Elasticity in Your Data Center

Gen 2 Exadata Cloud at Customer

**DATABASE AS
A SERVICE IN
YOUR DATA
CENTER**

**PUBLIC CLOUD
HARDWARE,
SOFTWARE,
AND APIs**

**PUBLIC CLOUD
OPERATIONAL
MODEL**

**PUBLIC CLOUD
FINANCIAL
MODEL**

**SEAMLESSLY
INTEROPERATES
WITH PUBLIC
CLOUD**

**25% percent of Fortune Global 100
have already adopted Exadata Cloud**



Oracle Provides Full Choice of Deployment Model

On-Prem Traditional

Exadata Database Machine



Customer Data Center
Purchased
Customer Managed

Cloud at Customer

Exadata Cloud at Customer



Customer Data Center
Subscription
Oracle Managed

Public Cloud

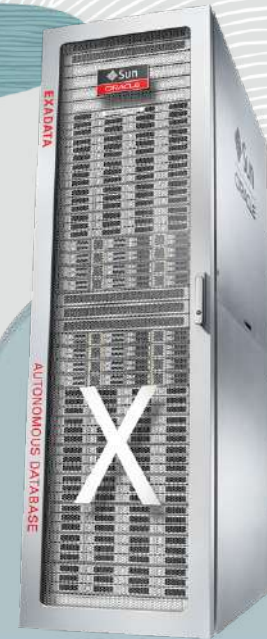
Exadata Cloud Service



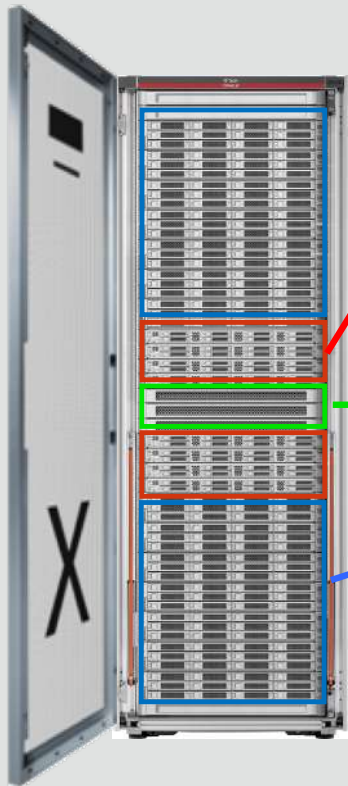
Oracle Cloud
Subscription
Oracle Managed

ORACLE

Gen 2 Exadata Cloud at Customer



Gen 2 Exadata Cloud at Customer X8 Hardware*



Scale-Out 2-Socket Database Servers

Latest Intel Cascade Lake **26 cores CPUs**

50 cores available per server for user VM

720GB of memory available per DB server for user VM

Double the default memory of on-prem Exadata

Ultra-Fast Unified InfiniBand Internal Fabric

Scale-Out Intelligent 2-Socket Storage Servers

Latest **24 core** Intel Cascade Lake CPUs

50% more cores than Exadata on-prem to offload database processing

25.6TB Flash, 12x 14TB Disk Drives per storage server

Gen 2 Exadata Cloud at Customer Hardware Shapes

	Base System*	Quarter Rack	Half Rack	Full Rack
Number of DB Servers	2	2	4	8
Max Number of OCPUs	48	100	200	400
Total Memory	720 GB	1,440 GB	2,880 GB	5,760 GB
No. of Storage Servers	3	3	6	12
Total Usable Disk Capacity	74.8 TB	149.7 TB	299.4 TB	598.7 TB

** Base System is a hardware-version agnostic entry-level configuration for Exadata Cloud*

- ExaCC X8 also includes 4X 1.2TB local drives in DB server for VMs, OS, Oracle Homes, logs, etc.
- ExaCC has a pre-configured cluster file system for large files and sharing files across database servers

Gen 2 Exadata Cloud at Customer Control Plane

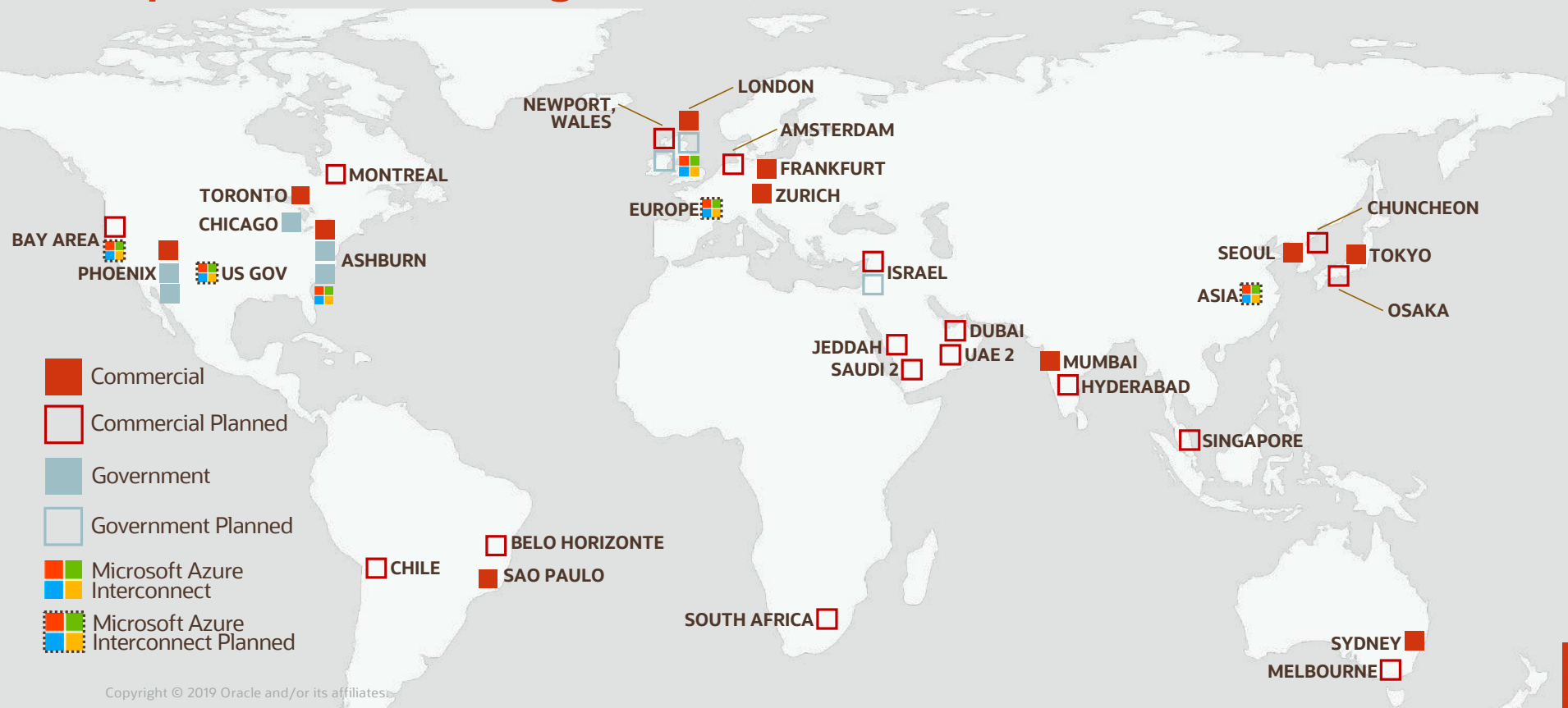


- Gen 2 Public Cloud control plane manages Gen 2 Exadata Cloud at Customer
 - No need for complexity and cost of on-site control plane system
- Customer uses Cloud UI and APIs in the public cloud to invoke database lifecycle operations
 - Identical for Exadata systems in public cloud and cloud at customer
 - Public Cloud control plane uses secure tunnel to invoke agents in cloud at customer system to run lifecycle operations

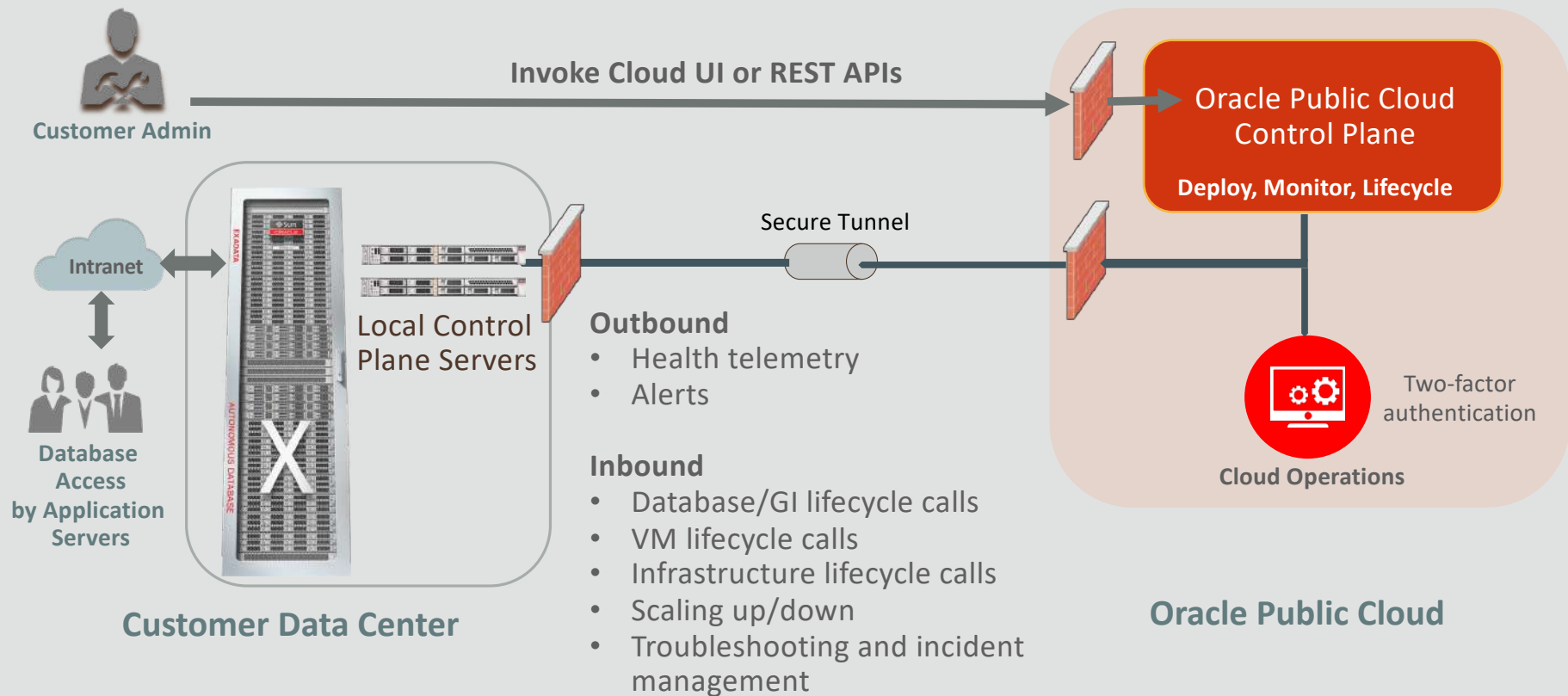
Customer Data Center

Oracle Cloud Infrastructure Global Footprint

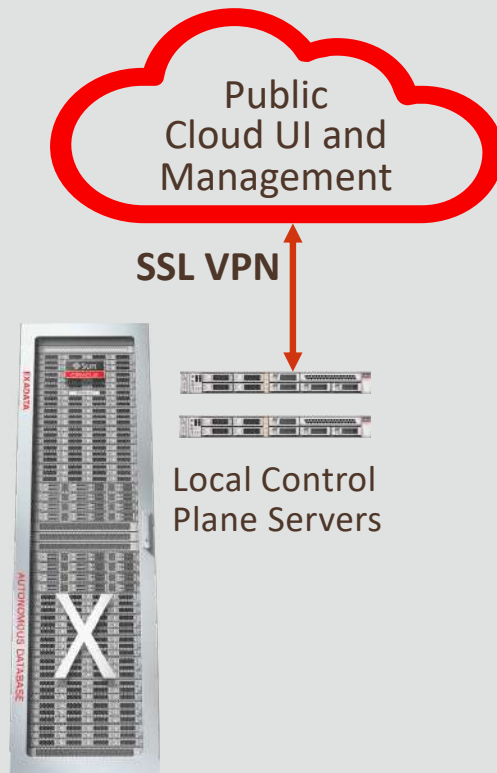
September 2019: 16 Regions Live, 20 Planned



Gen 2 Exadata Cloud at Customer— Management Flow



Lightweight Local Cloud Control Plane Servers



- Two lightweight cloud control plane servers in every ExaCC rack communicate to public cloud
 - SSL-based OpenVPN connection initiated from control plane servers to Oracle Public Cloud—requires outbound port 443 connection
 - Outbound-only connection simplifies firewall security configurations
 - Control plane servers are the only servers that communicate to public cloud control plane via the secure tunnel
 - No need for connectivity to application servers
 - Can be physically or logically connected to DMZ
- Receive lifecycle commands from public cloud and invoke agents on database servers to execute them
 - Also stage patch images
- Monitor for issues and send telemetry to Oracle
- Ensure key operations still run if WAN to Oracle is down
 - Scaling, backup, restore

Exadata Cloud at Customer Automation Highlights

- Automation implemented by Cloud Automation Agents inside user VMs
- Invoked by user using Public Cloud Control Plane REST APIs or UI

Database and GI (clusterware)

- Create, delete, start, stop
- Network and database encryption
- Backup, restore

VM Cluster

- Create, delete cluster of VMs
- OCPU scaling up/down
- Backup of VM

- **Automation invoked in the user VM:**


- DB/GI patch and patch rollback
- Enable/disable cloud automation calls (for highly secure systems)
- Data Guard (manual deployment)







- RAC Node Subsetting
- OS patching and upgrades
- ExaCli storage configuration

Management Interfaces


- Oracle Cloud Web based UI
 - Browser access via https - great for one time actions and ad hoc tasks
- Oracle Cloud REST APIs
 - Programmatic access via https
- Software Development Kit (SDK)
 - Build and deploy apps that integrate with Oracle Cloud Infrastructure services
 - Java SDK, Python SDK, Ruby SDK, Go SDK
- Command Line Interface (CLI)
 - Extend the Console's functionality
 - Convenient for developers and others to automate tasks through scripting
- Terraform
 - Programmatically manage, version, and persist your IT infrastructure as code

Create Database Service


 ORACLE Cloud

US Dev West (Seattle)      


Create Database [Help](#)

Configure Backups 


Backup Destination Type

Recovery Appliance 

Backup Destinations in ExaCC_Demo [\(Change Compartment\)](#)

Backup_Destination_RA_01 

VPC User

backup_user_01 


Password

☒ Enable automatic backups
Automatic backups are performed daily if enabled.

Create Database [Cancel](#)

View Created Database

Exadata Cloud at Customer » VM Cluster Details » Database Details



AVAILABLE

JTWCDB

[Restore Database](#) [Backup Settings](#) [Add Tags](#) [Terminate](#)

Database Information [Tags](#)

General Information

Database Name: JTWCDB
Compartment: sic-dbaas (root)/ExaCC_Demo
OCID: ...khfvia [Show](#) [Copy](#)
Created: Mon, Sep 9, 2019, 11:42:56 PM UTC
Database Unique Name: JTWCDB_sea1wh
Database Version: 19.0.0.0
Status: Available

Backup Information

Backup Destination:
Automatic Backups: Disabled

Resources

Backups

Automatic Backups are performed daily. You can also create separate full backups

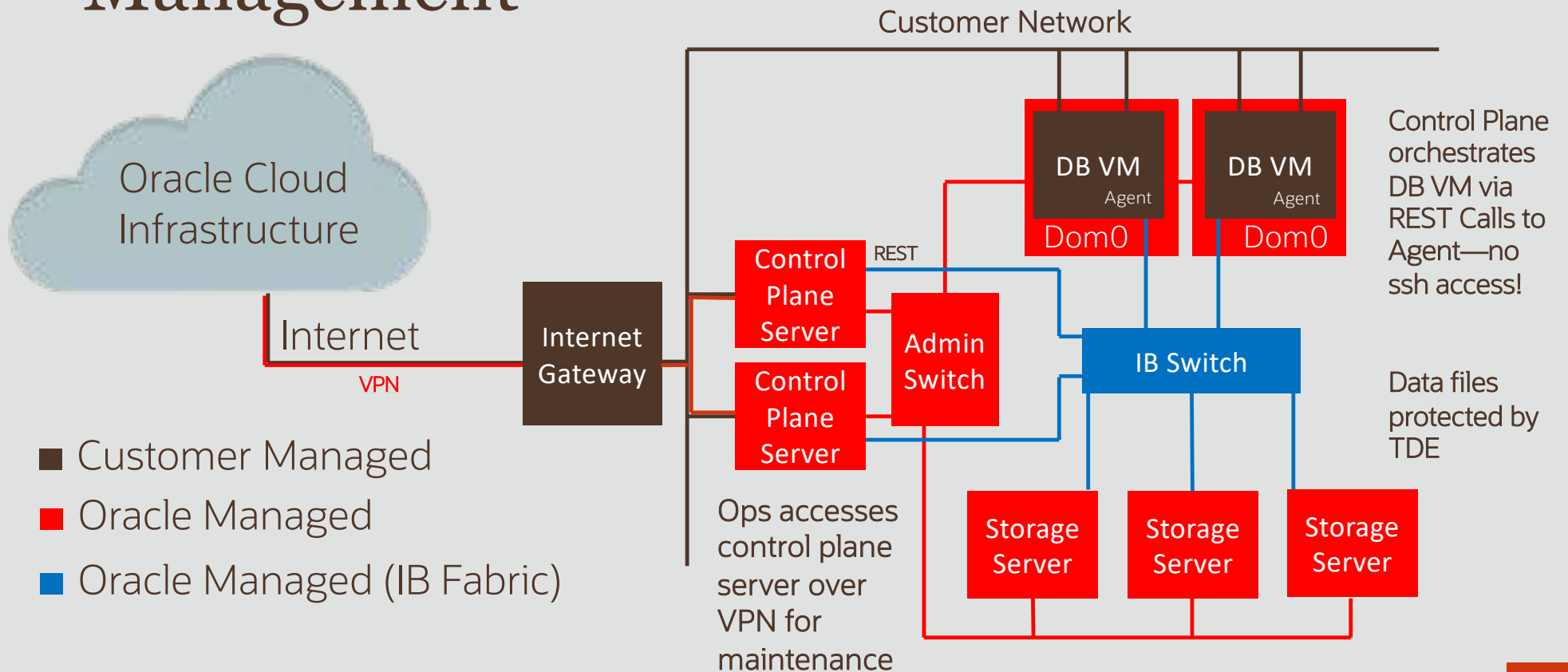
Cloud Management Model



Administration – Roles and Responsibilities

- Oracle owns and manages Exadata infrastructure
 - Servers, storage, storage software, networking inside rack, firmware, hypervisor, etc.
 - Routine management is automated through agents accessed through REST APIs
 - Oracle Cloud OPS can access infrastructure to diagnose and correct issues (no access to user VM or DBs)
- User VM provides isolation between Oracle and customer managed components
 - Oracle manages and owns Dom0, customer manages DomU.
- Customers manage VMs and databases using Oracle Automation
 - Only customer has credentials to access customer VMs and databases
 - Customer has root access to customer VMs and DBA access to databases
 - Oracle provides automation for lifecycle of database, Grid Infrastructure, OS, etc.
- Customers configure and run databases as they like
 - Manage database schemas, users, database access and encryption keys

Secure Isolation of Customer and Ops Management



Patching - Database and VMs (DomU)

- Oracle will upload updates (DomU, DB/GI) to OCI quarterly. Updates are available for download about a week after release in MOS
- Updates are automatically downloaded and staged on the control plane server
- Customer checks for available updates using dbaascli utility invoked on DomU
- Dbaascli queries the local control plane server for available images and applies updates in a rolling manner

Enterprise Manager for Exadata Cloud at Customer

- EM can manage both on-premises and cloud databases
- Configured using standard EM agents installed on Exadata Cloud on user VMs
 - Just like any other Oracle database
- Augment Oracle Cloud Monitoring and Automation
- Reference paper
 - <http://www.oracle.com/technetwork/database/exadata/em-exadata-cloud-3959023.pdf>

EXCSP0C2-009 (Cluster) - Overview

https://oraclecloudem.com:7802/em/faces/cluster-home?target=EXCSP0C2-009&type=cluster

Enterprise Manager Cloud Control 13c

EnterpriseTargetsFavoritesHistorySetupSYSMAN

EXCSP0C2-009

ClusterAdministration

Page Refreshed Sep 9, 2016 4:45:24 PM GMT

Summary

StatusUp

Cluster NameEXCSP0C2-009

Hosts Status2

Clusterware Status2

Cluster ModeRegular Cluster

Reconfiguration ActivitiesHappened

Configuration Changes

Configuration Changes8

Patch Recommendations

View byClassificationTarget Type

Patch recommendations are not available.

My Oracle Support preferred credential is not set for any super user. Either set the preferred credentials or change the connection setting to offline and manually upload the metadata required for generating patch recommendations.

No recommendations to report. Learn More

Job Activity

Summary of jobs whose start date is within the last 7 days.

ShowLatest RunSearchJob Name

Show Jobs

Clusterware

ViewClusterware

ViewDetach

Name	Status	Incidents	Compliance Score(%)	Host
has_cf0ldv0420m.us2.oraclecloud....	Up	0000		cf0ldv0420m.us2.oraclecloud.com
has_cf0ldv0421m.us2.oraclecloud....	Up	0000		cf0ldv0421m.us2.oraclecloud.com

Cluster Managed Resources

ViewCluster Databases

ViewDetach

Database Name	Status	Incidents	Compliance Score(%)	Version
BICSDB ExaCS	Up	0000		11.2.0.4.0
CRM ExaCS	Up	0000		12.1.0.2.0
DG2 ExaCS	Up	0000		12.1.0.2.0
SALES ExaCS	Up	0000		12.1.0.2.0

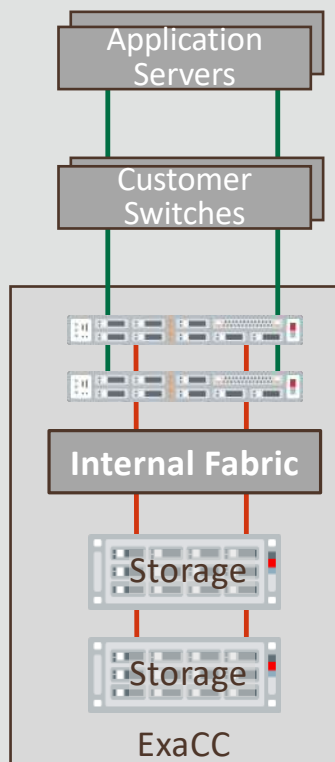
Server Pools

ViewDetach

Name	Minimum Size	Maximum Size	Important	Active Servers
Free	0	Entire Cluster	0	
Generic	0	Entire Cluster	0	cf0ldv0420m cf0ldv0421m
ora.BICSDB	0	Entire Cluster	1	cf0ldv0420m cf0ldv0421m
ora.CRM	0	Entire Cluster	1	cf0ldv0420m cf0ldv0421m
ora.DG2	0	Entire Cluster	1	cf0ldv0420m cf0ldv0421m
ora.ORCL	0	Entire Cluster	1	cf0ldv0420m cf0ldv0421m

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Simple Connectivity to Applications Using Customer Network



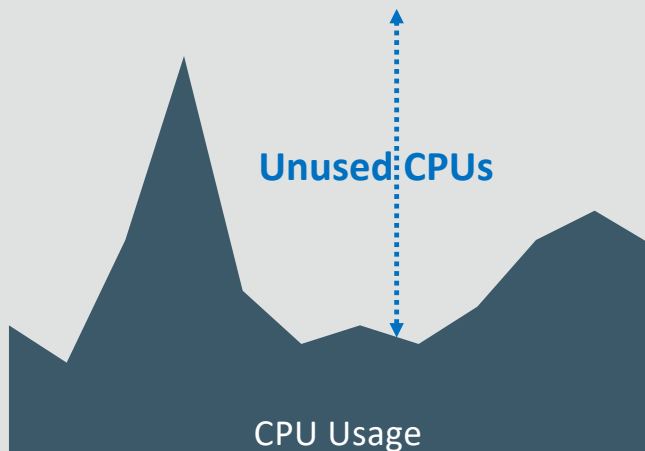
- ExaCC database servers connect directly to customer network to communicate with application servers
 - 10Gbps/25 Gbps fiber or 10 Gbps copper
- Customer uses their standard switches just like on-premises Exadata
 - Can optionally place switches inside Exadata rack
- Customer controls client network configuration
 - Support for flexible VLAN configurations and separate client and backup networks

Pay-per-Use for Software and DB Service

- Scale the service up and down to meet peak or seasonal demands and pay for DB software and DB Service only when you need it
 - Scale active OCPUs up and down depending on time, day of week, etc.
 - Run standby DB with minimal cores, scale up when it becomes the primary DB
- Programmatically scale the system up and down either on metrics or on a schedule
 - Scale using CLI, REST API, SDK, or Terraform
 - Scaling is fully online, no downtime required
 - OCPU adjustments can be done hourly

Elastic Scaling to Reduce Costs

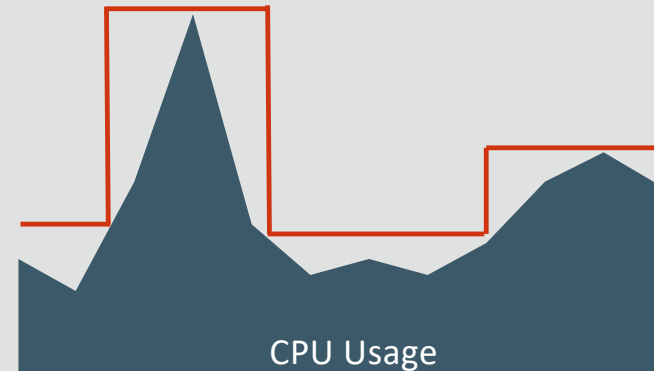
Configured CPUs and Software



On-Premises - Static

Purchase CPUs and software licenses for **highest projected peak load**

Enabled OCPUs



Cloud - Elastic

Adjust enabled OCPUs to match **actual load**
OCPUs are charged hourly

Cloud Financial Model in Your Data Center

- Oracle deploys Exadata X8 system in your data center sized for your needs
 - From Base System - 48 cores, 75TB storage
 - To Full Rack - 400 cores, 600 TB of storage
 - Pay monthly subscription for infrastructure - minimum 4-year term
- You scale active CPUs to pay-per-use for DB Software and DB Service
 - API or Cloud UI enables and disables OCPUs dynamically between 2 OCPUs per VM and full capacity of system
- Two Options for DB Software and Service – both use Universal Cloud Credits
 - Subscription for both DB Software and DB Service
 - Get Oracle Database Enterprise Edition with all Options included - RAC, ADG, Multitenant, etc.
 - Bring Your Own Database Licenses (BYOL) and just subscribe to DB Service

Choice of Commercial Models for Software and Service

- **Option 1: Subscribe to Database Enterprise Edition Extreme Performance**
 - All Oracle Database Options included
 - RAC, Active Data Guard, Partitioning, In-Memory, Multitenant, Advanced Security, Diag, Tuning, Real-Application testing, Advanced Analytics, Advanced Compression, Label Security, Masking, etc.
 - All Exadata system software features included
- **Option 2: Bring Your Own License (BYOL) to ExaCC**
 - Bring your existing Database Licenses and Options
 - One Oracle Processor License maps to 2 OCPUs
 - BYOL subscription fee cover DB Service Automation, Infrastructure Management and Monitoring, Exadata system software
 - BYOL also includes DB encryption, DB management options, DB testing options

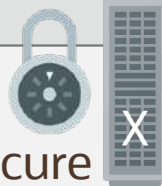


Universal Cloud Credits (UCC)

- Universal Credits
 - Oracle Universal Cloud Credits are used to pay for software and service subscription on Exadata Cloud at Customer
 - Same universal credit pool for Public Cloud and Cloud at Customer
 - Full flexibility - activate or scale any service at any location using a single pool of funds
 - Aggregates all cloud usage to qualify for higher discounts
- Government Subscriptions
 - Government contracts often don't allow flexible spending models like UCC
 - Fixed subscription to licenses and service are available for government users

Additional Security When Using Cloud at Customer

Exadata



- ✓ Globally deployed at 1000s of secure sites
- ✓ Full software stack scrutinized by Oracle and industry security experts around the world
- ✓ Vendor signed firmware
- ✓ Minimal Linux package install to run database reduces attack footprint
- ✓ Dedicated networks for client traffic

Database



- ✓ Only customer has credentials to database VMs
- ✓ Connections secured by Oracle Net Encryption
- ✓ Database files encrypted by Transparent Database Encryption by default

Exadata Cloud at Customer enforces high security standards in every component

Infrastructure

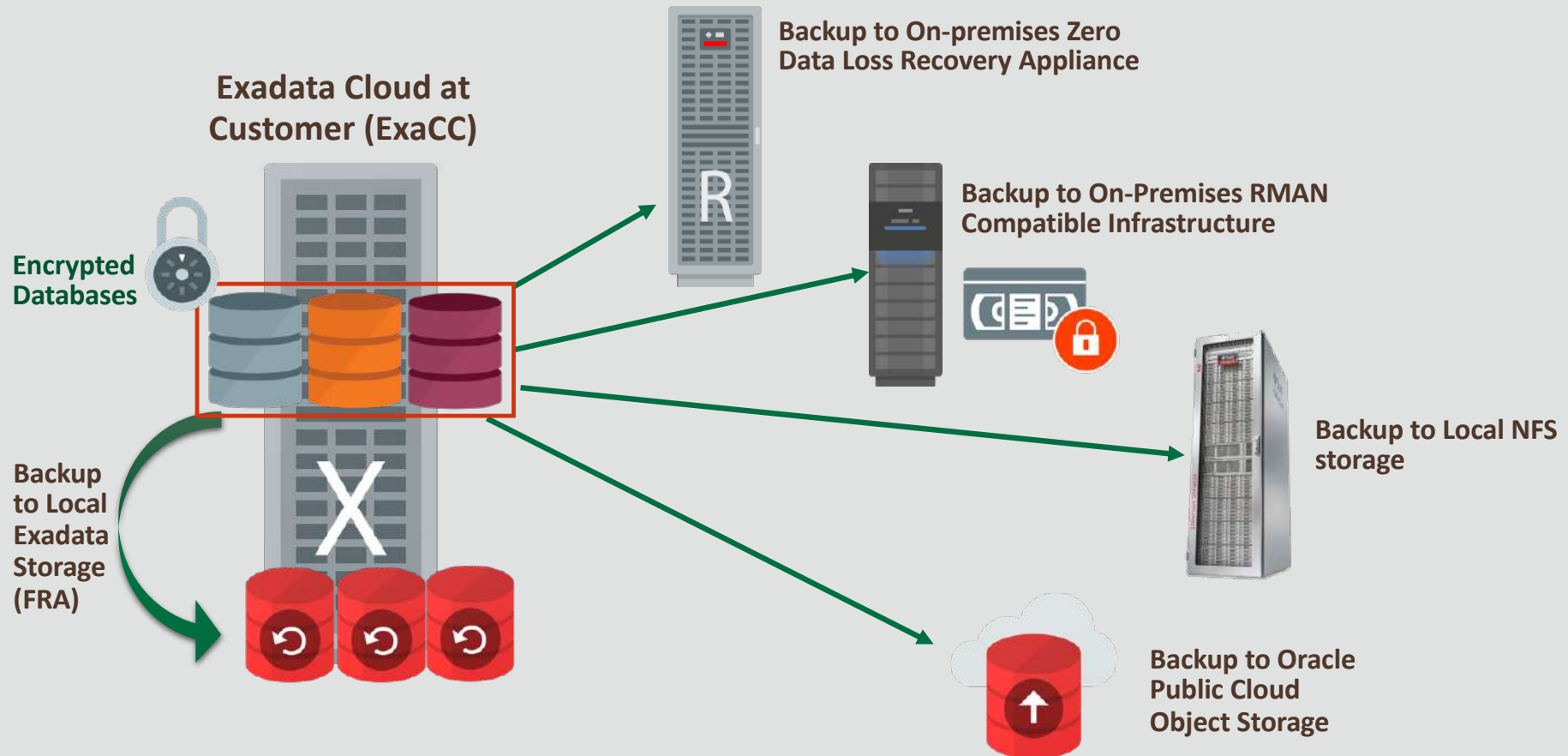
Network

Platform

Database

Automation

Database Backup Options with ExaCC

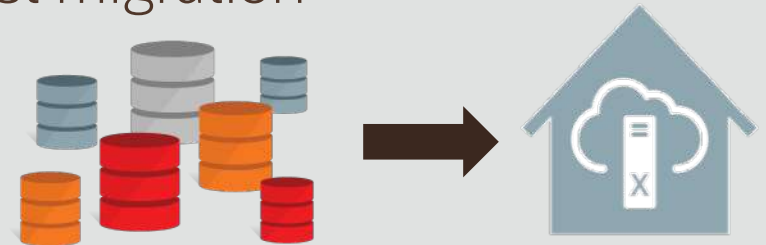


Deployment

- Customer provides data center space, network drops, power drops, network configuration information, and IP addresses
- Then Oracle engineer comes onsite to:
 - Deploy the ExaCC hardware and software
 - Connect the system to your network
 - Help customer to connect local control plane servers to public cloud control plane
 - Help customer to add ExaCC system to their cloud account
- Customer must enable OpenVPN connectivity from control plane servers in Exadata Rack to Oracle Public Cloud
- Oracle will do an end-to-end validation of the system prior to handing over the system to the customer

Migrating Databases

- 100% Oracle Database compatibility makes migration easy
- Local network connectivity enables fast migration
- Logical Migration
 - Data Pump, GoldenGate
- Physical Migration
 - RMAN, Transportable technologies, Data Guard
- Encrypt databases post-migration
- MAA Migration Best Practices “Best Practices for Migrating to Exadata Database Machine”



Roadmap: Autonomous Database Cloud at Customer

- All benefits of Autonomous Database Dedicated **in your data center**
 - Oracle fully automates and manages DomUs and Databases
 - Self-Driving
 - Self-Securing
 - Self-Repairing
- Customizable Isolation Policies
- Customizable Operational Policies



Gen 2 Exadata Cloud at Customer

Upgrade from Gen 1 to Gen 2 Exadata Cloud at Customer



Customer Data Center

- Gen 1 ExaCC Roadmap
 - No further enhancements to Gen 1 Software or Systems (no X8)
 - Security and maintenance patches only
 - No Automation of Database 19c
 - Expansions of existing systems can continue
- Gen 1 customers will receive free control plane and networking upgrade to Gen 2 starting in 2020
 - Oracle engineers perform the upgrade
- X6/X7 hardware is not replaced
- Existing Cloud at Customer contract continues unchanged

Gen 2 Exadata Cloud at Customer—Benefits over Gen 1

- Simpler Installation - no local control plane rack needed
- Simpler Management - consolidated management of systems and databases across public cloud and cloud at customer
- Simpler Security Controls: consolidated fine-grained administrative security controls across public cloud and cloud at customer
- Simpler User Experience - Identical user experience and lifecycle APIs between Gen 2 Public Cloud and Gen 2 Cloud at Customer
- Exadata X8 hardware (new deployments only) - more database cores, more storage capacity, and more storage server cores

ORACLE

Gen 2 Exadata Cloud at Customer

Roadmap



Gen 2 ExaCC - Short Term Roadmap

FEATURE
Data Guard Automation
Shared Oracle Homes <ul style="list-style-type: none">- Can already be invoked within VM
Cloud API/UI for DB/GI patching <ul style="list-style-type: none">- Can already be invoked within VM
Customer Can Subscribe to Lifecycle Notifications
Support Multiple VMs

Expected in 2019
or early 2020

Gen 2 ExaCC Medium Term Roadmap

FEATURE
OS (DomU) patching via Cloud API/UI
Database and GI Major Version Upgrades
RAC DB Instance Subsetting by VM via Cloud API/UI
Instantiate Database from Backup
Key Vault (OKV) integration for DB Encryption Keys
Customer API for Diagnostics Collection
Autonomous Database at Customer
Outbound HTTPS replaces OpenVPN Secure Tunnel
Automation of Pluggable Database (PDB) Lifecycle

Expected by mid 2020

Gen 2 ExaCC Roadmap

FEATURE
CPU Over Subscription for Multi-VM
VM Cluster on Subset of DB Servers
Add Compute and Storage Servers
Sparse Database Clones
Upgrade from Gen 1 ExaCC to Gen 2 ExaCC

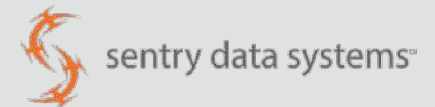
Expected in 2020

Customer Deployment Examples

Sentry Data Systems Gains Cloud Benefits with On-Premises Security Using Exadata Cloud at Customer



Industry: Healthcare data analytics
Headquarters: US



Sentry Data Systems provides Big Data technology solutions that help healthcare providers address their three biggest challenges: reducing total cost of care, managing compliance and producing better quality.

Sentry Data Systems Objective

Faster ingest and processing of growing data feeds without compromising security.

Result

100% ROI in six months. **60% decrease** in batch processing window. **60% increase** in transaction throughput.

SENTRY DATA SYSTEMS

APPLICATIONS

- ☁ Data Visualization
- ☁ GoldenGate
- ☁ OLAP
- ☁ ODI

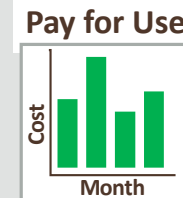
CHICAGO

PROD



MIAMI

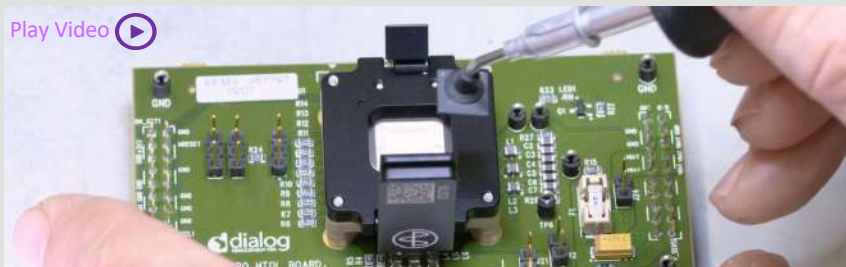
DR/DEV/TEST



Data Guard

Exadata Cloud at Customer

Dialog Semiconductor Heads Toward Oracle Public Cloud via Exadata Cloud at Customer



Play Video

Industry: Manufacturing (semiconductors)
Headquarters: UK/Germany



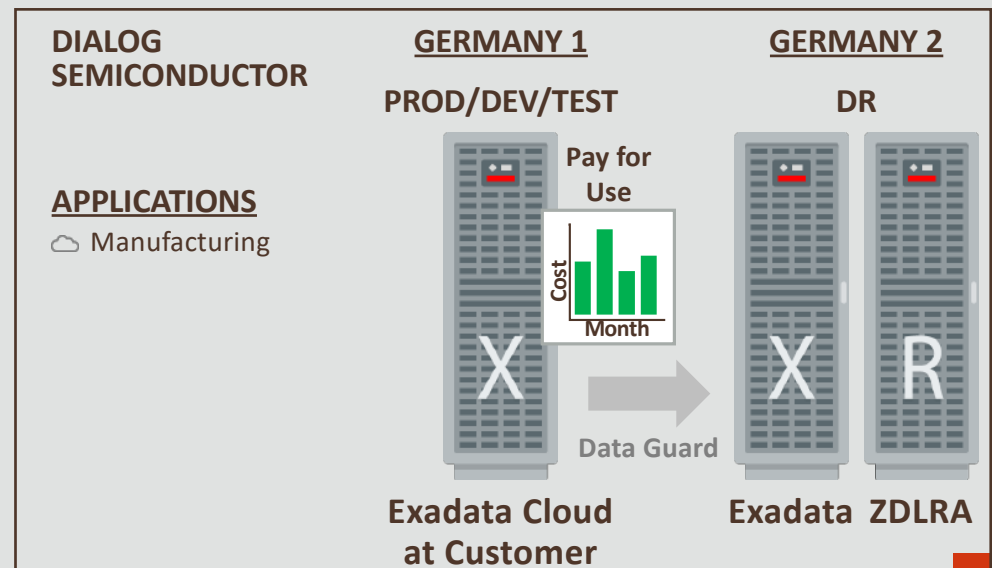
Dialog Semiconductor is a leading designer and developer of semiconductors used in Consumer electronics, such as smartphones, LED lighting and IoT devices.

Dialog Semiconductor Objective

Downsize on-premises data center assets over time by transitioning to Oracle Public Cloud.

Result

“Wall to wall solution Oracle is responsible for”. New database creation time reduced from **days to minutes**; backup and recovery using ZDLRA **4x faster**.



Galleries Lafayette Consolidates Servers, Adds Security for GDPR with Exadata Cloud at Customer



Industry: Retail (fashion)
Headquarters: France

Galleries Lafayette

Galleries Lafayette group is an upscale fashion retailer committed to setting the standard as an omni-channel and responsible retailer that puts the customer first and is actively engaged in promoting the French “Art of Living”.

Galleries Lafayette Objective

Consolidate aging servers into a new data center on a tight timeline, gaining OpEx pricing, GDPR security and new DB options.

Result

3 months from delivery to go live for all critical applications in a new data center. Multiple servers decommissioned and outsourcing services discontinued.

GALERIES LAFAYETTE

APPLICATIONS

- Oracle Retail
- GoldenGate
- SAP
- MicroStrategy
- Adobe

DB OPTIONS

- Adv Security
- Multitenant
- In-Memory

DC 1 PROD



DC 2 DR/DEV/TEST



Exadata Cloud at Customer

Sejel Technology Handles Peak Visitor Volumes and Lowers Costs 40% Using Exadata Cloud at Customer



Sejel Technology Objective

Refresh aging systems for scalability and flexible pay for use licensing, without compromising on-premises data security.

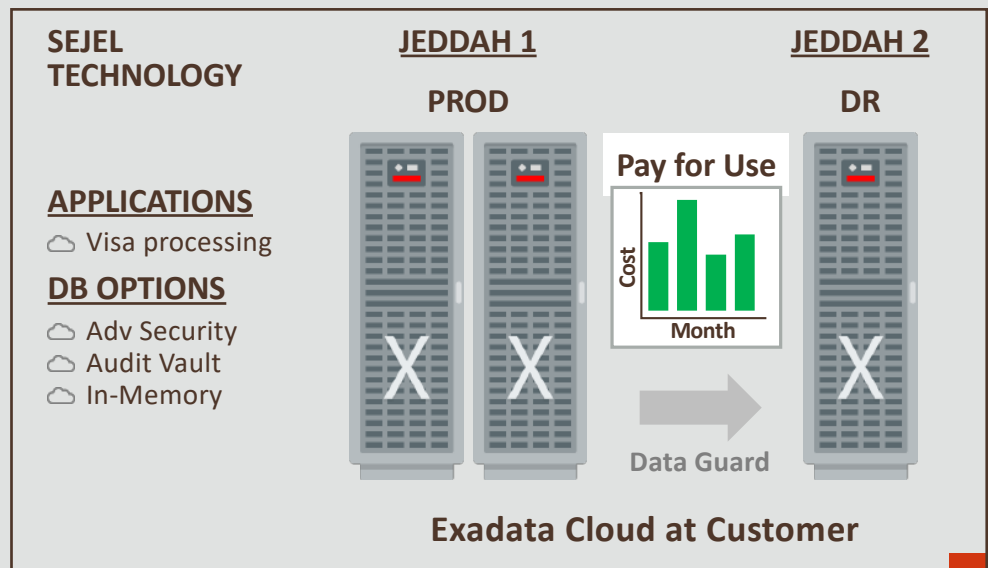
Result

Overall **5 – 10x performance** improvement.
Visa issuance time decreased from **2 weeks to 2 days**. **40% cost savings** compared to CapEx model.

Industry: IT Services
Headquarters: Saudi Arabia



Sejel Technology is an IT consulting company working with the Saudi Ministry of Hajj and Umrah to process visa application requests for over 10 million annual visitors to the holy sites in Saudi Arabia.



Hospital Alemão Oswaldo Cruz Reduces Administration, Increases Security Through Exadata Cloud at Customer



Alemão Oswaldo Cruz Objective

Refresh technology, streamline administration, move from CapEx to OpEX and enhance the security of medical records.

Result

Overall **40% decrease** in TCO, while adding advanced database options and offloading systems management to Oracle.

Industry: Healthcare
Headquarters: Brazil



Hospital Alemão Oswaldo Cruz is a general hospital with a Center of Oncology which is considered one of the most important references in cancer care in Brazil. The hospital has 1,914 employees and 5,231 registered physicians.

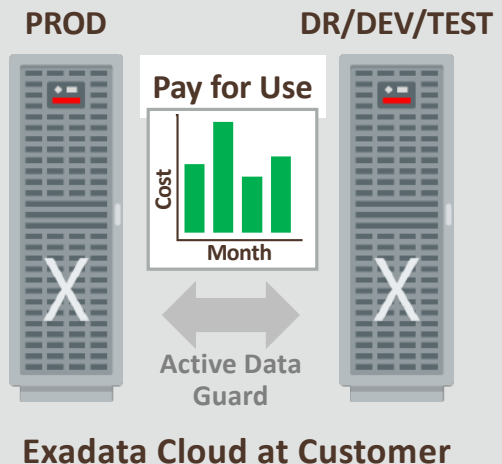
HOSPITAL ALEMÃO OSWALDO CRUZ

APPLICATIONS

☁ Philips Tasy EMR

DB OPTIONS

- ☁ Adv Security
- ☁ Adv Compression
- ☁ Tuning Pack
- ☁ Diagnostics Pack



CITIC Technology Builds Standardized Oracle Database as a Service on Oracle Cloud at Customer



CITIC Technology Objective

A standardized Oracle DBaaS private cloud environment for all Oracle DB deployments, enabling efficiency and driving innovation.

Result

30% reduction in time to market for new applications (estimated). **50% reduction** in Oracle Database and infrastructure budget (estimated).

Industry: Cloud services provider (internal IT)
Headquarters: China



CITIC Technology is a subsidiary of the Chinese conglomerate CITIC Group, chartered with providing IT Cloud services to over 2,000 CITIC Group subsidiaries.

CITIC TECHNOLOGY

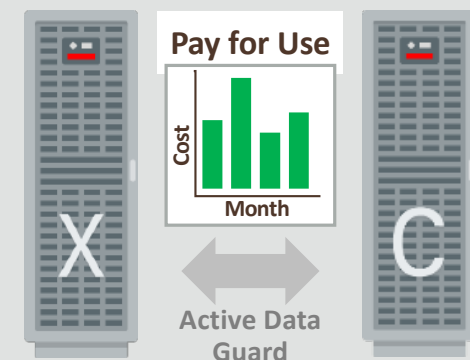
APPLICATIONS

- Any Oracle DB
- Big Data
- IOT
- Blockchain
- Mobility
- Autonomous DB

DB OPTIONS

- RAT
- In-Memory

Oracle DBaaS



Oracle Cloud at Customer

Conclusion: Gen 2 Exadata Cloud at Customer

Exadata Public Cloud Simplicity and Elasticity in Your Data Center

Gen 2 Exadata Cloud at Customer

**PUBLIC CLOUD
HARDWARE,
SOFTWARE,
AND APIs**

**DATABASE AS
A SERVICE IN
YOUR DATA
CENTER**

**PUBLIC CLOUD
OPERATIONAL
MODEL**

**PUBLIC CLOUD
FINANCIAL
MODEL**

**SEAMLESSLY
INTEROPERATES
WITH PUBLIC
CLOUD**

Safe Harbor

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Thank You

