Oracle Cloud Infrastructure
Highlights & Value Add

RB Hooks, III

Vice President, Infrastructure Solutions
Oracle National Security Group

Agenda

1300 – Introductions – Todd Rankin

1305 – Oracle Cloud Overview – RB Hooks

1400 – Oracle Multi Domain Database Solution – David Slaughter

1430 – Follow-up Actions & Wrap Up

Safe harbor statement

The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions.

The development, release, timing, and pricing of any features or functionality described for Oracle's products may change and remains at the sole discretion of Oracle Corporation.

“In order to make a true enterprise grade cloud we had to rethink todays approach to clouds. The result was our Gen 2 architecture. ”

“It is designed completely different from our competitor’s Gen 1 clouds. Gen 2 provides better performance, better SLAs, better security, it’s more open with no lock-in, and….all at lower costs.”

Larry Ellison

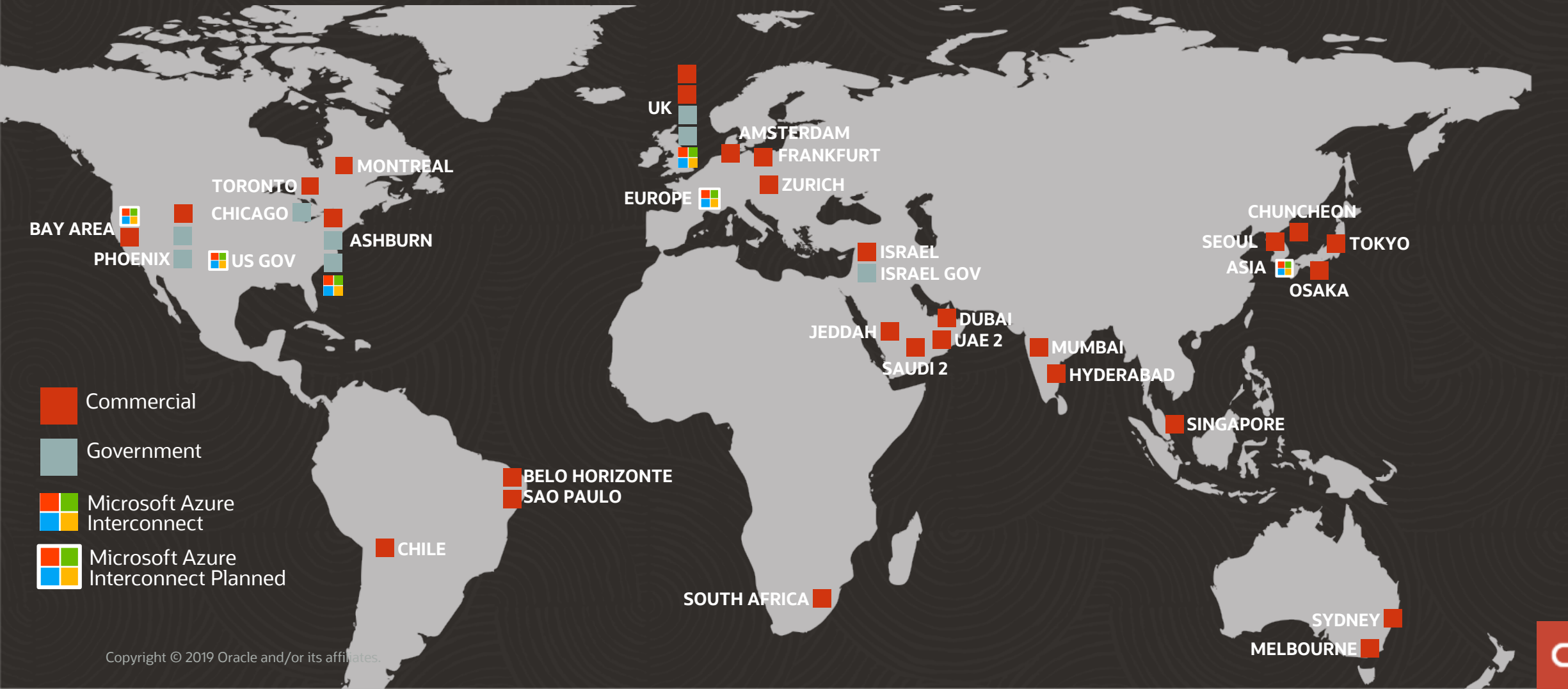
Executive Chairman & CTO
Oracle

Oracle Cloud Infrastructure Global Footprint

Today: 16 Hyper-Scale Regions

Oracle Cloud Infrastructure Global Footprint

Next Year: 36 Oracle Regions vs 25 AWS Regions



Oracle Cloud Government Regions

FedRAMP Moderate

Two regions online and IL2 authorized, FedRAMP Moderate Authorized

DoD IL 5 Authorized

Two regions finished and audited, authorization imminent for FedRAMP High

Top Secret/SCI-SAP, Secret

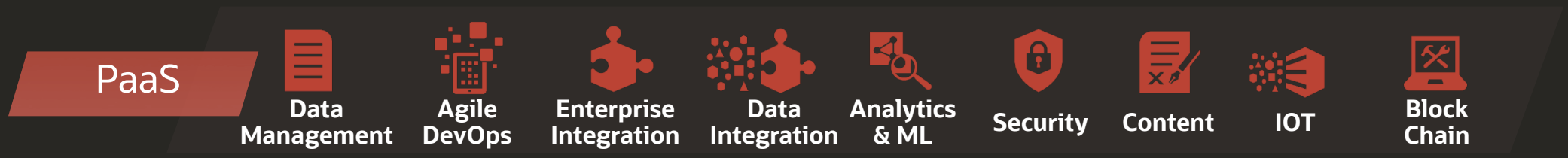
Two Oracle National Security Regions (ONSR) (S&TS/SCI) in final development, planned authorization in 9 months

*US Air Force Executive Cloud Sponsor

- Due to technical capabilities and cost reductions

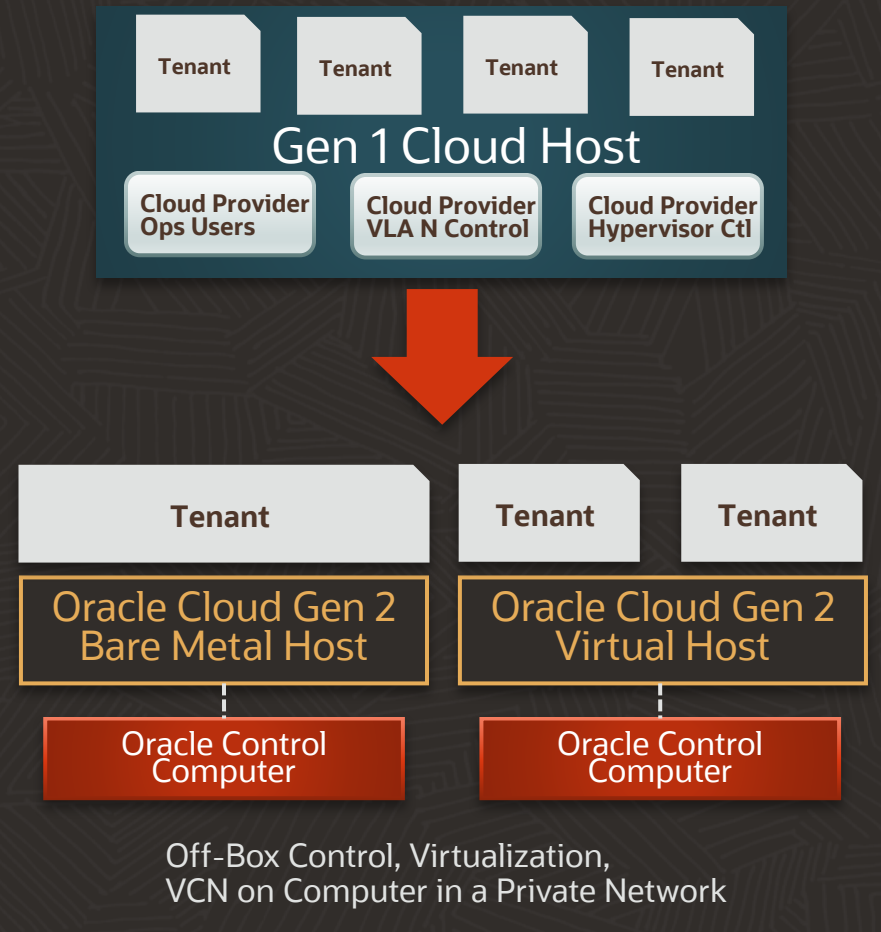
Oracle Cloud is Holistic (IaaS, PaaS, and SaaS)

Open and Pre-integrated to reduce complexity



Oracle Cloud Design Overview – Gen 2

- Open, Hybrid, Cloud Native, True Lift and Shift
- Extremely flat CLOS network delivers high performance
  - Network topology similar to Telco/5G specs
  - No over provisioning
- Off-Box Control and Virtualization provides:
  - No Oracle access to tenant machines
  - Provides new levels of tenant isolation and security
- Bare Metal Nodes allow total customer control
  - Use own OS, Lockdowns, Hypervisor, Encryption, IPs
- HPC/RDMA networks deliver low latency



Off-Box Control, Virtualization,
VCN on Computer in a Private Network

Complete Cloud Infrastructure Services

Compute

Bare metal/VM, CPUs/GPUs, HPC

Up to 64 CPU cores, 8 GPUs, 768 GB RAM, 51 TB local NVMe SSD, 5M IOPS, AMD and Intel processors

Storage

NVMe, Block, File, Object, Archive

Predictable IOPS Block Storage for up to 98% less, storage for whole lifecycle

Autonomous Database

Transactions, Data Warehouse

Fast provisioning. Automatic tuning, patching, securing. 99.995% availability.

Security

IAM, Audit, KMS, CASB

Integrated security services to protect data and to control and monitor access

Complete Cloud Infrastructure Services

Containers

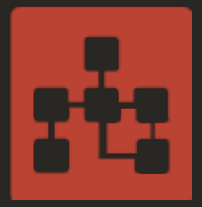
Containers and Kubernetes

Fully managed, certified Kubernetes service with Docker containers

Networking

VNC, LBaaS, FastConnect, VPN

Isolated networks with reserved IPs, security lists, firewalls, lowest cost private connectivity



Database

Bare metal, VMs, Exadata

Millions of TPS; Full RAC and Active Data Guard support

Edge

DNS, WAF, DDoS, Email

Global DNS, application protection, bot management, DDoS protection, email delivery

Complete Cloud Infrastructure Services

Migration

Migrate Apps, KVM

Move on-prem environments to the cloud with full hardware performance

OCI at Customer

Exadata on-premises

Subscription-priced cloud infrastructure, database managed by Oracle

Data Movement

Storage appliance, Data Transfer

Software NAS gateway, data ingest service with full chain of custody (HDD or appliance)

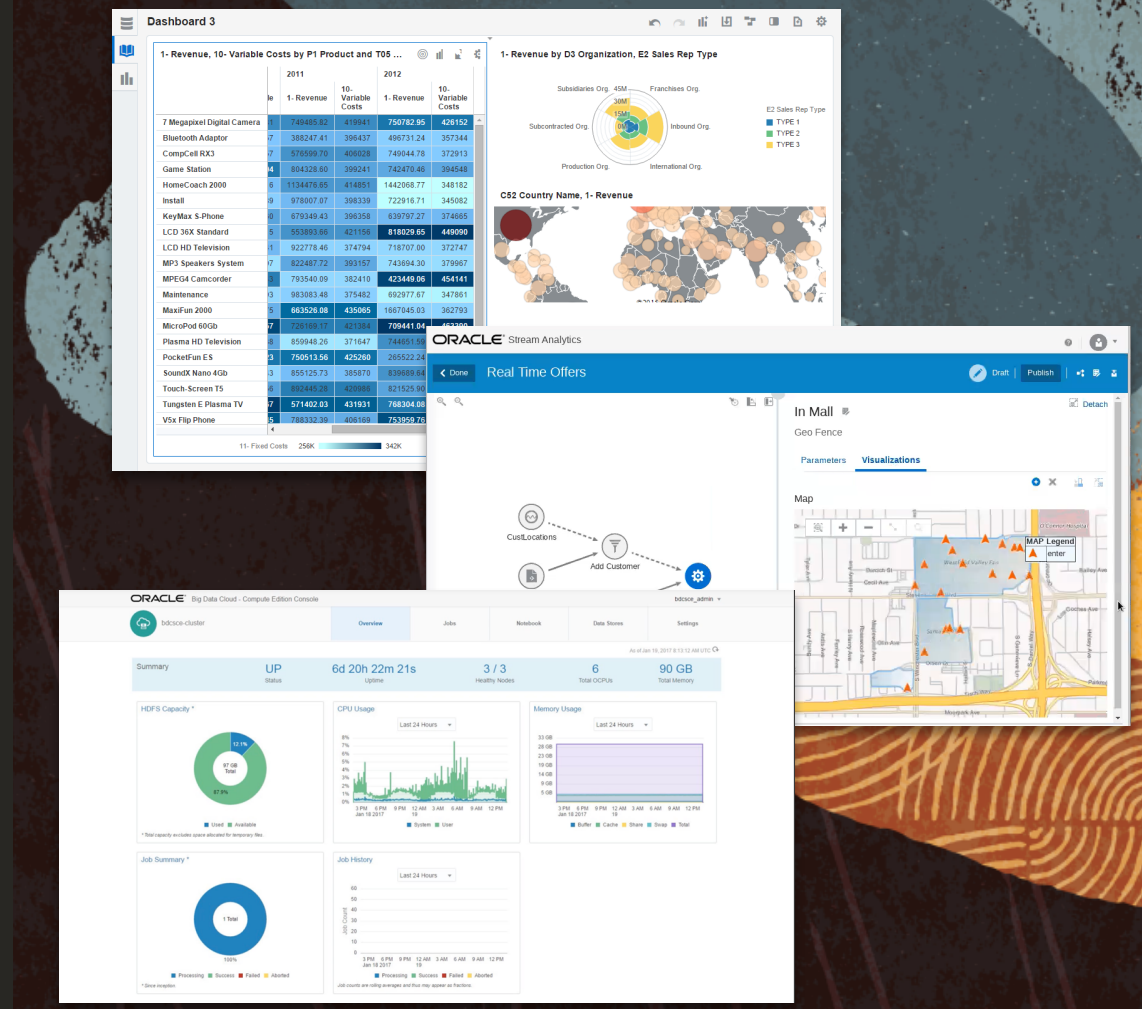
Governance

IAM, Tagging, Cost Management

Logical separation and tagging of resources for simplified management

Oracle Cloud Platform Services

- Open Source and Open Standards based services
- Higher order services provide rapid low/no code setup
  - Ease of Use empowers larger talent pool
  - Faster time-to-mission impact
  - Easy Scale Up/Down
- Autonomous Service Options
  - Self Tune
  - Self Heal (Patch)
  - Self Manage (Backup/Recovery/Upgrade)
- Pay for what you use subscription-based pricing with BYOL option



Oracle Cloud Platform Services

Data Services
Autonomous Data Warehouse
Autonomous Transaction DB
Exadata Service
Database Service
Data Integration Service
Data Catalog Service
Data Migration Service
Streaming (Kafka) Service
NoSQL DB Service
Data Safe

Analytics
Oracle Analytics Service
Stream Analytics Service
IOT Service
Data Science Service
Big Data Service

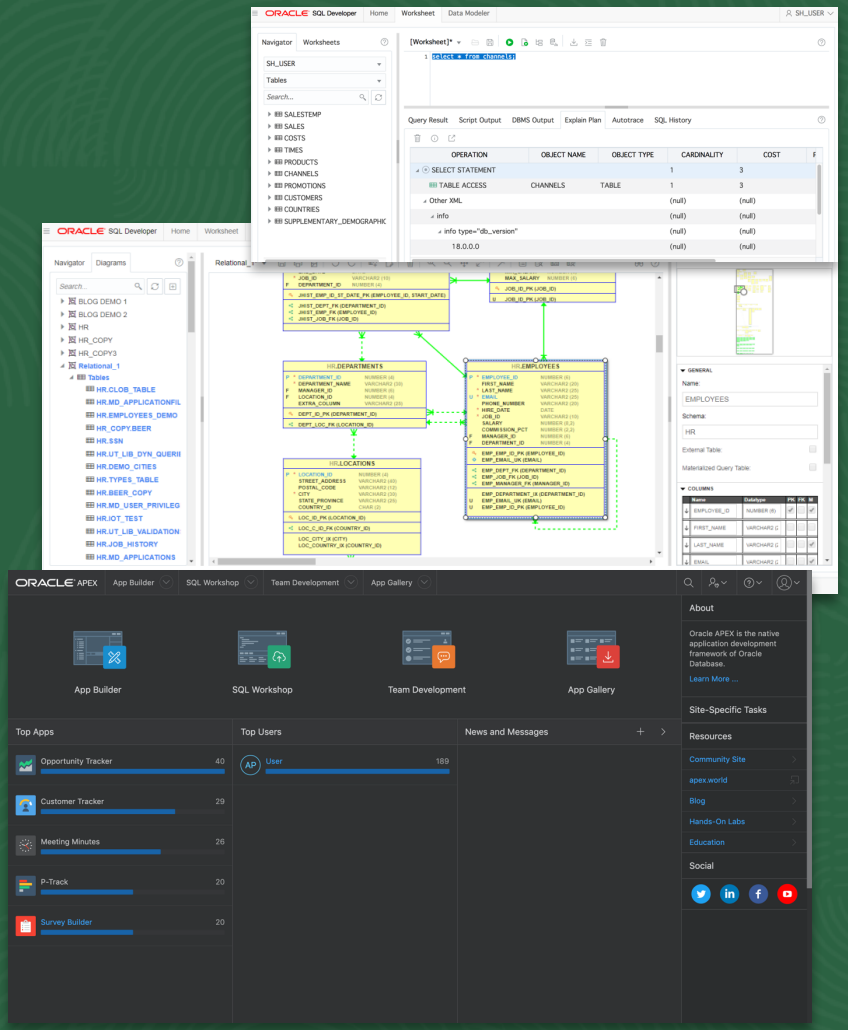
DevOps and Integration
Agile Developer Service
Container Service
Container Pipeline Service
Application Integration Service
Process Management Service
Block Chain Service
API Management Service
Java Service
Mobile Service
Digital Assistant Chatbot Service

Enterprise Services
Identity Management Service
CASB Service
Enterprise Management Service
Content and Experience Service
Email Delivery Service

Awarded Vendor on AFLCMC/HNC BOA for Cloud Services providing IL2/IL5 and upcoming IL6

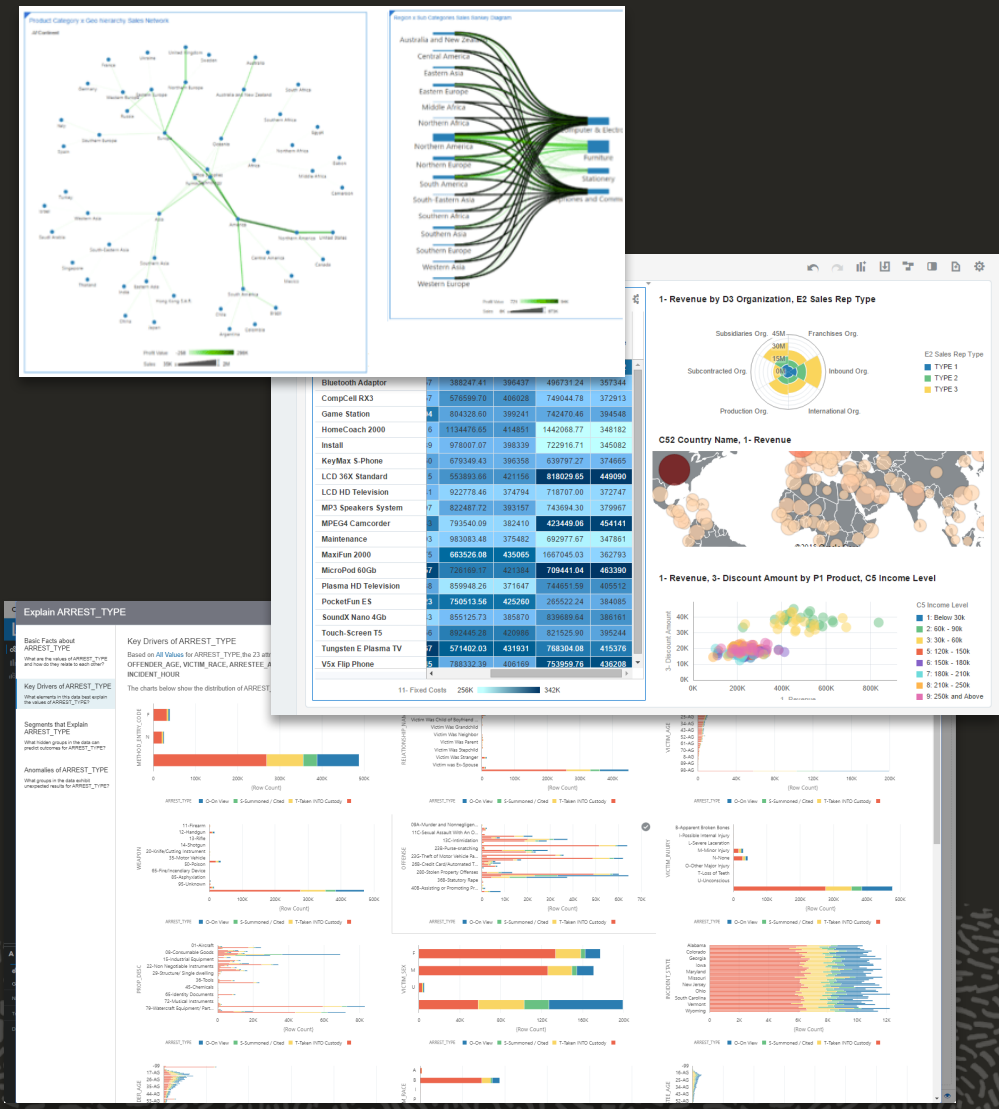
Oracle Cloud Data Services

- Open Source, SQL, Big Data, and NoSQL Services
- Oracle Autonomous database services natively run on OCI
  - Up to 268 TB of capacity and millions of IOPS per instance
  - Auto Healing, Auto Tuning, Auto Patching, Auto HA
- Provides high performance data services for extreme IOPS
  - Run Bare Metal, VMs, and Exadata
- Oracle Cloud provides migration provisioning and management tools for data services
- Extremely low cost ingress/egress fees

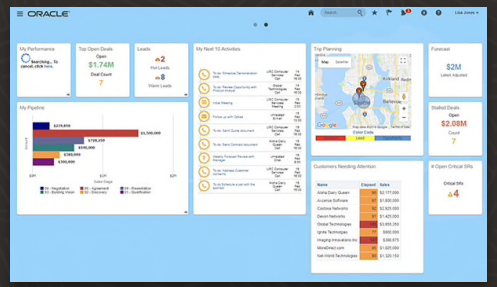


Oracle Cloud Analytic Services

- Oracle Cloud provides a suite of machine learning/AI, Big Data, Advanced Analytics, Data Integration, Data Science, Data Lake, and Data Cataloging services
- Access and process data across other cloud vendors, object storage, files, or commercial and open source databases
- Services designed for the role of data scientists and analysts
- Extensive data discovery and visualization features
- Supports notebooks, Python, R, and SQL

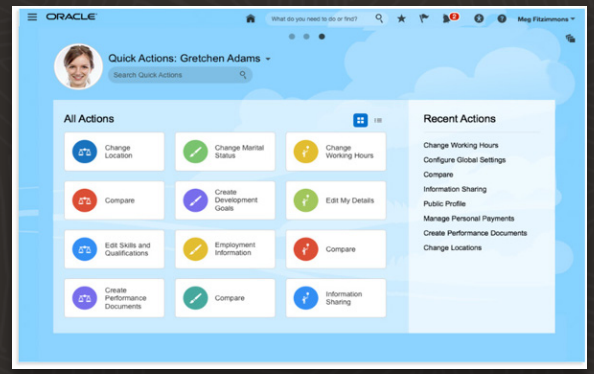


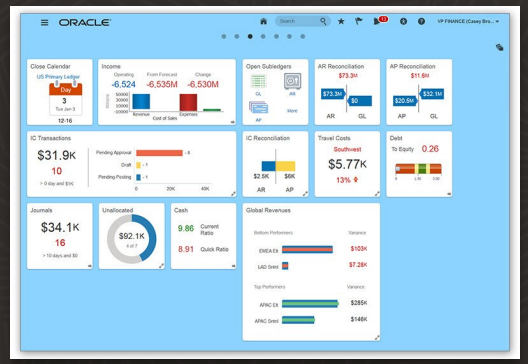
Oracle Enterprise Software Services (SaaS)



Customer Experience
Service
Engagement
Sales
Marketing
Configure, Price and Quote
Commerce
Call Center
Help Desk
CRM Analytics

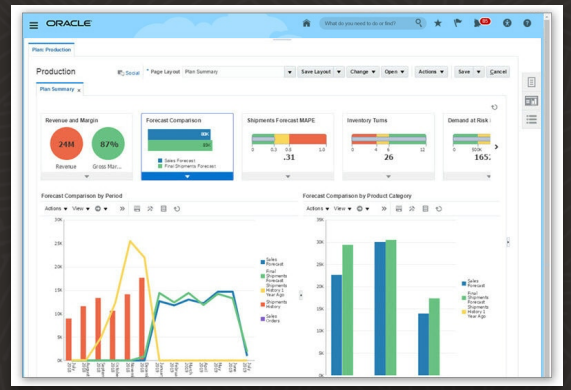
HCM
Human Resources
Talent Management
Workforce Rewards
Workforce Management
Work Life Solutions
HCM Analytics
Recruiting





Financials and ERP
Financials
Accounting Hub
Project Financial Management
Project Management
Risk Management
Procurement and Contracts
ERP Analytics
Enterprise Planning and Budgeting
Financial Consolidation and Close
Account Reconciliation

Supply Chain Management
Inventory Management
Logistics
Maintenance
Manufacturing
Order Management
Procurement
Product Lifecycle Management
Supply Chain Planning
SCM Analytics



Managing Multiple Databases is Complex

- **Amazon:** Each Database has different Application Interfaces, Security Models, Recovery Procedures, Scalability Procedures, etc.
- **Oracle:** One Standard Application Interface, One Security Model, One Set of Recovery and Scalability Procedures, etc.

Amazon Strategy:

Many Single-Purpose Databases

Separate specialized databases for each different data type & workload

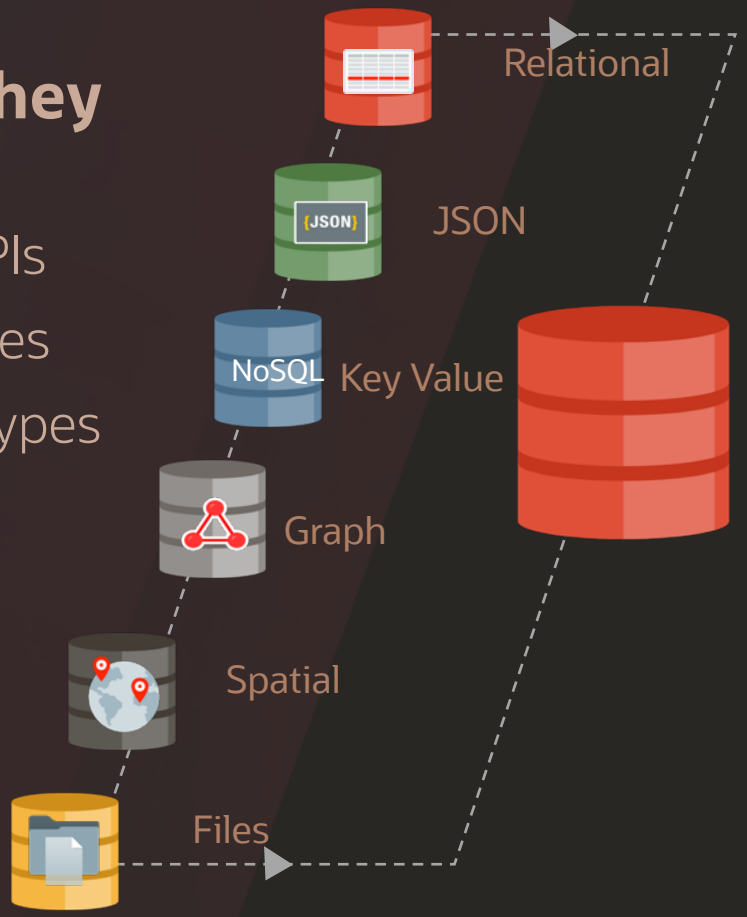
Fact | Oracle is a Multi-model Database

Developers get what they want…

Use popular dev tools and APIs

SQL query across all data types

Transactions across all data types



… Analysts and Ops get what they need

Consistent, queryable view of data

Reliability

Scalability

Security

2019 Forester Wave

Multi-model

- Oracle Leads the industry
- Postgres?
- AWS?
- SAP Hana is expensive

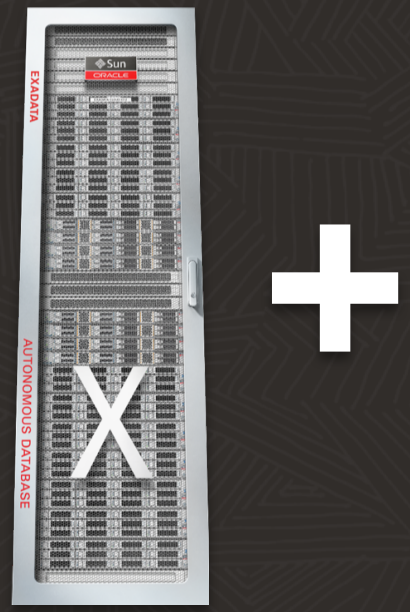
Oracle Autonomous Database

Nothing to Learn – Nothing to Do

- Automatic Provisioning
- Automatic Scaling
- Automatic Tuning
- Automatic Security
- Automatic Fault Tolerant Failover
- Automatic Backup and Recovery
- And more…

- **Easiest to Use – Lowest Cost to Operate**

Exadata Cloud: Choice of Deployment Models



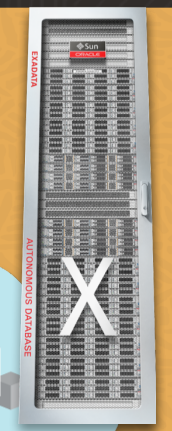
+

- Flexible Subscription Model
- Cloud Automation
- Network Isolation
- Cloud Security and Hardening
- Oracle-Managed Exadata Infrastructure

Exadata Cloud at Customer (ExaCC)

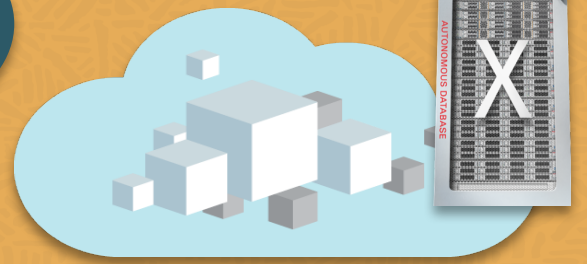
TS/SCI Available

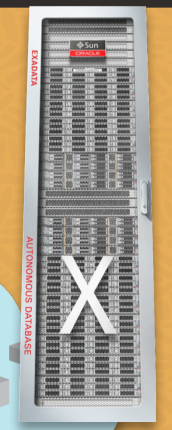
In Customer Data Centers



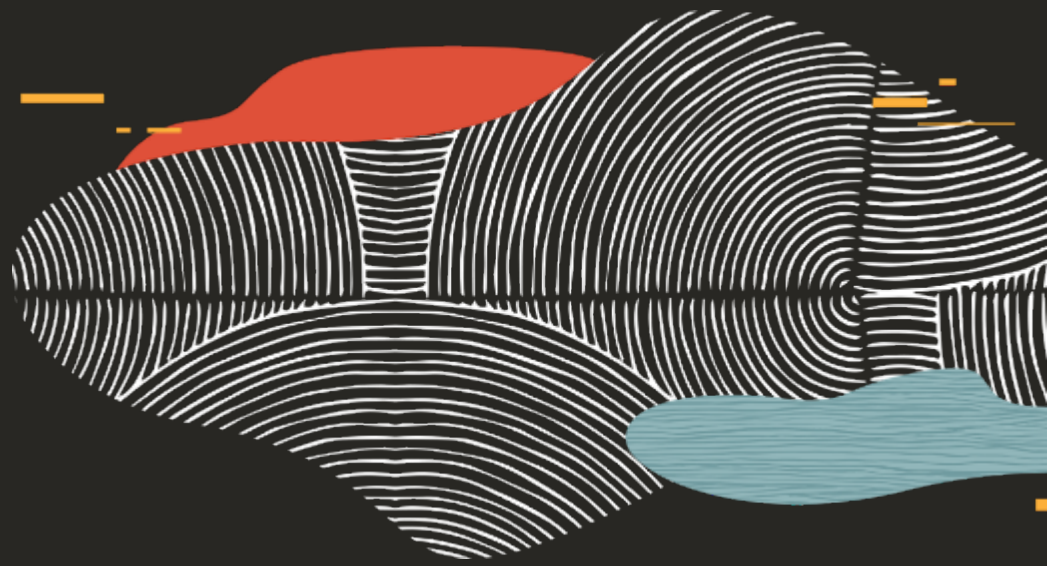
Exadata Cloud Service (ExaCS)

In Oracle Cloud





OCI Value Adds



Oracle Cloud Key Differentiators

Open

Performance

Security

Superior Economics

Oracle Cloud Key Differentiators Overview

Open and Pre-integrated to reduce complexity

Open Platform to enable hybrid cloud development and cloud mobility

- Built for non-proprietary Open Source and Industry-wide Open Standards for cloud DevSecOps

Natively Secure to eliminate known and future attack vectors

- Off-box non-X86 network and virtualization management with secure wipe of non-volatile devices

Built for Performance to broaden the range of addressable IT challenges

- Large Bare-Metal server instances and Exadata with ultra-low-latency, high-bandwidth network

Lower Cost to better rationalize Cloud Native, Migration and Lift & Shift deployments

- OCI instances are ~ ½ the price of commercial AWS instances & data egress charges are ~ 1/13 the price

Oracle's Commitment to Cloud Native Open Source

Leadership role in Open Source communities

THE LINUX FOUNDATION

CLOUD NATIVE COMPUTING FOUNDATION

OPENAPI INITIATIVE

HYPERLEDGER

kubernetes

ECLIPSE FOUNDATION

MySQL

Bringing Open Source software to OCI platform

Terraform

kubernetes

OPENSHIFT

CHEF

ANSIBLE

docker

Contributing back to Open Source software

fn

OpenJDK

GraphPipe™

smith

crashcart

railcar

kubernetes

Oracle Cloud provides a CNCF Native Kubernetes Managed Service and a Container CI/CD Pipeline Service for deployment

Positive Excerpts of Oracle Cloud Open Native Services

THENEWSTACK

Oracle Cloud Native Framework Promises 'Bi-Directional ' Cloud Portability

Forbes

"Oracle Cloud Native Framework is a bold move. I believe this is a credible play to displace Red Hat OpenShift with a modern and completely cloud-native software stack."

PR Newswire

Oracle Arms Developers with the Most Comprehensive Cloud Native Framework

DEV CLASS

"Oracle crashed the party at KubeCon today, promising to free developers from vendor lock-in with what it claims is the "most comprehensive cloud native framework."

siliconANGLE

Oracle Pitches New Serverless Computing Options for Developers

Forbes

Oracle's 'Open' Approach to Cloud-Native Software

Highest and Most Consistent Storage Performance

Raw I/O performance outruns the competition

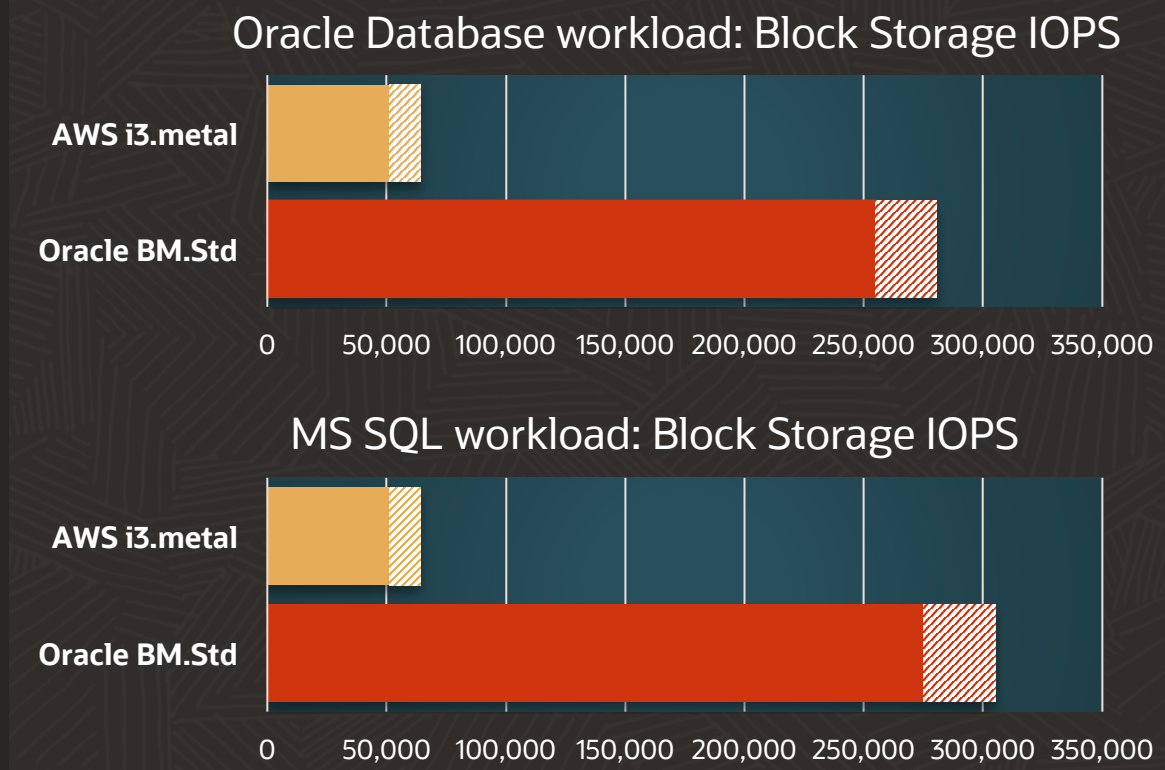
StorageReview

Independent testing demonstrates **2-5X performance advantage** over AWS

Advantages driven by **bigger available configurations**, **faster network**, no resource oversubscription

Oracle Cloud has these benefits **across all workloads** including Oracle Database as well as non-Oracle workloads

Oracle is **the only cloud vendor** with a service level agreement **that covers performance, manageability and availability**



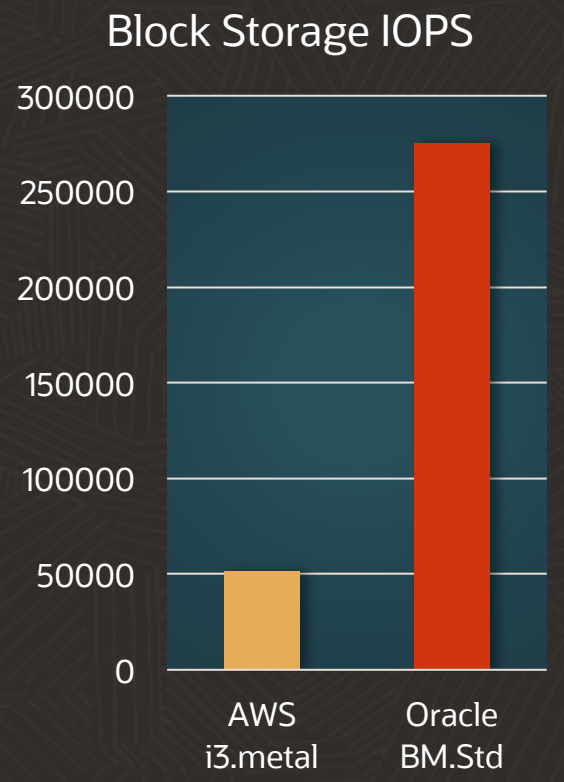
www.storagereview.com/oracle_cloud_infrastructure_compute_bare_metal_instances_review
www.storagereview.com/amazon_ec2_i3metal_review

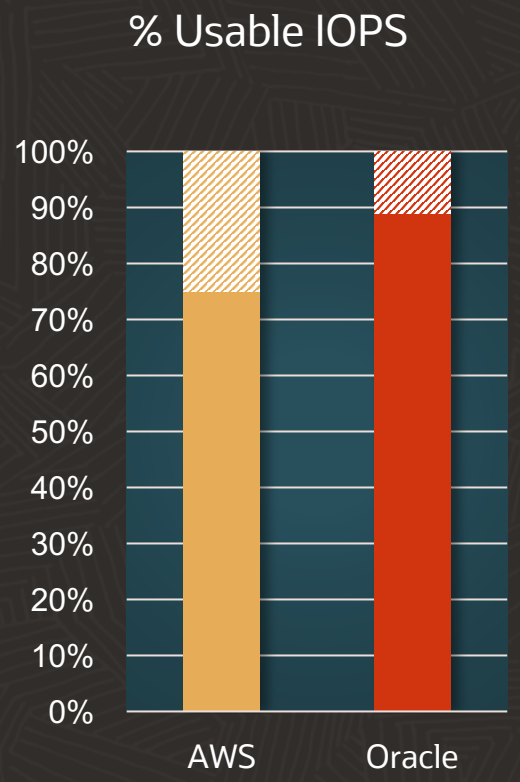
Better, more consistent storage performance than other clouds

2-5x performance advantage over AWS

- Oracle Database
- Microsoft SQL
- VDI
- Mixed workloads
- Hadoop
- HPC (computational fluid dynamics)
- AI/ML

Backed by performance SLAs





www.storagereview.com/oracle_cloud_infrastructure_compute_bare_metal_instances_review
www.storagereview.com/amazon_ec2_i3metal_review

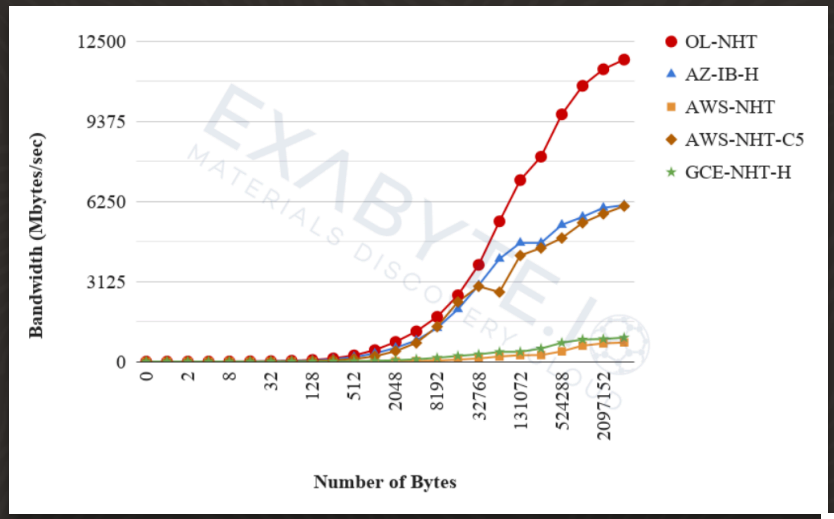
Oracle Cloud Infrastructure Cluster Networking

Cloud-first network for ultra low latency and high bandwidth

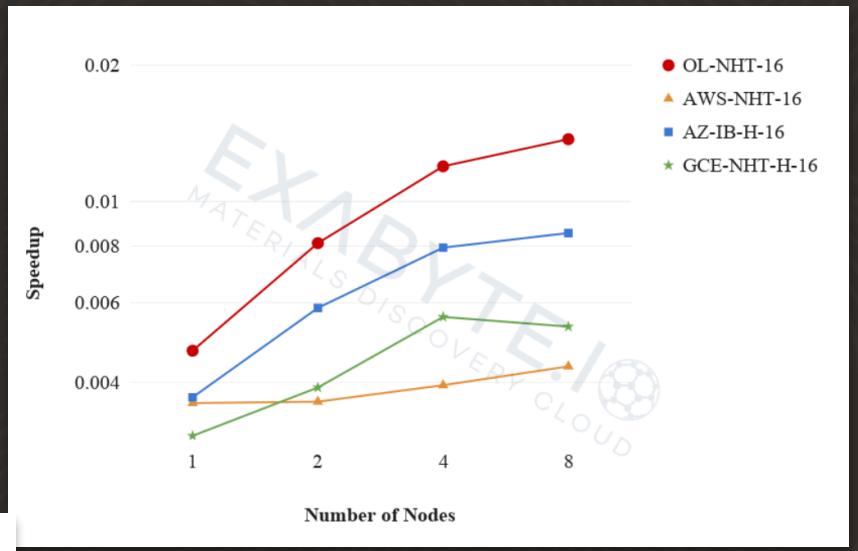
For high performance workloads (HPC, Database, Big Data, AI) including the hardest product development workloads like CFD, Crash Simulations, Reservoir Modelling, DNA Sequencing

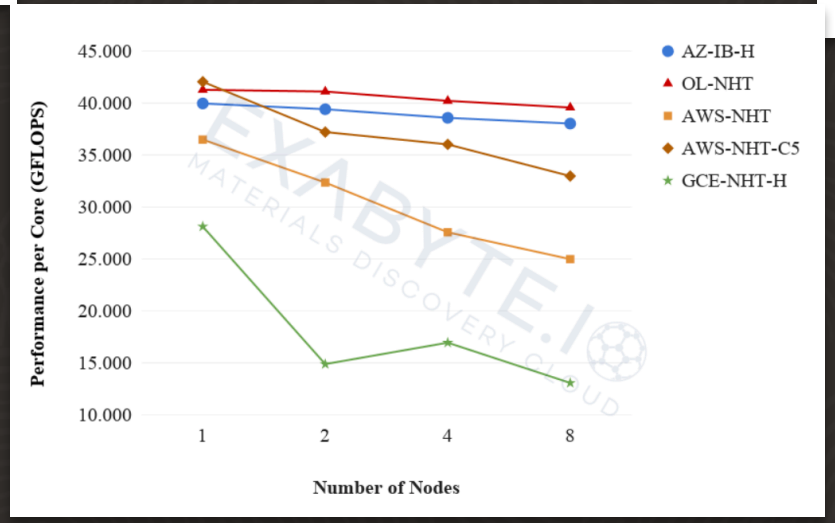
- Bare Metal RDMA
  - For the hardest product development workloads such as CFD, Crash Simulations, Reservoir Modelling, DNA Sequencing
- Ultra low latency and high bandwidth
  - For HPC, Databases, Big Data, and AI workloads
  - Cluster 1,000's of cores on RDMA
  - Supports MPI including IntelMPI and OpenMPI

Third Party Cloud Performance Testing



"Our findings demonstrate that Oracle Cloud outperforms other cloud vendors"





Benchmarking Test: AWS, Microsoft, Oracle, and Google

https://blog.exabyte.io/cloud-hpc-2018-12-google-cloud-42f6de60464d

Industry First end-to-end Cloud Warranty

	ORACLE	AWS	Azure	GCP
AVAILABILITY	Covered	Covered	Covered	Covered
PERFORMANCE	Covered	Not Covered	Not Covered	Not Covered
MANAGEABILITY	Covered	Not Covered	Not Covered	Not Covered

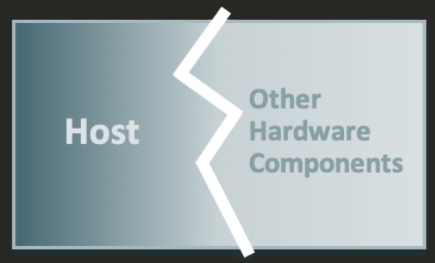
Oracle is the only CSP that Builds, Uses, and Sells their own servers

- Hardened and secure supply chain
- Specific out of band secure hardware trust provides control of hardware components and secure wipe
- Provides secure Bare Metal host isolation
- Built for on-prem and public cloud scale and performance
- Secure ILOM & TPM
- Better testing, certifications, and SLAs for our Cloud
- Cloud Engineers and HW Engineers work together to innovate on Gen 2 Oracle Cloud

Security Focused Design and Supply Chain

Oracle Cloud is Built Using Oracle hardware for a Reason

Open and Pre-integrated to reduce complexity

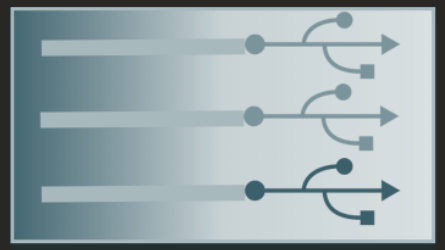


Hardware-Based Host Isolation

ensures tenants on host cannot gain access to non-tenant hardware components such as service processor and BIOS flash storage

Secure Wipe of Service Processor and BIOS firmware

uses special hardware to remotely wipe foundational firmware (BIOS and Service Processor) after each tenant use or whenever security is compromised



Fine-grained Disable of Unused Hardware Components

use special hardware to remotely disable unused PCIe slots, USB ports, on-board NICs, and more

Powerful Human Readable Policy Engine Enforces Separation

Tenancy = TS/SCI

Users
User1
User2

Groups
NSA-Y3
SOCOM

Instances
Instance1
Instance2

Dynamic Groups
Shared HPC

Policies

PolicyA: allow group **NSA-Y3** to manage all-resources in compartment **Program-A**

PolicyB1: allow group **SOCOM** to manage all-resources in compartment **Program-B**

PolicyB2: allow dynamic-group **Shared-HPC** to use buckets in compartment **Program-B**

Compartment = Program A

PolicyA

Object Storage Buckets

VCN

Compartment = Program B

PolicyB1

PolicyB2

Compute Instances

Block Volumes

Load Balancers

Object Storage Buckets

Oracle Cloud Costs Less

"If you want better SLAs, better security and better performance you have to be willing to spend less" -Larry Ellison

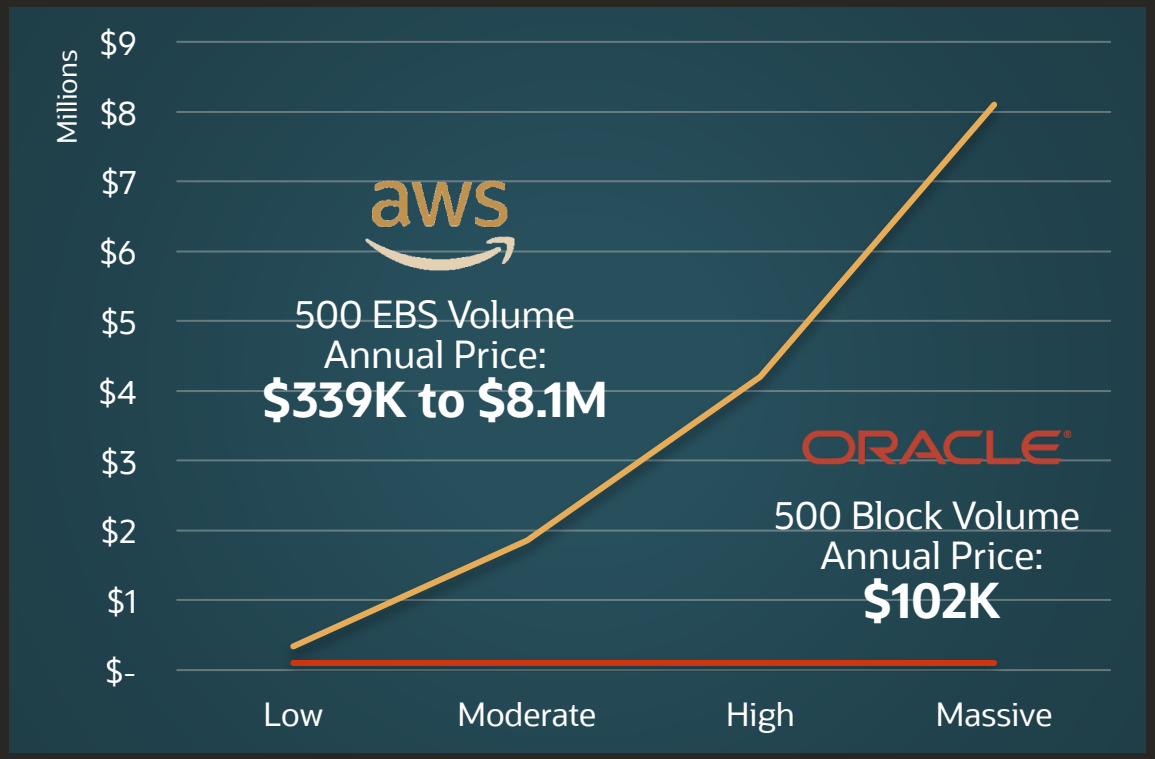
	ORACLE	AWS	Azure	GCP
Standard Virtual Machine Instances ($/OCPU/Hour)	$0.0638	+52%	+52%	+46%
DenseIO Virtual Machine Instances ($/OCPU/Hour)	$0.1275	+18%	+48%	+20%
Bare Metal Standard ($/OCPU/Hour)	$0.0638	+34%	N/A	N/A
Bare Metal Dense IO ($/OCPU/Hour)	$0.1275	-25%*	N/A	N/A
GPU Instances ($/GPU/Hour)	$2.25	+26%	+26%	+4%
Block Storage: Massive Perf (annual cost, 400GB 20K IOPS)	$204	+7,900%	+2,900%	+400%
Data Archive ($/GB/Month)	$0.0026	+35%	-30%	+63%
File Storage ($/GB/Month)	$0.425	+86%	+29%	+79%
Internet Data Egress (50TB/Month)	$340	+1,300%	+1,300%	+1,300%
Private Line Network (1 Gbps, 100TB Data, Monthly)	$155	+2,100%	+3,700%	+1,500%

= Lowest Cost

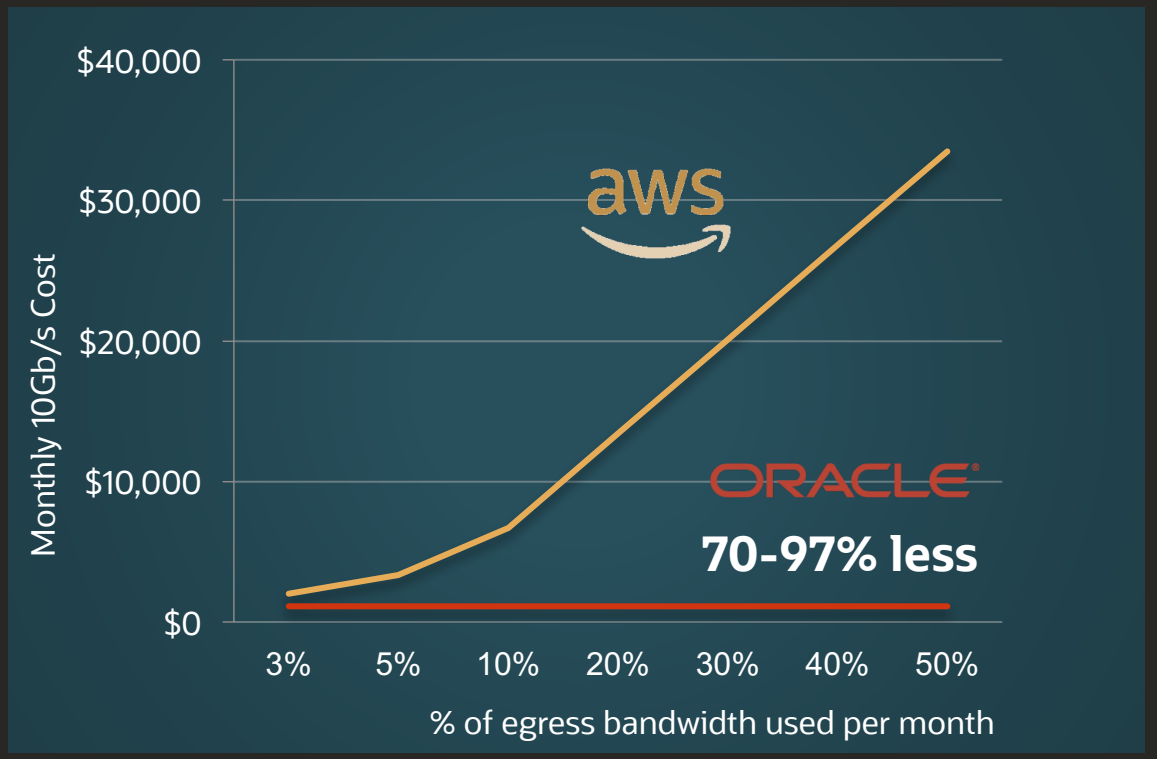
*Oracle DenseIO bare metal has 44% more cores and 3.4X local SSD capacity vs AWS i3.metal

*Based on published Price List

Pay less for guaranteed performance and connectivity



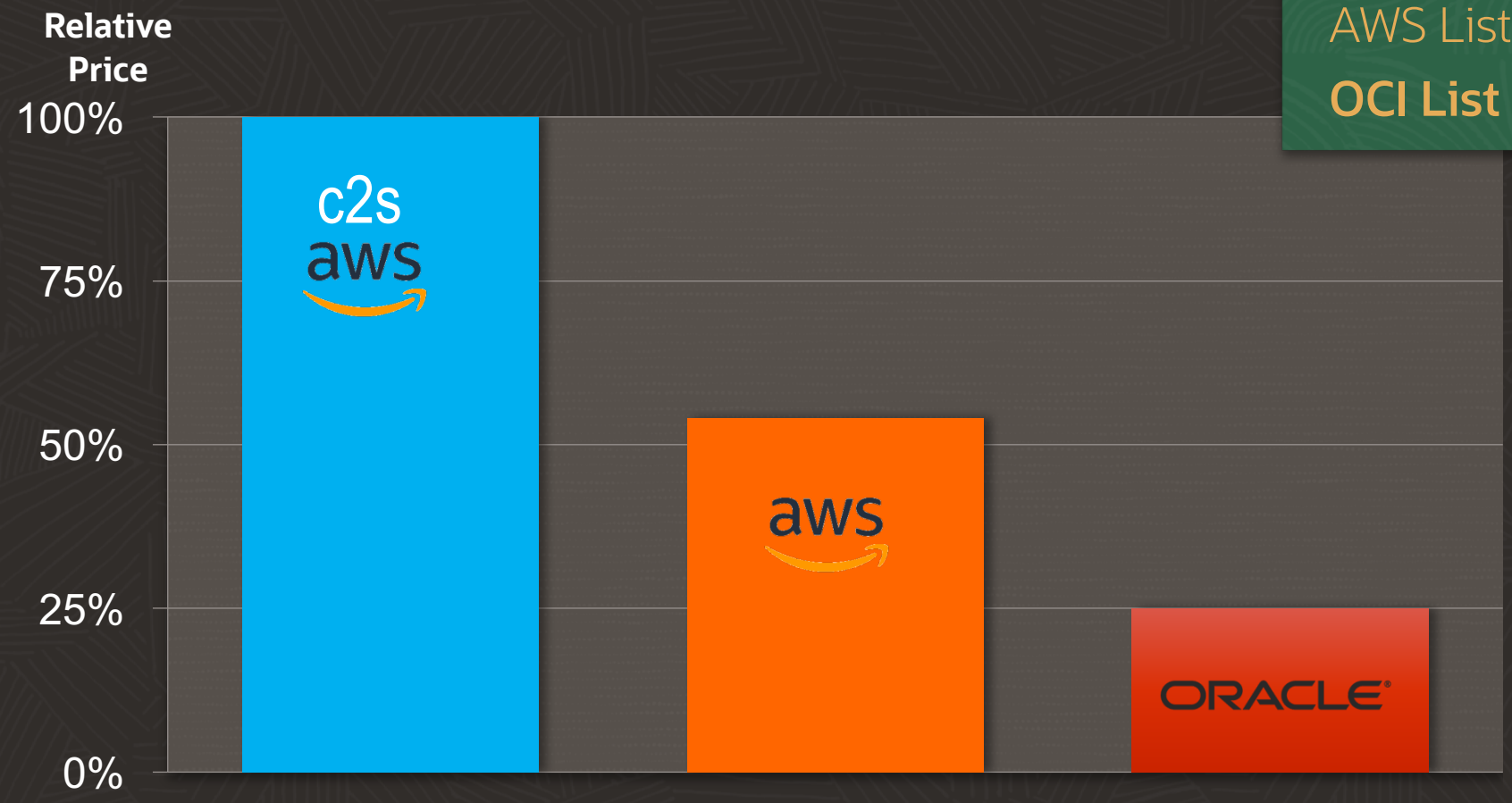
Oracle doesn't charge for storage performance, and **guarantees** it. AWS charges $0.065 for every IOP and **doesn't guarantee** performance.



Oracle doesn't charge for dedicated connectivity (FastConnect) bandwidth. The more you use FastConnect, the more you save.

Oracle Cloud Costs Less

Example: 15 GB per CPU VM Instance



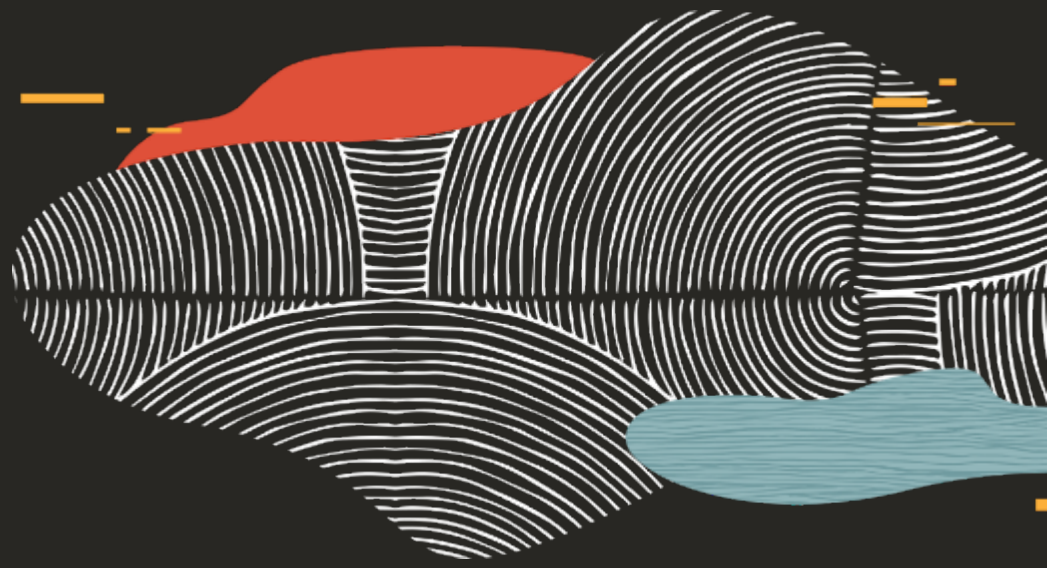
OCI List Price = ~ 1/2 AWS List Price

AWS List Price = ~ 1/2 AWS C2S Price

OCI List Price = ~ 1/4 AWS C2S Price

How are we doing? A few of our customers:

New Cloud Announcements



Next Generation Cloud Enhancements

Next Gen Compute Platform

✓ **True Flexibility**

Pick exactly the number of cores you need

✓ **True Elasticity**
Autonomously scale cores up/down

✓ **True Availability**
Never go down even when auto-scaling cores

Next Gen Storage Platform

✓ **True Flexibility and Elasticity**
Pick starting amount of storage
Auto-scale up while running as needed

✓ **Performance On Demand**
Optimize between high-performance and low-cost

✓ **Always Available**
Zero downtime. Period.

Cluster Networking

Bare Metal RDMA Clusters Instances Supported:

✓ **Available Today:** HPC Instances: 36 cores, 3.7Ghz, 384GB RAM, 6.7TB NVME, 100G RDMA

✓ **Coming Soon:** GPU Bare-Metal Instances: 8x GPUs, 2TB RAM, 25TB NVME,
8x 100G RDMA

ORACLE

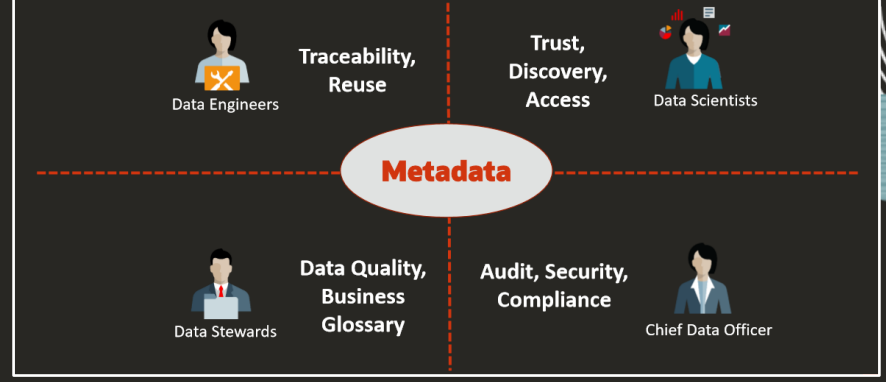
Data Catalog Cloud Service

OCI Data Catalog Vision

Self-service Data Discovery and Governance Solution

A single collaborative solution for data professionals *to collect, organize, find, access, enrich and activate technical, business and operational metadata* to support self-service data discovery and governance for trusted data assets in Oracle Cloud and beyond.

Metadata is the key!



OCI Data Catalog Vision

Self-service Data Discovery and Governance Solution

Search & Discovery

- Metadata harvesting from on-prem and cloud systems
- Semantic search, data profiling, lineage and impact analysis, data relationships

Curation

- Enterprise Business Glossary, Approval Workflows
- Tagging, User annotations, social collaboration, ratings/comments, **associations and links**

Intelligence

- AI/ML based Recommendations
- Auto-discovery, Auto-classification, Auto-association, Data Similarity

Enterprise Class

- OCI Native, REST APIs
- Hive Metastore for OCI Obj Store, ADW etc.
- Value added Integration with other OCI services

Key Data Catalog Concepts

- **Data Asset:** A source, provider, system or store containing data, e.g. a Database, an Object Store, a File or Document Store, a Message Queue, or an Application.
- **Data Entity:** A set of data in a Data Asset, normally representing a single type of data, e.g. a database table, a file, or several files representing a common set of data.
- **Data Attribute:** An attribute of a data entity describing an item of data, with a name and data type, e.g. a column in a database table or file.
- **Harvesting:** Process of collecting technical metadata from a data asset.
- **Glossary:** A collection of business concepts (typically by subject matter) in hierarchical form of Categories and Business Terms.

ORACLE + vmware®

The Partnership: Improving the experience of joint customers

- ✓ Oracle is developing a new product: Oracle Cloud VMware Solution
- ✓ Seamlessly migrate and extend VMware fleet to Oracle Cloud
- ✓ A familiar experience with full configurability and management
- ✓ Oracle joins VMware Cloud Provider Program
- ✓ Oracle Cloud VMware Solution will be sold by Oracle and Oracle partners
- ✓ Oracle will provide support for VMware on Oracle Cloud Infrastructure
- ✓ Oracle will also support Oracle Database and applications deployed on VMware

Benefits

Cloud Flexibility

Extend your VMware deployment to a hybrid cloud combining your datacenter and Oracle Cloud, or migrate VMs at your own pace to reduce your own infrastructure. Use Universal Credits for all.

Control

You control the software and hardware, with full administrative access to the entire stack of VMware software and the underlying bare metal cloud compute instances. Maintain your proven architectures and processes.

Manageability

Manage your Software Defined Data Center with a single pane of glass in the cloud or across a hybrid environment – vCenter

Extend and leverage with Oracle Cloud and Autonomous Services

ORACLE + Microsoft

Interconnected Multi-Cloud Solutions for Enterprise

- ✓ Microsoft Azure and Oracle Cloud are interconnected today, so you can migrate and run mission-critical enterprise workloads across clouds
- ✓ Unified identity and access management via single sign-on with automated user provisioning to easily manage resources across clouds
- ✓ Collaborative support of custom and Oracle Applications on Azure with Oracle Database on Oracle Cloud – connect best-in-class services across clouds

Available Now: US East, London
Coming Soon: US West, Government, Asia, and Europe regions

Enterprise Cloud Interoperability Partnership

- Oracle Cloud Infrastructure
- Oracle Autonomous Database
- Oracle Exadata
- Oracle Applications
- Oracle RAC
- Oracle Analytics Cloud
- And other services…

- Azure DevOps
- Azure Stream Analytics
- Azure Databricks
- Azure Cognitive Services
- Azure IoT Hub
- Azure Kubernetes Service
- And other services…

Resources to Learn the Oracle Cloud

- Always Free Cloud Tier is now available!
- Engineering Assisted Cloud Trials
- Free Government on-premise Technology & Training Sessions
- Free Lunch and Learn Sessions Onsite
- Free Hands on Cloud Certificate Training Workshops
- Visit our National Security Cloud Lab for Demos, Solution Design, and Prototyping

- Learn more: *cloud.oracle.com*

Break