Deploying Oracle Databases in the Cloud with Exadata

Strategies, Best Practices

ORACLE OPEN WORLD

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ORACLE

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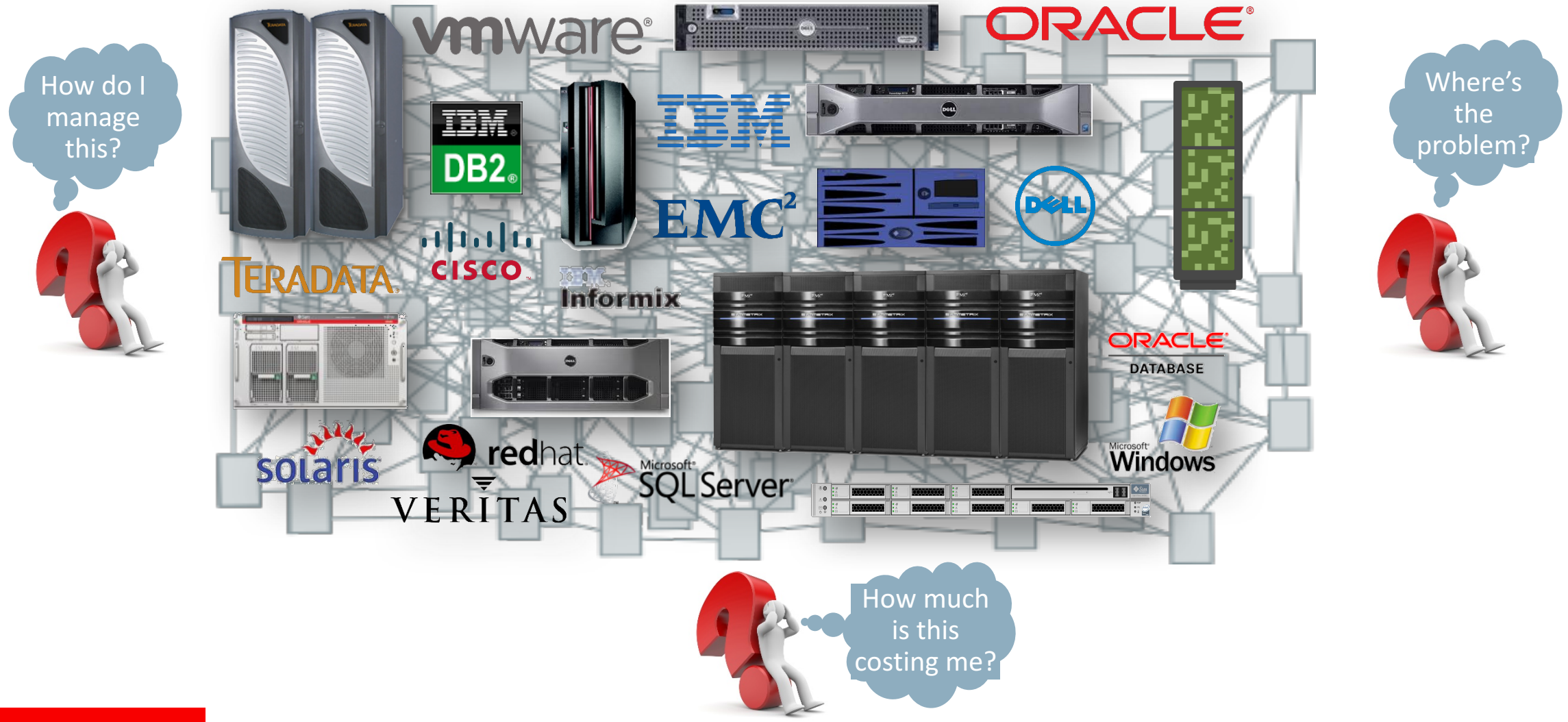
Agenda

1. Exadata: Foundation Architecture for the Cloud
2. Exadata Cloud
3. Best Practices
4. Customer Case Study: Detroit Water & Sewerage
5. Exadata Cloud Commercial Models
6. Summary

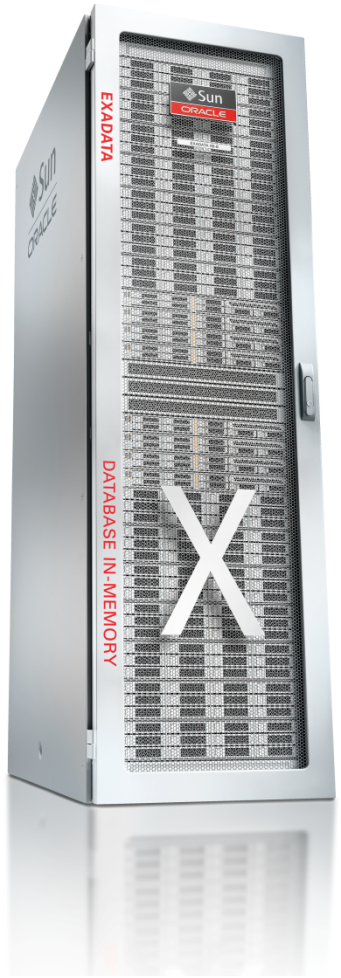
Enterprise IT … with Time

Chaos, Lack of Accountability, Operational Inefficiencies



Exadata Database Machine

Performance, Availability and Security



Best Platform for Oracle Databases on-premises and in the Cloud

Enabled by:

- **Single-vendor accountability**
- **Exclusive focus on databases**
- **Deep hardware and software integration**
- **Revolutionary approach to storage**

Proven at Thousands of Critical Deployments since 2008

OLTP – Analytics – Data Warehousing – Mixed Workloads

- Petabyte Warehouses
- Online Financial Trading
- Business Applications
  - SAP, Oracle, Siebel, PSFT, …
- Massive DB Consolidation
- Public SaaS Clouds

4 OF THE TOP 5
BANKS, TELCOS, RETAILERS RUN EXADATA

Exadata Architecture: Built for the Cloud

Most scalable, available, high-performing Database platform

Scale-out with Fastest CPUs	Ideal server architecture
Unified ultra-fast InfiniBand	Ideal network architecture
Scale-out servers + DB offload	Ideal storage architecture
Ultra fast NVMe PCIe flash	Ideal flash architecture
Tier PCIe flash & 10TB SAS disks	Ideal capacity architecture

Exadata Architecture: Built for the Cloud

No bottlenecks: Ideal for Database Consolidation

- Optimized hardware delivers millions of IOPs & ¼ ms latency
- Uniquely prioritizes I/O by PDBs, database jobs, users, service, etc.
- Uniquely prioritizes critical DB network messages
- Uniquely unifies CPU & I/O prioritization for end-to-end customer assurance

Numerous customers have implemented custom private clouds (Database as a Service) with Exadata infrastructure

Exadata Cloud is the next Evolution …

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Database Platform as a Service (PaaS)

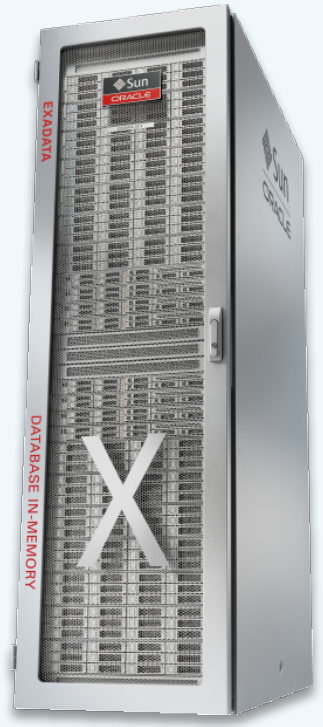
Imperatives for Data Management in the Cloud

Predictable service consumption model	Pay for only what you subscribe to
Provisioning for business spikes	Minutes/hours, not days/months
Focus on core business	No $$ & time on infrastructure management
No more data center buildouts	CAPEX can be prohibitive
Technology refresh	Stay current with latest innovations

Exadata Cloud Services:
Most powerful cloud-based data management solution

Exadata Cloud: Deployment Models

Core Exadata Platform



Database PaaS Services

Flexible Subscription Model

Oracle-Managed Exadata Infrastructure

Exadata Cloud at Customer

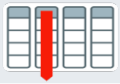
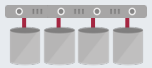
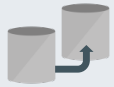
In Customer Data Centers

Exadata Public Cloud Service

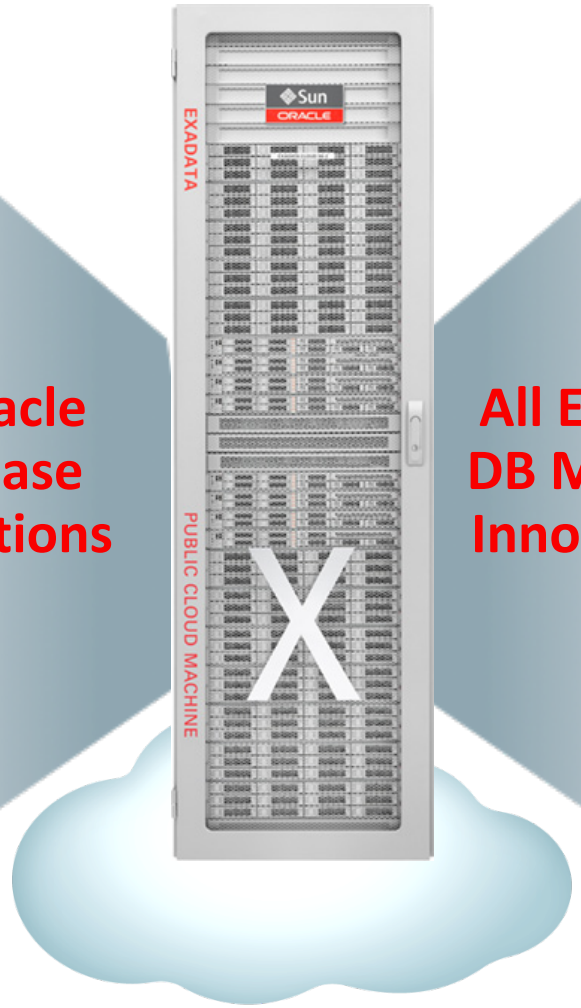
In Oracle Public Cloud Data Centers

Exadata Cloud: Available with FULL Database Functionality

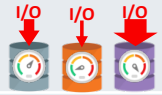
Decades of Database Innovation Proven at Millions of Mission-Critical Deployments

	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	
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 Public Cloud Service

- Most powerful data management cloud service available today
  - **Full** Oracle Database with **ALL** Database Options and Database EM Packs
  - Based on Exadata: most scalable, available, robust Database Platform
  - Cloud-based pricing, with Oracle cloud-based provisioning
  - Customers have full control of their databases
- Available at Oracle's public cloud data centers
  - Powered by Oracle Cloud Infrastructure
  - Oracle manages all Exadata and data center infrastructure
- Ideal customer profile
  - Need for a consumption-based cloud strategy
  - Use cases and workload identified to migrate to public cloud
  - No restriction regarding data residency laws

Oracle Cloud Data Centers (powered by Oracle Cloud Infrastructure)

Exadata Cloud at Customer

- Most powerful data management cloud service available today
  - **Full** Oracle Database with **ALL** Database Options and Database EM Packs
  - Based on Exadata: most scalable, available, robust Database Platform
  - Cloud-based pricing, with on-site provisioning by Oracle
  - Customers have full control of their databases
- Available at customers' data centers
  - Customer responsible for data center infrastructure
  - Oracle manages all Exadata infrastructure
- Ideal customer profile
  - Customers who want cloud benefits but not ready for public cloud
  - Customers with systems too complex to move to public cloud
  - Customers who require compliance with data residency laws
  - Customers with apps that are sensitive to WAN network latency

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1. Exadata: Foundation Architecture for the Cloud
2. Exadata Cloud: Public Cloud Service
3. Best Practices
4. Customer Case Study: Detroit Water & Sewerage
5. Exadata Cloud Commercial Models
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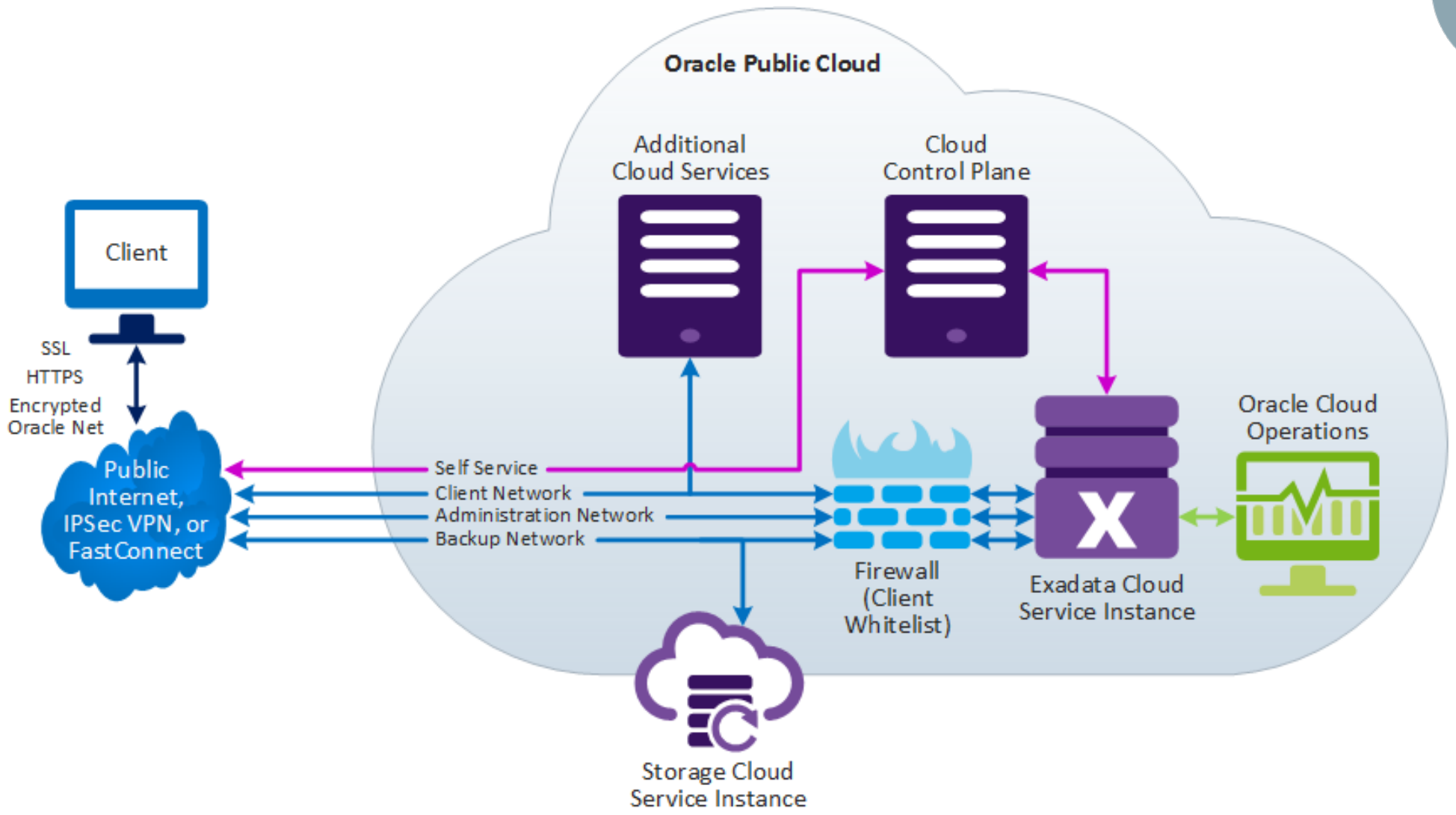
Service Details

Allocation Unit: 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

- Customer requests Exadata Service on Oracle Cloud Portal
  - Provides system size; Database names, sizes, versions, etc.
  - Pricing is based on Database CPU Cores enabled
- Start with a minimal number of cores within a Quarter Rack Shape
  - Minimum: 16 (X5) / 22 (X6) cores, enable additional cores on demand
  - Access to all storage, flash, memory and IOPs for minimum configuration
  - 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 and Exadata software includes all options and features
  - Oracle Database 11.2.0.4, 12.1.0.2 and 12.2.0.1 available
  - Automation tools provided to backup, update, upgrade, and add databases
- Customers manage databases, Oracle manages all infrastructure
- MAA Configuration / Best Practices are built-in

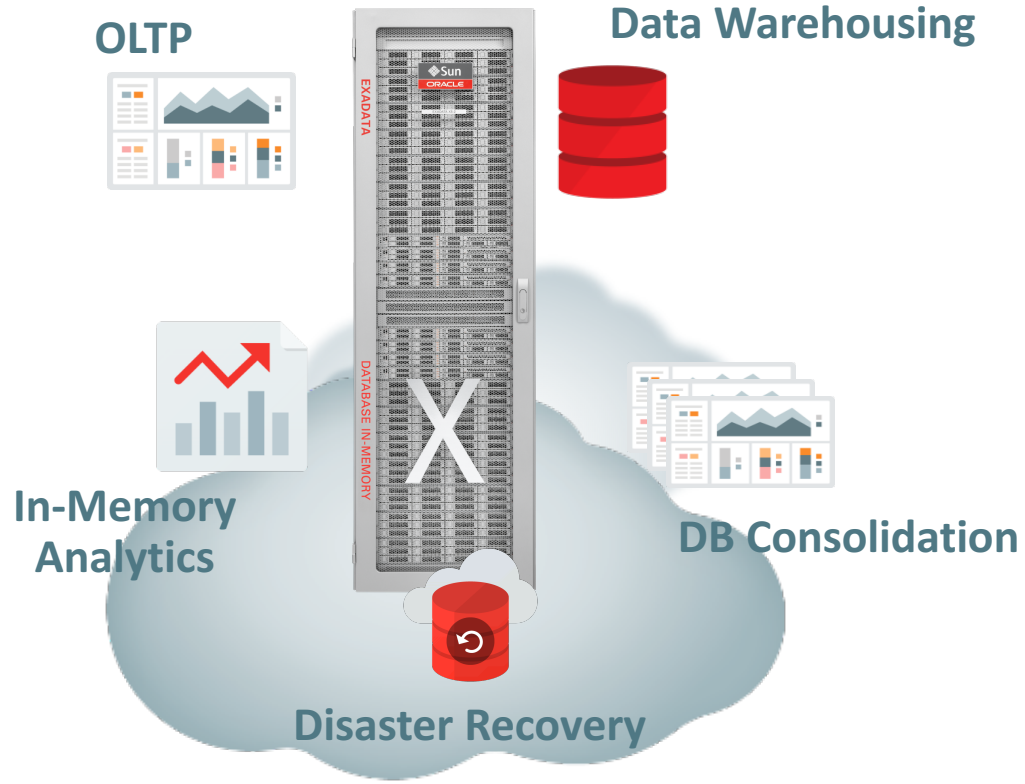
1. *OCPU = Oracle CPU = 1 usable compute core*
2. *After provisioning DATA and RECO disk groups, actual space depends on space needed for local backups*

Architecture: Exadata Public Cloud Service

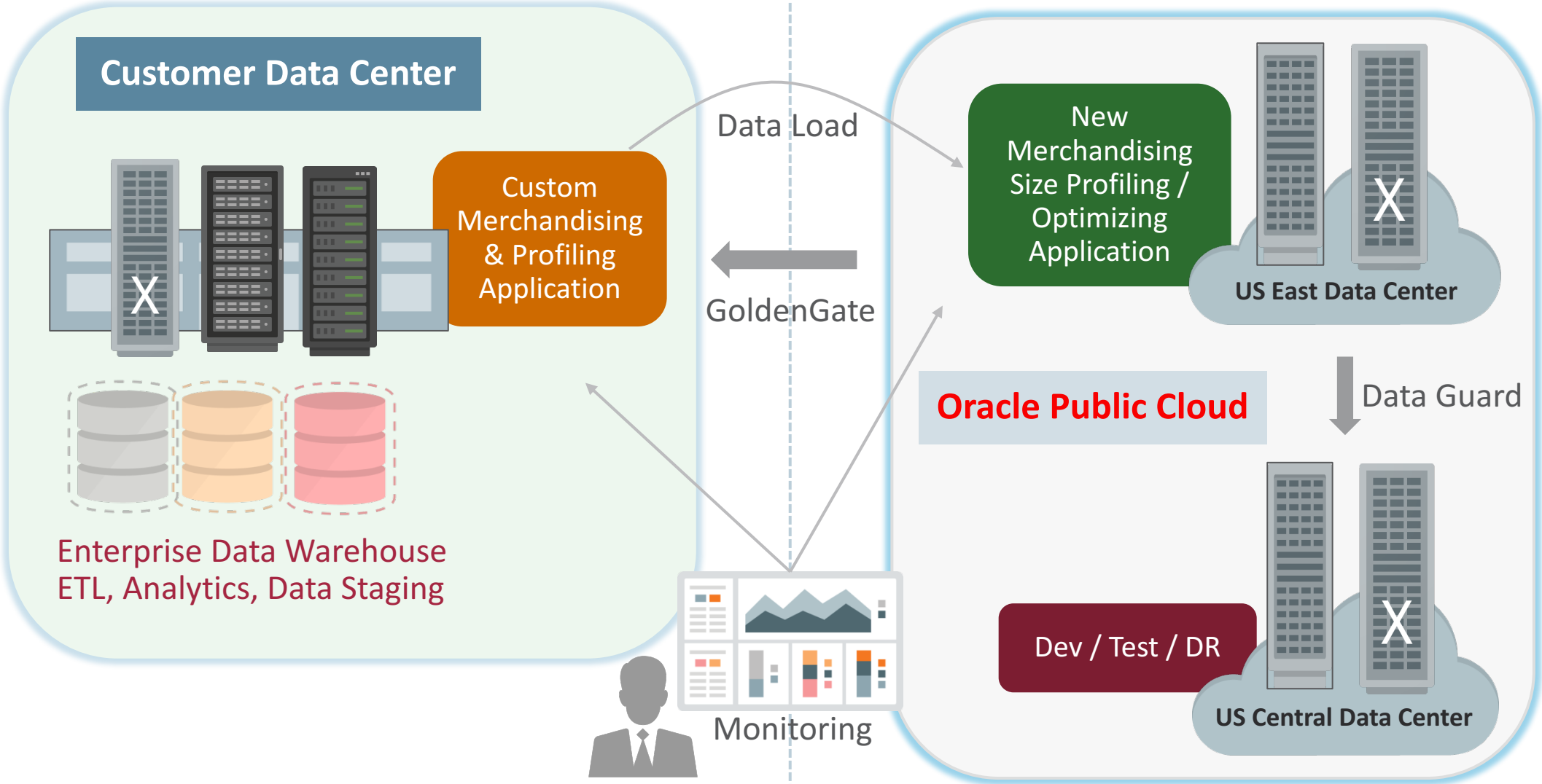


Use Cases: Exadata Public Cloud Service

- Mission Critical Production Databases
  - Single large database or consolidate many
  - OLTP, Data Warehousing, Analytics, …
  - Well-contained applications are ideal fit
- Disaster Recovery and Reporting
  - Facilitated by Active Data Guard
- Test, Development, Certification, Try before Buy



Elastic Scaling with Exadata Cloud Service: Large Retailer



Compute Cloud Service

- Packaged app, mid-tier business logic, test suite

Exadata Cloud Service

- High-perf DB consolidation: Prod & Dev / Test / Standby Databases, Online Bursting for DR & business peaks

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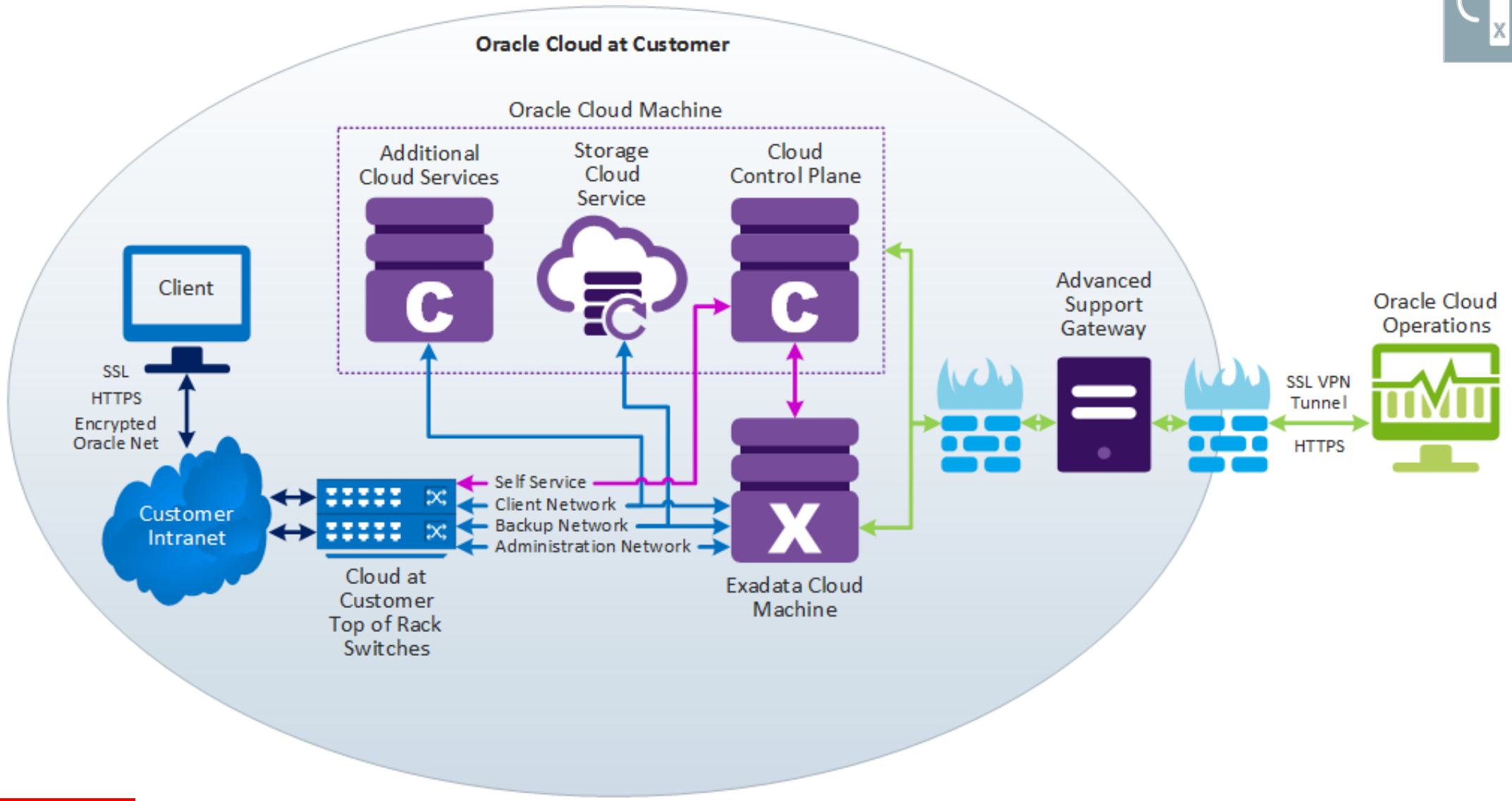
Service Details

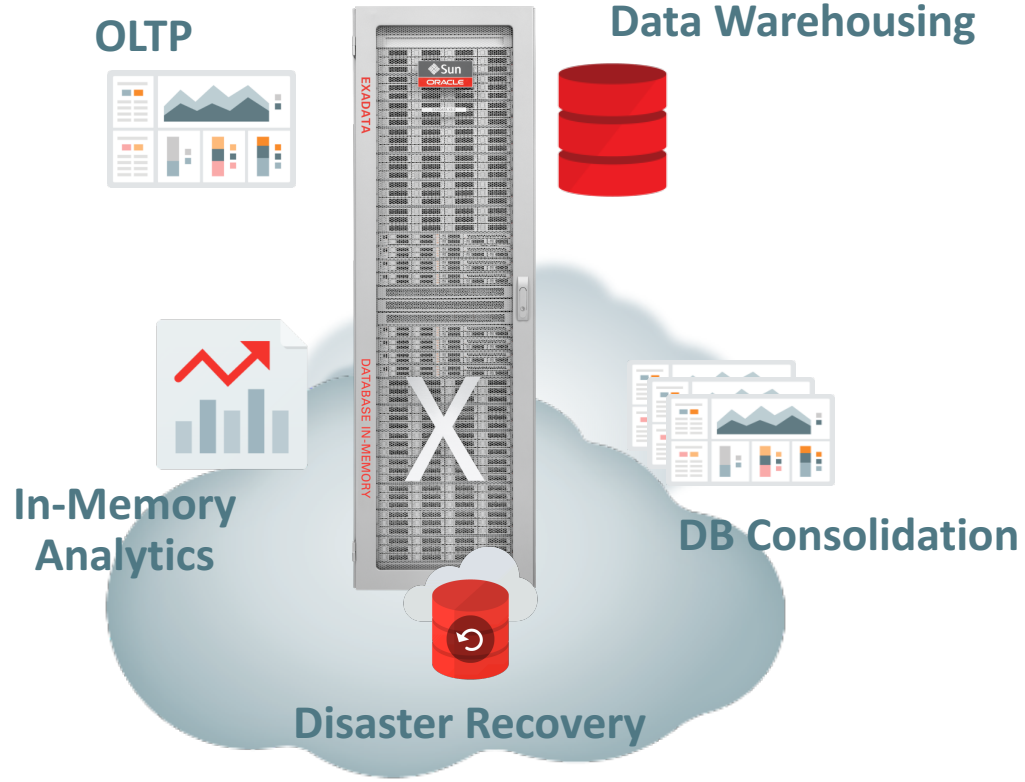
- Same Services as Exadata on Public Cloud
  - Includes Exadata HW (X6) & SW, Database SW
  - Oracle Database 11.2.0.4 or 12.1.0.2 with Grid Infrastructure 12.1.0.2
  - Oracle Database 12.2.0.1 with Grid Infrastructure 12.2.0.1
  - All database options and features, Exadata features, DB Management Packs
- Oracle Cloud Control Plane required to deploy cloud software
  - One Control Plane can manage multiple ExaCMs in same metro region
  - Control Plane Compute (OCM) can be leveraged to deploy additional cloud services such as JCS, DBCS etc. to bring full stack cloud to customer
- Start with minimal cores within a rack, scale as needed
  - Minimum: 16 cores, enable additional cores on demand
  - Dozens of terabytes of storage, hundreds of thousands of IOs per second
  - Can expand to 100s of cores, 100s of TB storage, Millions of IOPs
- Customers manage databases, Oracle manages infrastructure
- MAA Configuration / Best Practices are built-in
- Requires minimum 4-year subscription

Architecture: Exadata Cloud at Customer

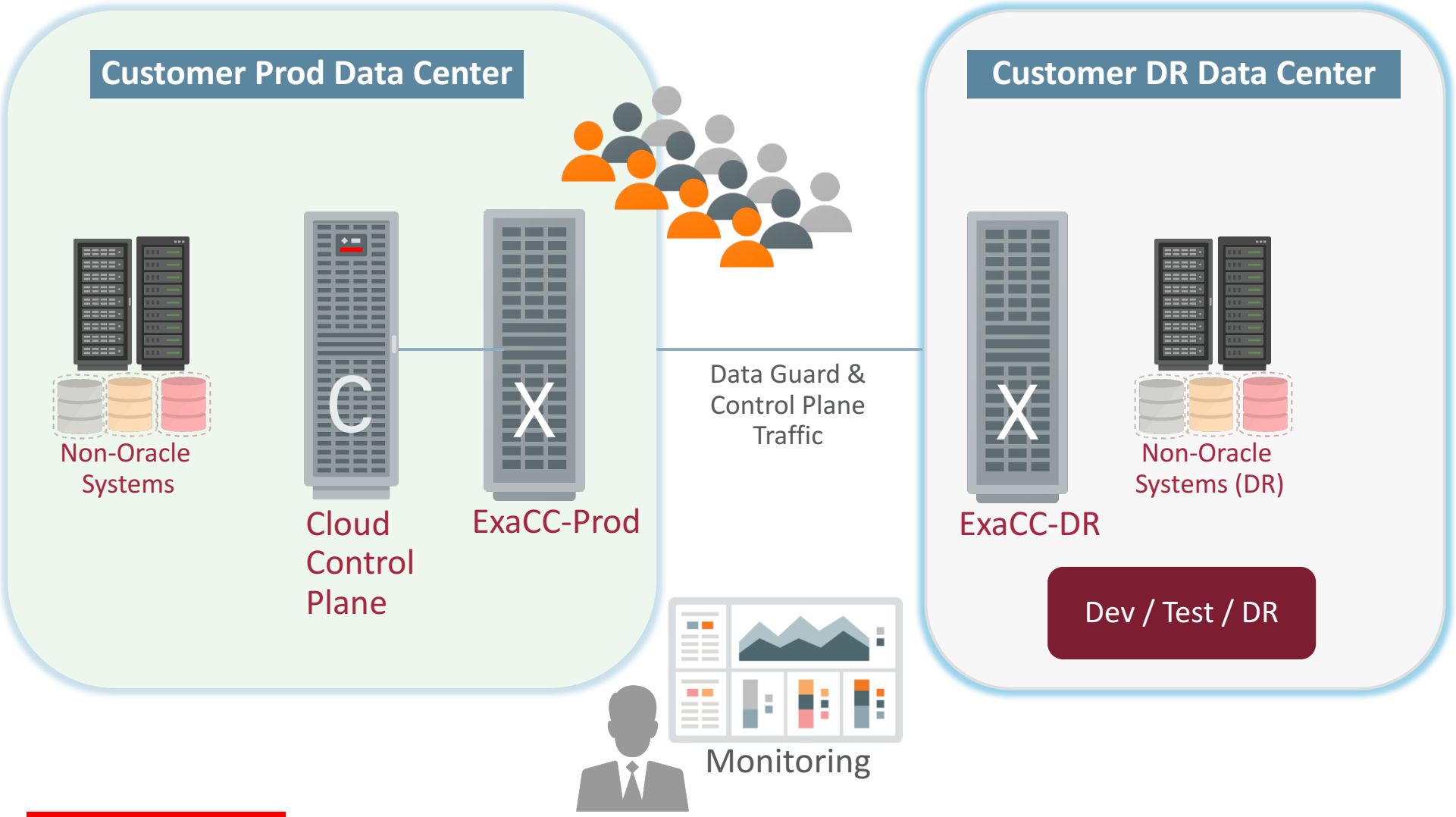


Use Cases: Exadata Cloud at Customer

- Mission Critical Production Databases
  - Single large database or consolidate many
  - OLTP, Data Warehousing, Analytics, …
- Disaster Recovery and Reporting
  - Facilitated by Active Data Guard
  - Can serve as DR for existing on-premises Exadata
- Test, Development, Certification,
  Try before Buy
- Cloud-based database deployments: business-units, compliance/regulatory, SLA-based, …



Exadata Cloud at Customer: Large Financial Institution



- ✓Corporate mandate for a cloud-based IT strategy
- ✓Applications are too mission-critical to be deployed on generic H/W architecture
- ✓Focus on self-service agile provisioning of Database services
- ✓Standardized deployment models that can quickly scale for business spikes
- ✓Data too sensitive to leave private data centers
- ✓All data needs to be encrypted
- ✓Simple, predictable licensing model

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Best Practices: Exadata Public Cloud Service

- Application Services
  - Identify well-contained applications as the target for Cloud transition
  - Deploy middle-tier on Oracle Cloud Infrastructure for low-latency connectivity
  - Use Fast Connect solutions to enable secured, low-latency connectivity from on-premises applications
- Security
  - Enable least permissive rules during white-listing ingress IP addresses and enabling ports in your cloud dashboard
- Updates
  - Oracle provides regular Database and Security updates when available
  - Keep database deployment updated to recommended levels
- Disaster Recovery (DR) / Data Validation
  - For DR within Oracle Cloud, agree on standby database location, check DR preparedness by doing test Data Guard switchovers
  - Verify backup & recovery processes by regularly recovering databases from cloud backups

Best Practices: Exadata Cloud at Customer

- Organizational
  - Recommended: a centralized cloud architecture team, comprised of technical leads from database, network, systems, storage
  - This team should function as the cloud liaison in all cloud-related conversation with Oracle
  - Agree on a clear deployment / provisioning plan and communicate that to Oracle
- Network Connectivity
  - Familiarize with network design considerations: network connectivity to Oracle Cloud at Customer configuration is through Oracle-provided Layer 3-based Top of the Rack (TOR) switches
  - Review bandwidth requirements for client/application traffic and backup/data load/Data Guard redo transport traffic
  - Review isolation requirements: each business unit may require its own Exadata Cloud at Customer deployment
- Roles and Responsibilities
  - Understand / agree on roles and responsibilities between your operations team and Oracle Cloud Ops
  - Agree on Infrastructure / Database update cadence: quarterly updates recommended
  - Review new cloud functionality that is enabled with the periodic control plane updates

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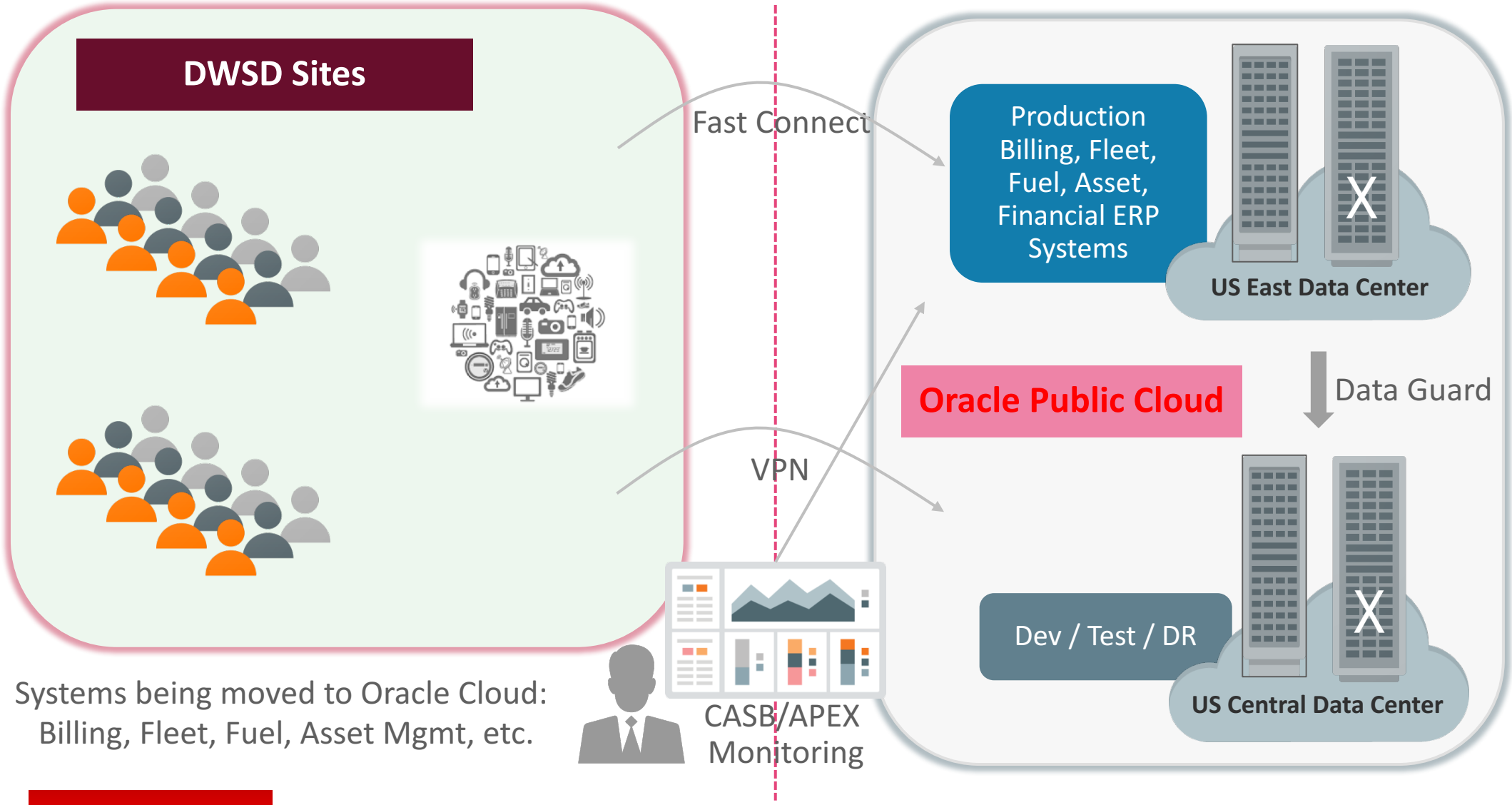
Detroit Water & Sewer

A 150 Year old Startup

- No More Business as Usual
- Reinventing
- Rediscovering
- Cloud First
- Data Rich
- Analytics

DETROIT
Water & Sewerage
Department

Oracle Cloud Configuration Plan



Compute Cloud Service

- Packaged app, mid-tier business logic, test suite

Exadata Cloud Service

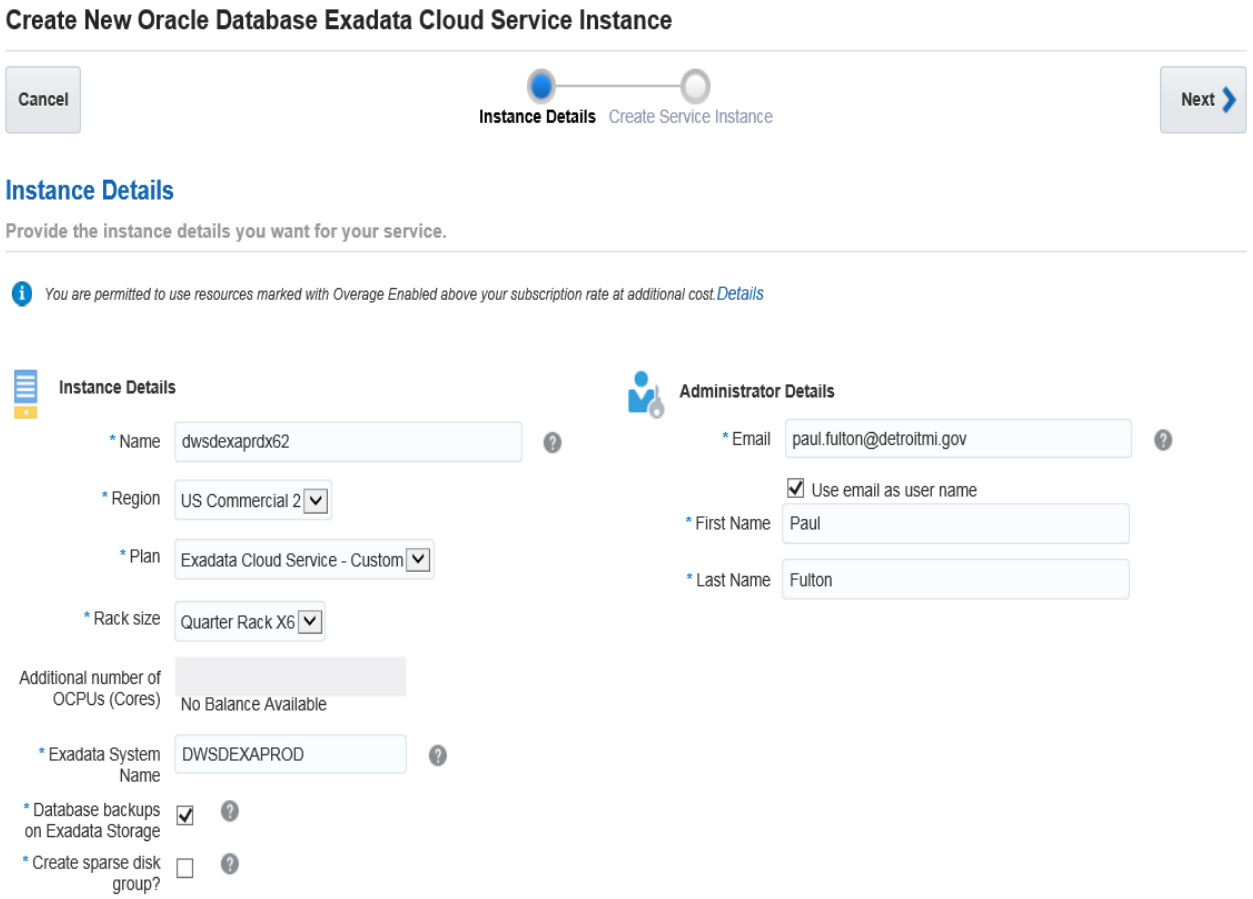
- High-perf DB consolidation: Prod & Dev / Test / Standby Databases

Service Provisioning

Step 1

- Determine Naming Convention
- Conduct Risk Assessment
- Backup Strategy
- Service Accounts
- Snapshot Strategy

- Gotcha #1 – Region
  - Changes requires re-order

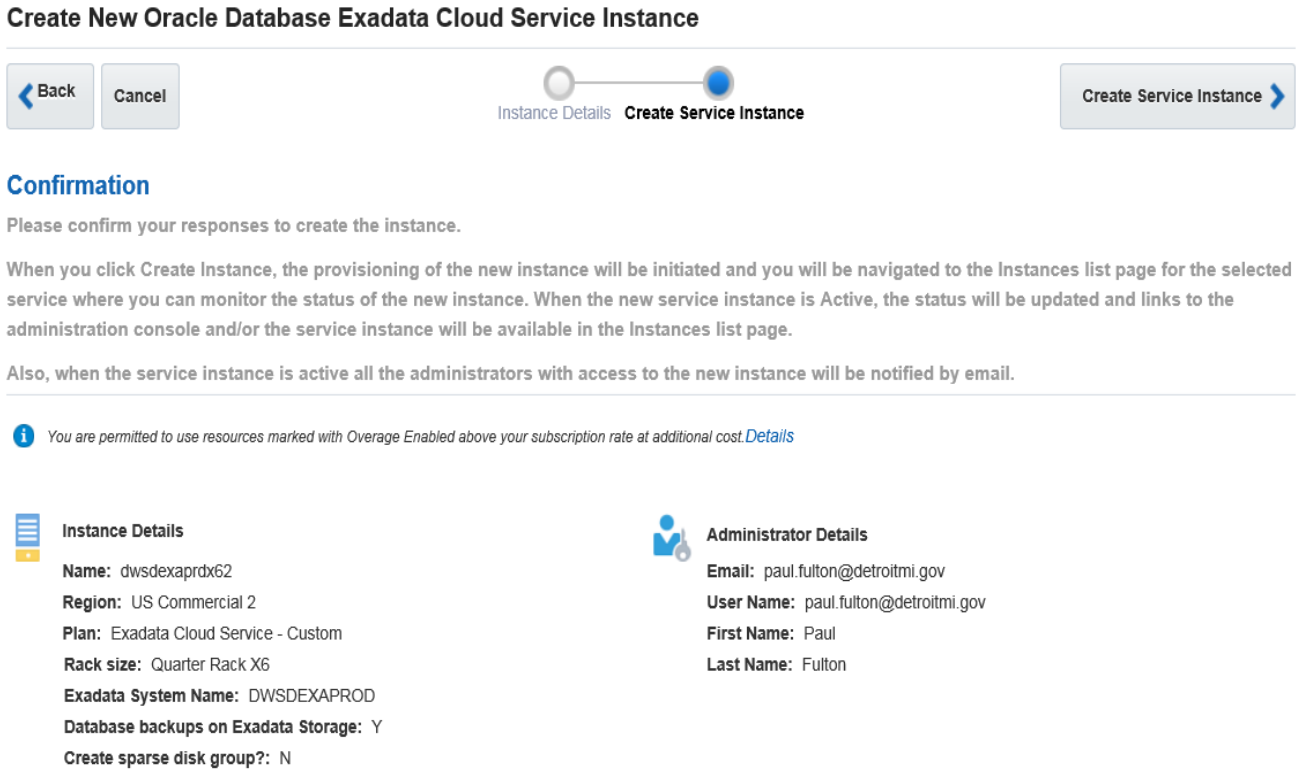


Service Provisioning

Step 2

- Measure Twice
- Cut Once

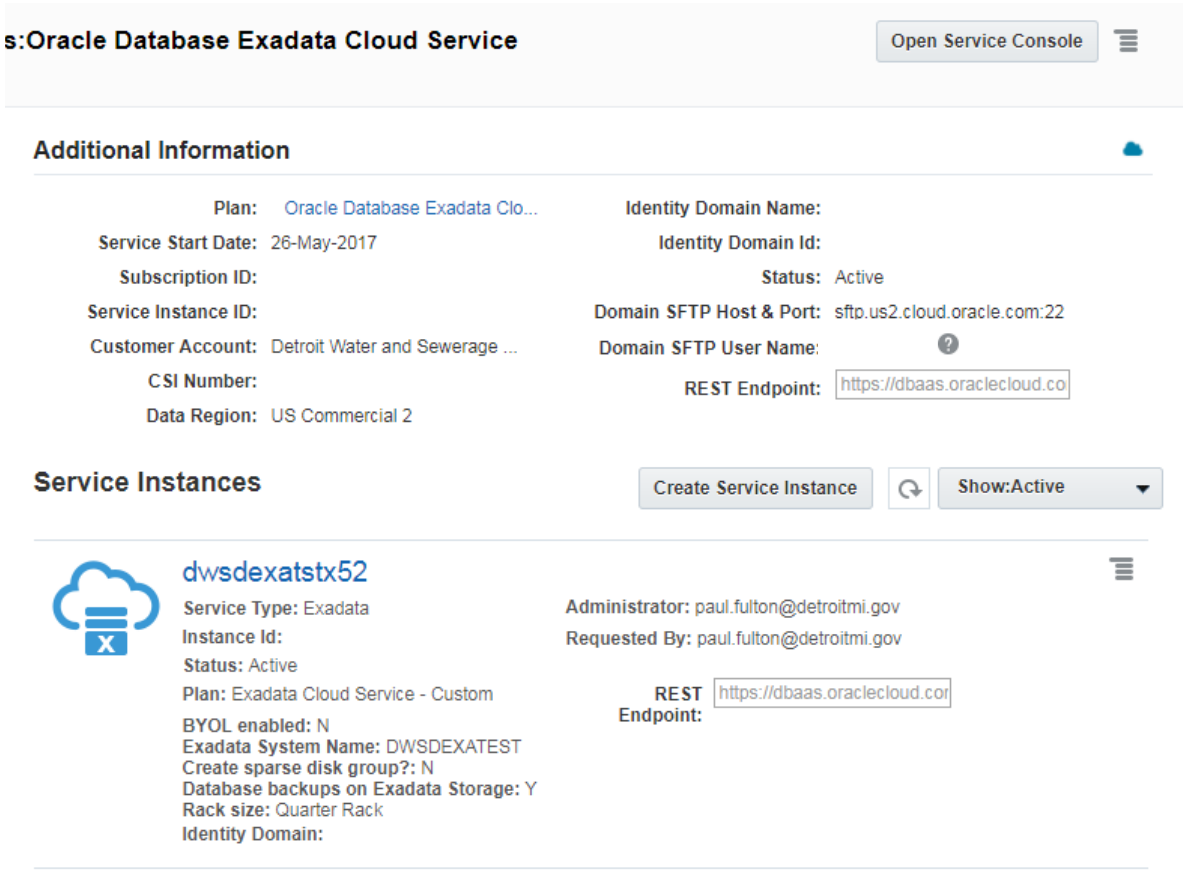
- Gotcha #2 – Backups & Snaps
  - Errors will cause problems
  - Min 2 week delay



Service Provisioning

Complete

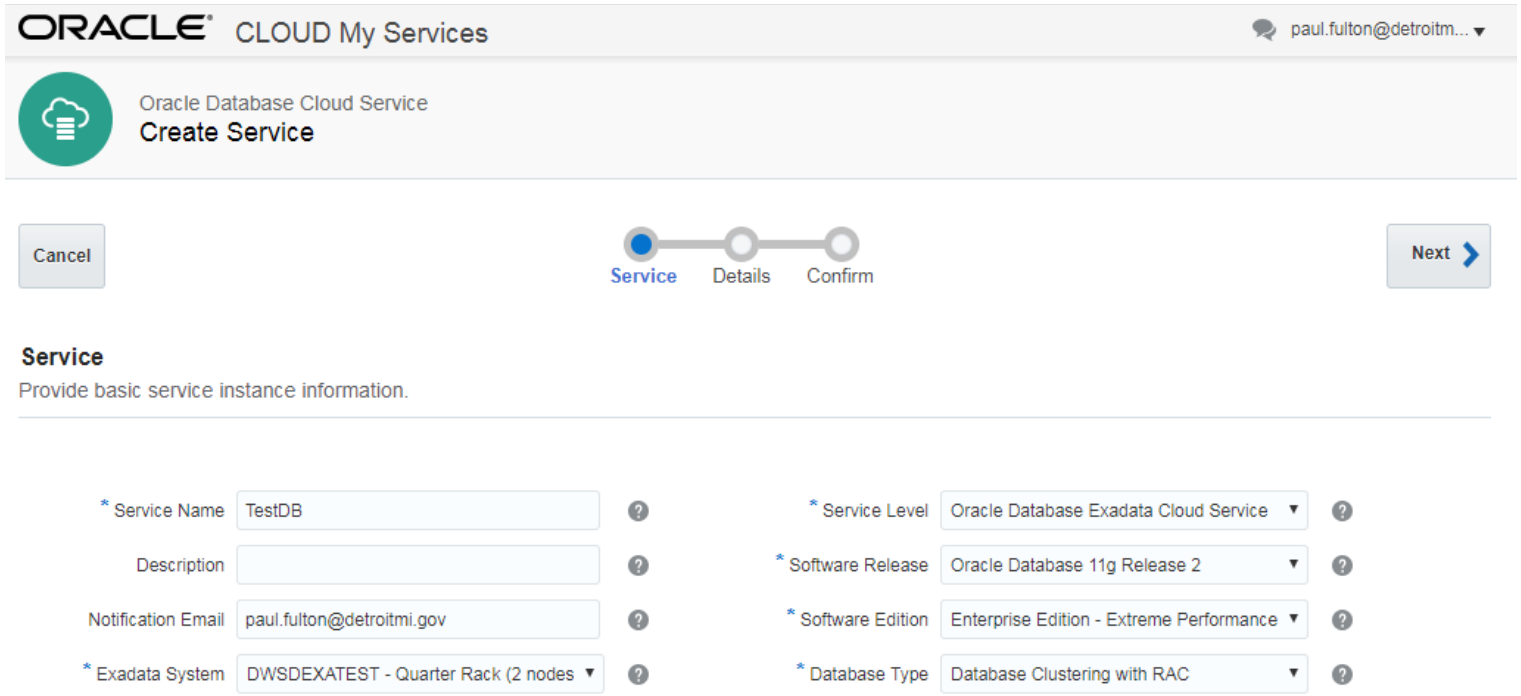
- Takes a couple of hours



Database Creation

Step 1

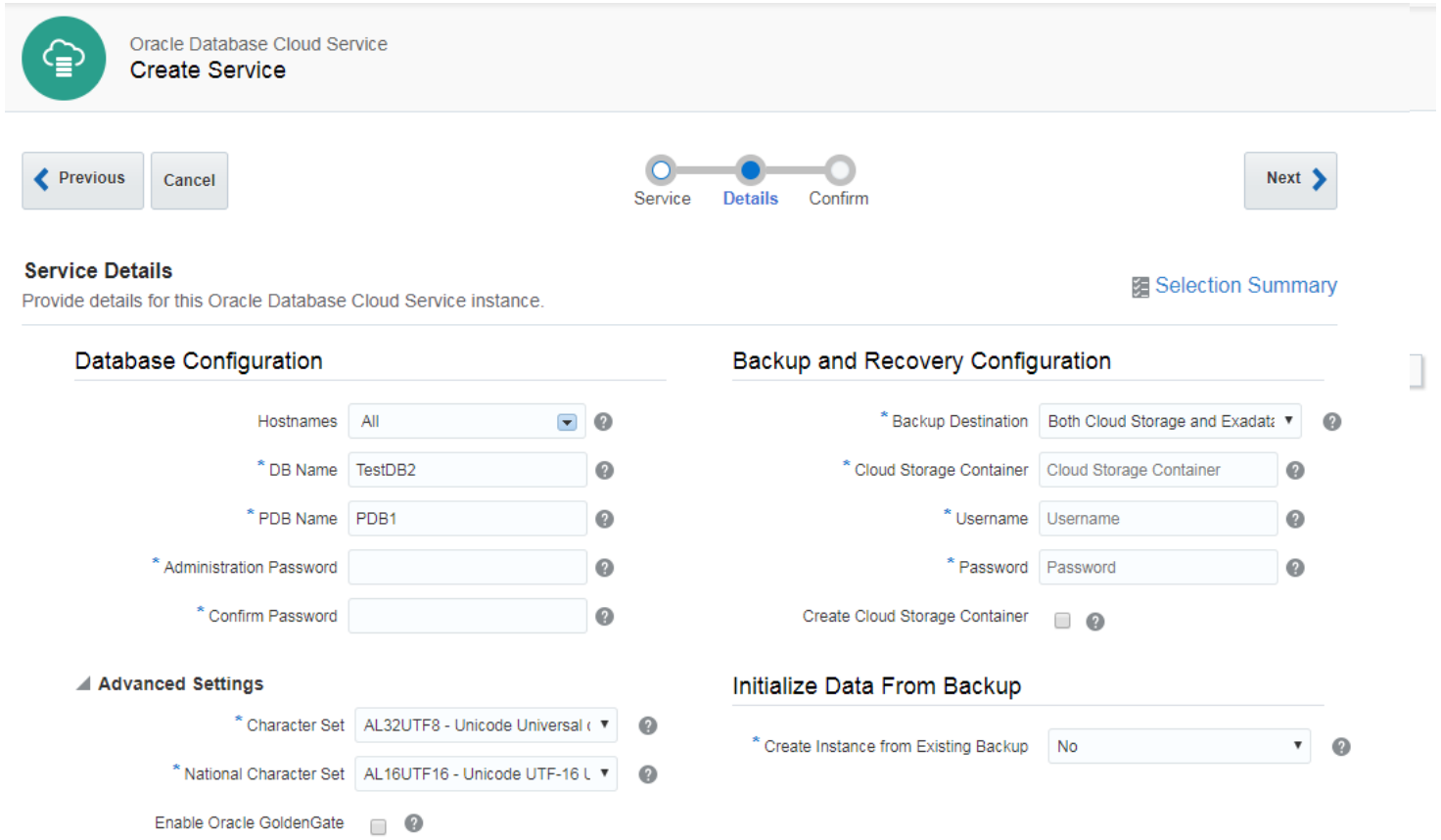
- Uses DBaaS Console
- Basic Info: Name, Description
- Only Purchased Options
- Only Configured Services
- Software Release Level



Database Creation

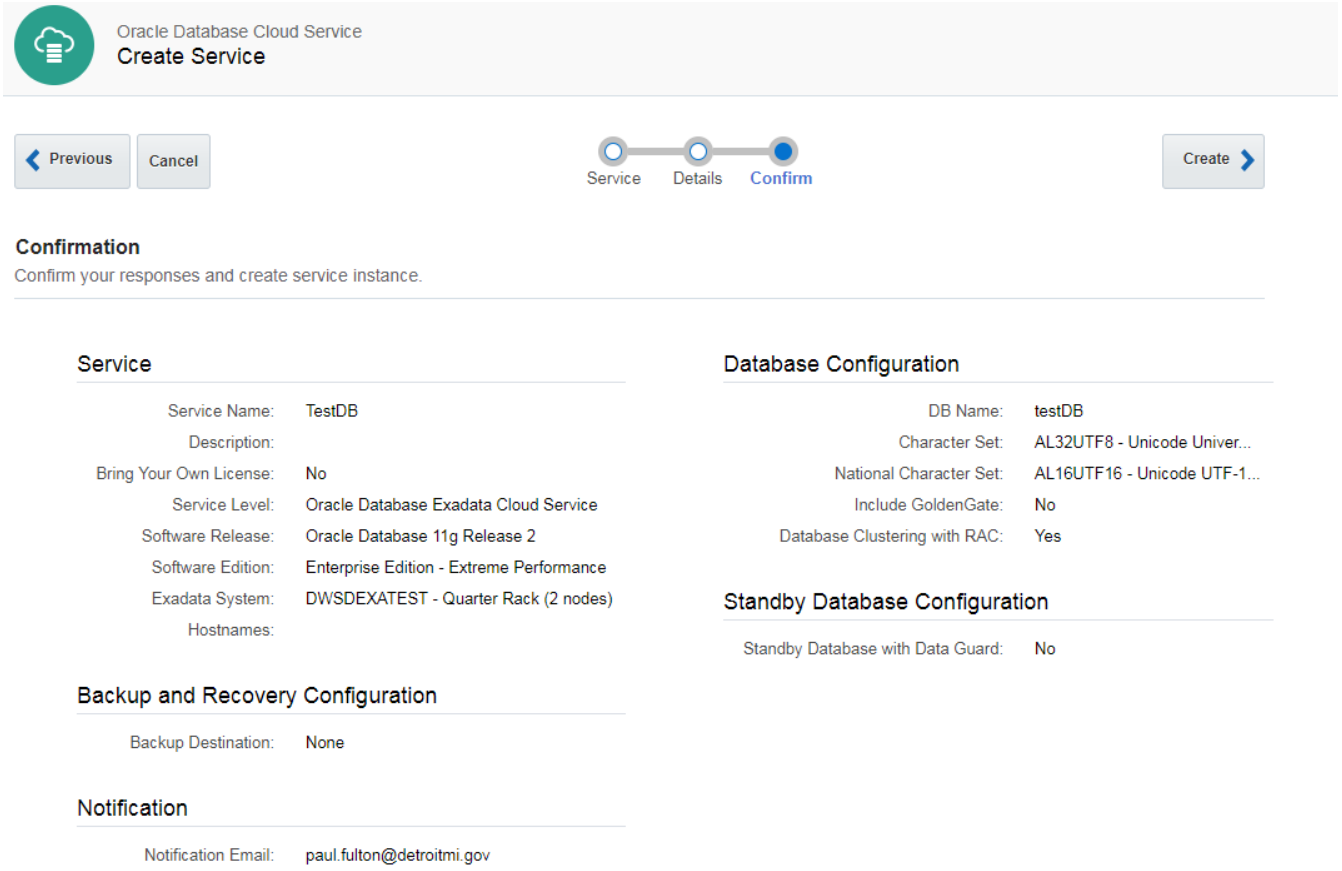
Step 2

- CDB or PDB Name
- Sys Password
- Backup and Recovery (see manual)
- Initialization
- Advanced Settings
- Different Options 12c vs 11g



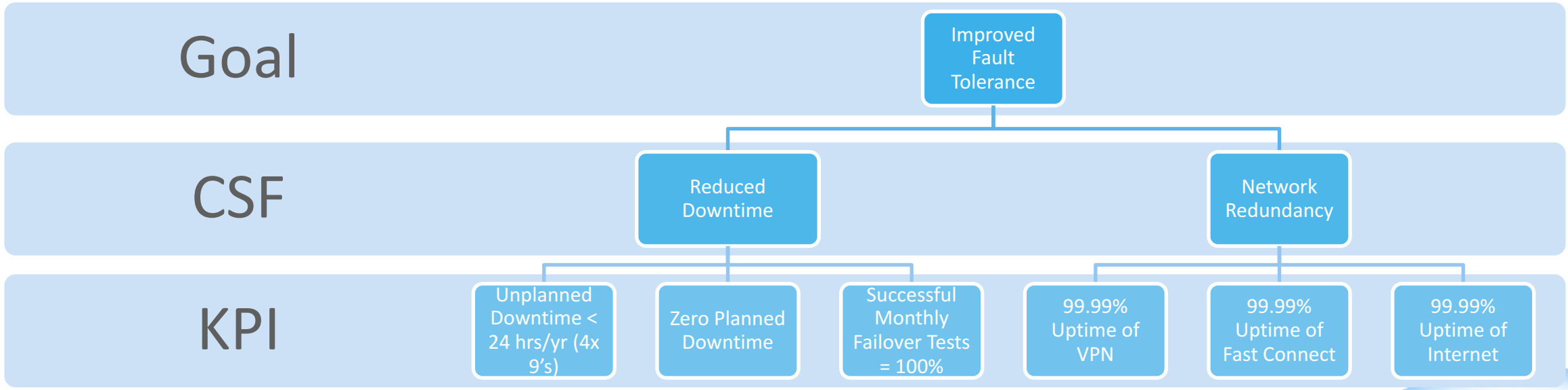
Database Creation
Confirmation

- Confirmation of settings
- Restrictions based on Entitlement



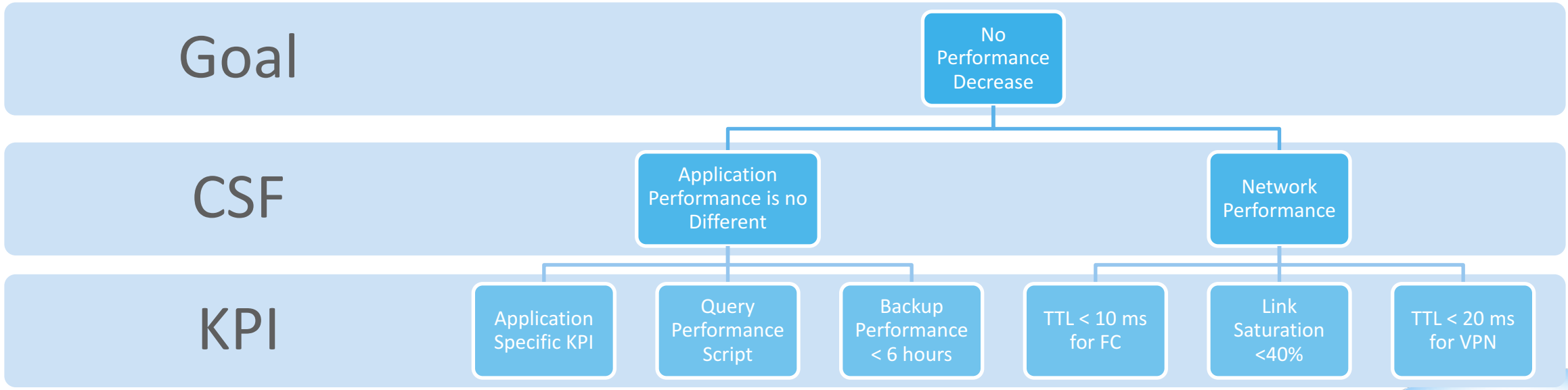
Planning for Success

Goal: Improved Fault Tolerance



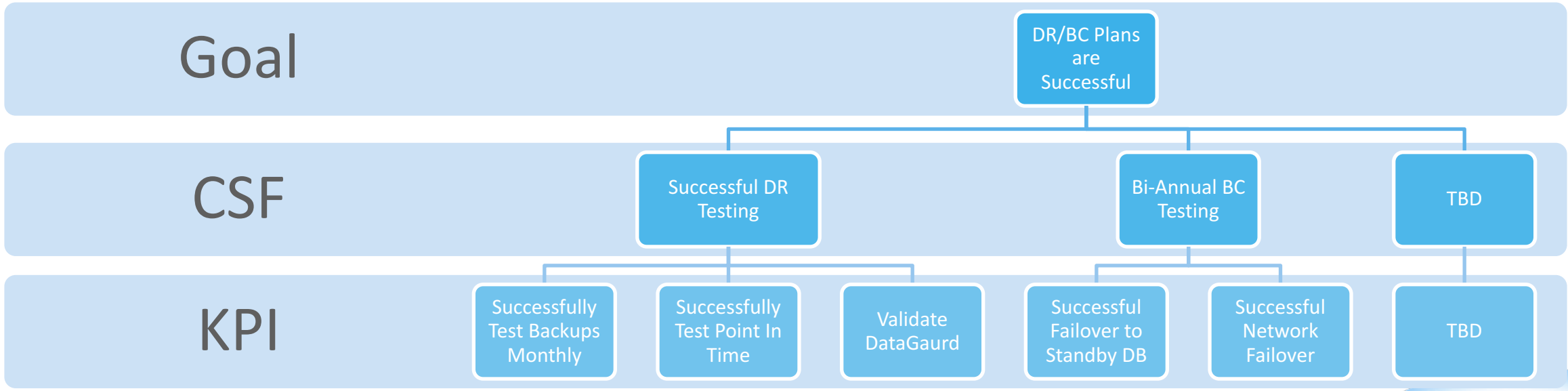
Planning for Success

Goal: No Performance Difference



Planning for Success

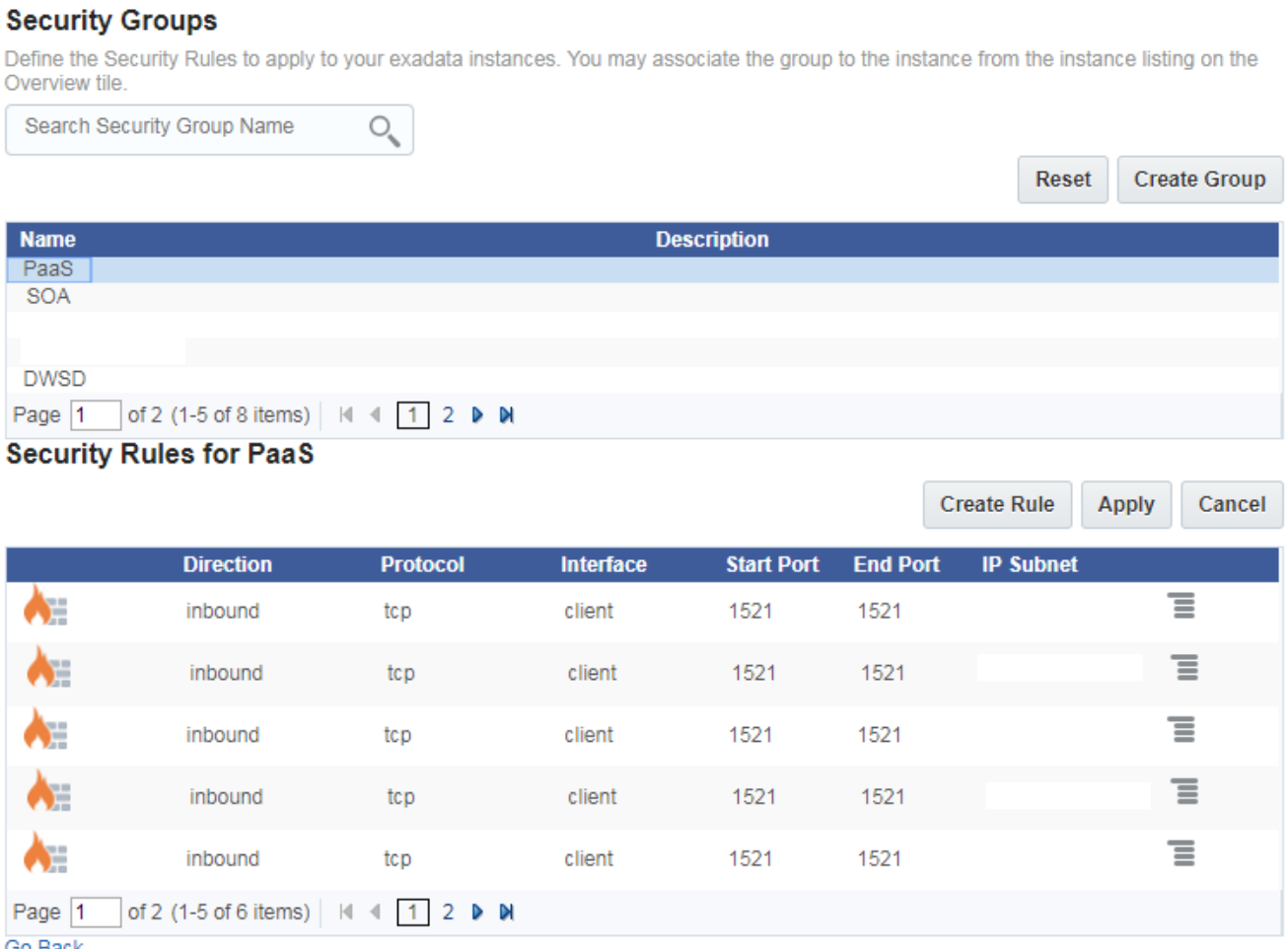
Goal: Disaster Recovery / Business Continuity



Exadata Firewalls

Overview

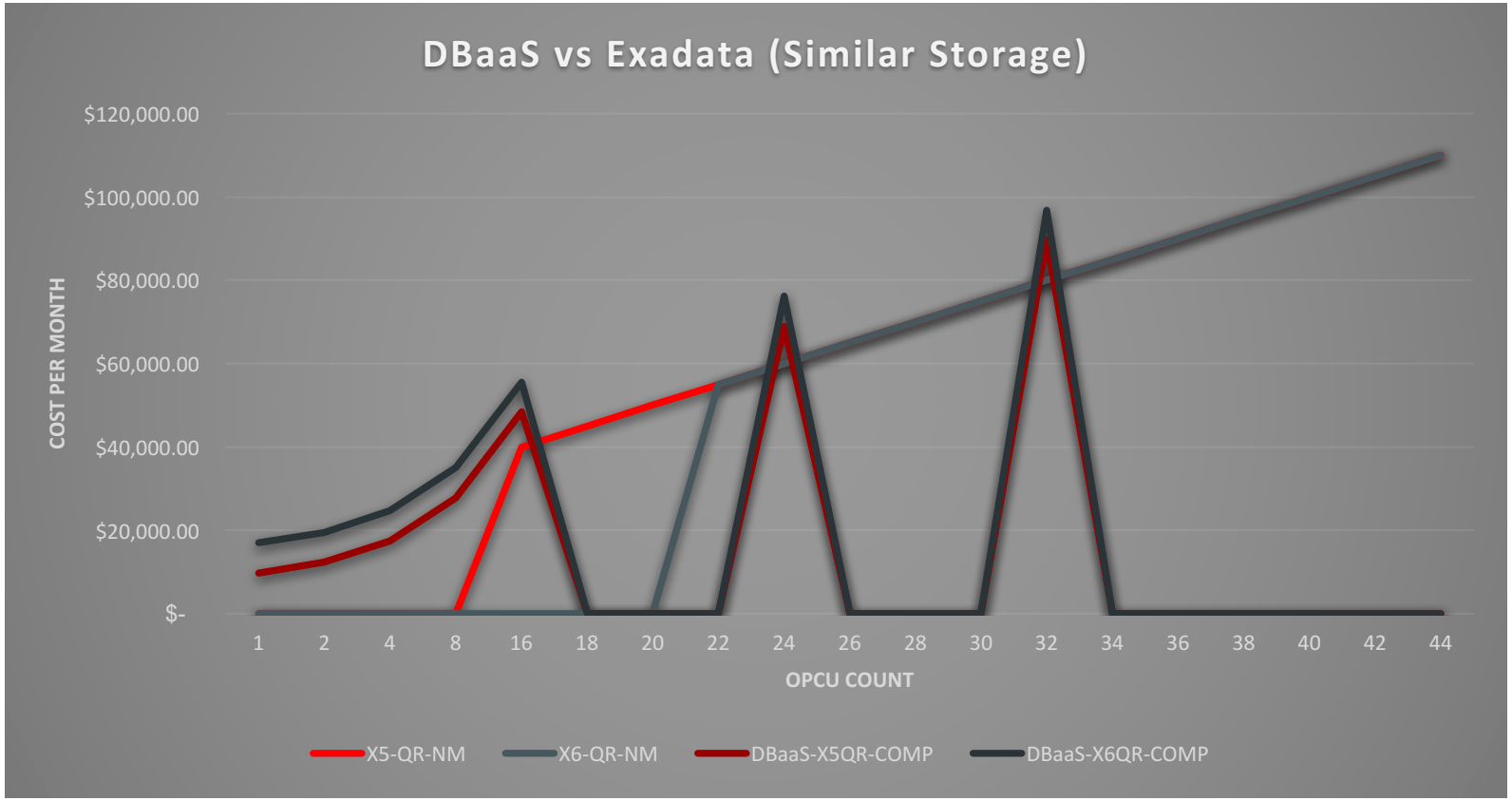
- Limited
- CIDR
- Oracle Firewalls are Unique
- Plan



Exadata for Managers

Overview

- EXPENSIVE
- DBaaS vs Exadata
- Justification
- Risk Assessments



Exadata for Managers

ROI Calculation

- Define Line of Business
- Assess Cost of LoB
  - Material
  - Staff
- Assess Risk
  - In-Tangible Costs
  - Tangible Costs
- Determine Configuration Cost
  - Oracle Implementation Costs
  - Maintenance Costs
- Timing – Use upgrades as swing migrations
- Staffing Required
  - Skillsets
  - Quantity

When the rubber hits the road, with Exadata Cloud Service, DWSD was able to save approximately, 15-20% on existing outsource contracts.

Staffing

- Replacing Outsourced Staff
  - Hiring 2x Cloud Admins
  - Hiring 2x Cloud Database Admins
  - Hiring 1x Cloud Services Manager
  - Hiring 2x Applications Analysts
- Oracle Cloud Success Team
  - USE THEM

The City of Detroit is an equal opportunity employer. No applicant shall be discriminated against on the basis of race, religion, color, age, gender, national origin, disability, or other criteria prohibited by City, State or Federal law.

To qualify for a job, an applicant must meet the education, training, experience and any applicable license or certificate requirements for the job classification. It is the applicant's responsibility to provide acceptable proof of their work record and personal history.

City of Detroit
Human Resources Department
Employment Services Division
Coleman A. Young Municipal Center
2 Woodward Avenue, Suite 314
Detroit, Michigan 48226

Office of Chief Financial Officer

- Job Openings

Buildings, Safety Engineering and Environmental Department

- Job Openings

Department of Innovation and Technology

- Job Openings

Department of Transportation

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Exadata Cloud Commercial Models: At a Glance

	Exadata (Traditional)	Exadata Cloud
Offering	Product	Service
Acquisition Method	Purchase, Lease	Subscribe
Acquisition Items	Exadata Hardware, Exadata Storage Software, Oracle Db, Oracle Db Options, Support, Services	PaaS
Asset Owner	Customer (usually)	Oracle
Term Length	Follows Customer's Depreciation Schedule	Min 1 Month (Public Cloud Service) 4 Years (Cloud at Customer)

Exadata Public Cloud Service vs Cloud at Customer

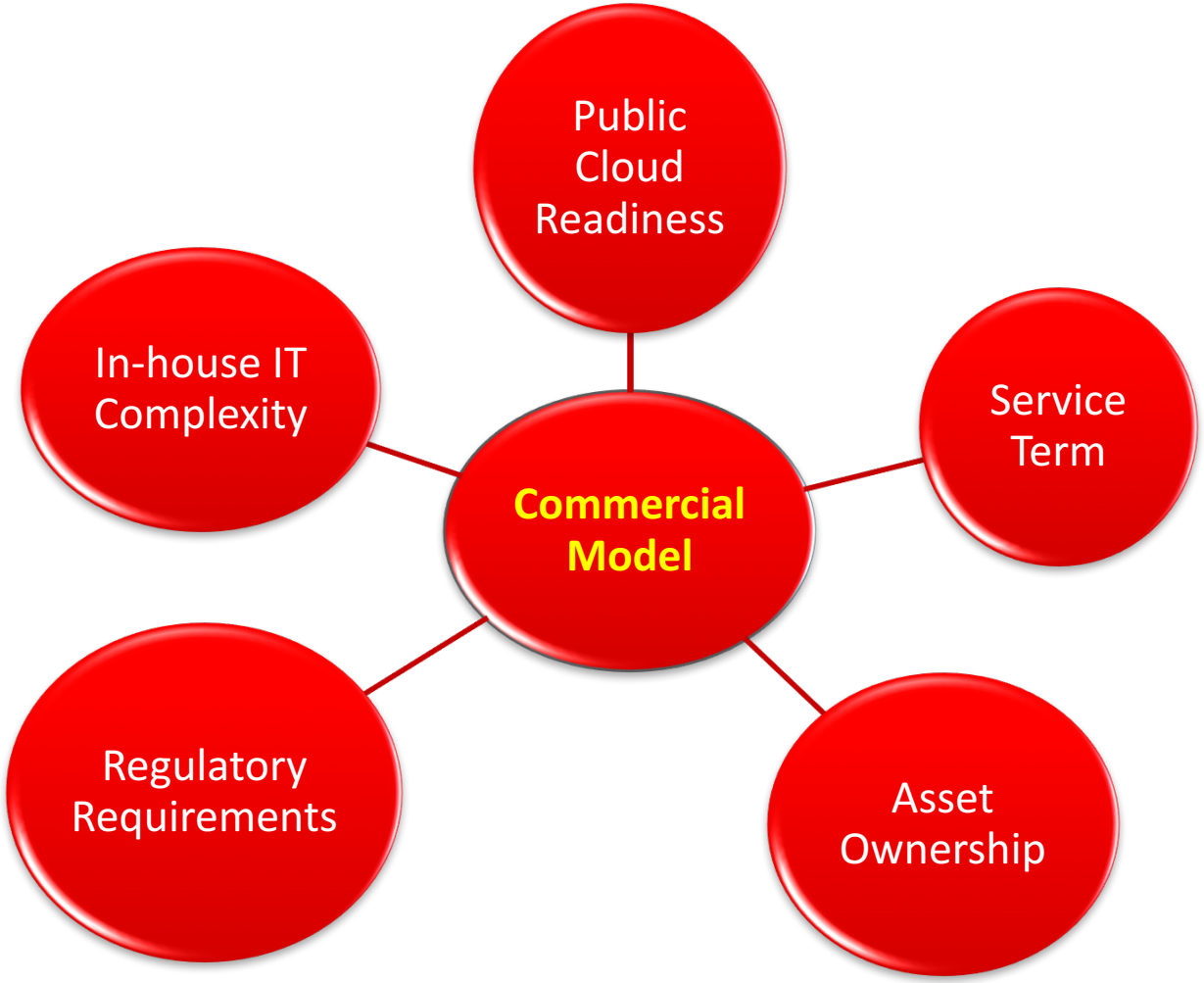
	Exadata Public Cloud Service	Exadata Cloud at Customer
Service Location	OCI Data Centers	Customer or Partner
Term Length	Min 1 Month	4 Year
Additional Service Requirements	None	Needs Oracle cloud plane per data center (separate subscription)
Contracting Mechanism	Universal Credit Program	4 Year Service Contract

Exadata Cloud at Customer Special Models

- Disconnected Mode: Additional Fees
- Semi Connected Mode: Additional Fees
- Indirect Country Model:
  - Allows customer is certain countries (without Oracle legal entity) to subscribe to Exadata Cloud at Customer
  - Countries Include: UAE, Saudi Arabia, Qatar, Bahrain, Bulgaria, Nigeria, Indonesia

Commercial Model Decision

Same Technology Availability with Different Commercial Constructs



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Cloud, Your Way

100% Compatible, No Application Changes, Consistent Cloud Experience

Private Cloud	Cloud at Customer	Public Cloud
Exadata Database Machine	Exadata Cloud at Customer	Exadata Public Cloud Service
		
Customer Data Center	Customer Data Center	Oracle Cloud
Purchased	Subscription	Subscription
Customer Managed	Oracle Managed	Oracle Managed

Next Steps: Very Relevant OOW Sessions*

- CON6661 - Oracle Exadata: Disruptive New Memory and Cloud Technologies, Monday 2:15 – 3:00, Moscone West 3014
- CON7237 - Better IT Service Delivery: Exadata Cloud Machine and Oracle Cloud Machine, Monday 2:15 – 3:00, Moscone West 3020
- CON6663 - Oracle Exadata Technical Deep Dive: Architecture and Internals, Monday 3:15 – 4:00, Moscone West 3014
- CON1502 - Oracle Cloud at Customer: Why It Makes Sense for Large Enterprises, Monday 4:45 – 5:30, Moscone West 3008
- CON2793 - On Cloud 9 with Speed and Stability, Monday 4:45 – 5:30, Moscone West 3020

- CON6666 - Oracle Database Exadata Cloud Service: Technical Deep Dive, Tuesday 11:30 - 12:15, Moscone West 3006
- CON6668 - Oracle Database Exadata Cloud at Customer: Technical Deep Dive, Tuesday 3:45 - 4:30, Moscone West 3006

- CON6675 - Maximum Availability Architecture Best Practices for Oracle Cloud, Wednesday 11:00 - 11:45, Moscone West 3006
- CON4867 - Oracle Database Exadata Cloud Service Enables Rapid App Delivery, Wednesday 12:00 - 12:45, Moscone West 3011
- CON6390 - UPM and Oracle Database Exadata Cloud at Customer: A Case Study, Wednesday 1:00 - 1:45, Moscone West 3008
- CON6671 - Oracle Exadata Security Best Practices, Wednesday 5:30 - 6:15, Moscone West 3008

** Customer sessions in Red*

Oracle Database Development: High Availability, Exadata, and Cloud Services

Monday 2 October

CON6672 High Availability and Sharding Deep Dive with Next Generation Oracle Database
11:00am – Moscone West 3006

CON6713 Oracle's New, Scale Out, OLTP Optimized, In-Memory RDBMS
11:00am – Moscone West 3014

CON6569 GoldenGate : Deep Dive into Automating GoldenGate using the new Microservices
1:15pm – Moscone West 3010

CON6661 Oracle Exadata: Disruptive New Memory and Cloud Technologies
2:15pm – Moscone West 3014

CON6667 Recovery Manager (RMAN) Tips and Tricks for On-Premises and Cloud Databases
3:15pm – Moscone West 3006

CON6663 Oracle Exadata Technical Deep Dive: Architecture and Internals
3:15pm – Moscone West 3014

CON6583 Memory Without Bounds-Policy Based Automation of In-Memory Column Store Content
3:15pm – Moscone West 3010

CON6581 Database Consolidation: Resource Management Best Practices
4:45pm – Moscone West 3010

CON6678 Zero Data Loss Recovery Appliance: The World's Best Database Protection
4:45pm – Moscone West 3006

CON6665 Deploying Oracle Databases in the Cloud with Exadata: Strategies, Best Practices
5:45pm – Moscone West 3006

Tuesday 3 October

CON6666 Oracle Database Exadata Cloud Service: Technical Deep Dive
11:30am – Moscone West 3006

CON6584 Oracle Database In-Memory Deep Dive: Past, Present and Future
11:30am – Moscone West 3014

CON6682 Revolutionize Analytics with Oracle Database In-Memory
12:45pm – Moscone West 3014

CON6668 Oracle Database Exadata Cloud at Customer: Technical Deep Dive
3:45pm – Moscone West 3006

CON6894 Accelerate Cloud Onboarding Using Oracle GoldenGate Cloud Service
3:45pm – Moscone West 3024

CON6745 Implement a Business Continuity Solution for Your Open Cloud Infrastructure
3:45pm – Marriott Marquis Yerba Buena 13

CON6716 Accelerate OLTP Performance with an Application-Tier In-Memory Database
4:45pm – Moscone West 3008

CON6570 GoldenGate: Maximize Availability for Oracle GoldenGate Microservices
4:45pm – Moscone West 3014

CON6674 Maximum Availability Architecture Best Practices: Oracle Database 12c Rel. 2
5:45pm – Moscone West 3006

Wednesday 4 October

CON6715 Oracle TimeTen in the Cloud
11:00am – Moscone West 3004

CON6675 Maximum Availability Architecture Best Practices and Techniques for Oracle Cloud
11:00am – Moscone West 3006

CON6680 Exadata: Achieving Memory Level Performance: Secrets Beyond Shared Flash Storage
12:00pm – Moscone West 3008

CON6577 Get the Best Out of Oracle Compression
12:00pm – Moscone West 3006

CON6568 GoldenGate: Best Practices & Deep Dive on GoldenGate 12.3 Microservices at Cloud
12:00pm – Moscone West 3003

CON6589 Quick Start Your Oracle Database In-Memory Deployment – Step-By-Step Guide
1:00pm – Moscone West 3004

CON6679 Zero Data Loss Recovery Appliance: Deep Dive and Best Practices from Development
1:00pm – Moscone West 3006

CON6673 Oracle Sharding: Linear Scalability, Extreme Availability and Geo-distribution
2:00pm – Moscone West 3006

CON8173 Preview of Oracle Autonomous Database
3:30pm – Moscone West 3014

CON6664 Oracle Exadata: Maximum Availability Best Practices and New Recommendations
3:30pm – Moscone West 3008

CON6590 Oracle Sharding: Linear Scalability, Extreme Availability and Geo-distribution
3:30pm – Moscone West 3004

CON5966 Orchestrating and Automating Business Continuity with Engineered Systems
4:30pm – Marriott Marquis Yerba Buena 11

CON6671 Oracle Exadata Security Best Practices
5:30pm – Moscone West 3008

CON6676 Oracle Active Data Guard: New Features in the Next Generation Oracle Database
5:30pm – Moscone West 3

Demos: Monday 10:15a-6:00p - Tuesday 11:00a-5:15p - Wednesday 10:15a-4:30p

1988 Oracle Maximum Availability Architecture for Cloud and On-premises

1982 Oracle Backup and Recovery Solutions

1493 Sharding with Oracle Database 12c

1986 Oracle Active Data Guard

Integrated Cloud

Applications & Platform Services


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