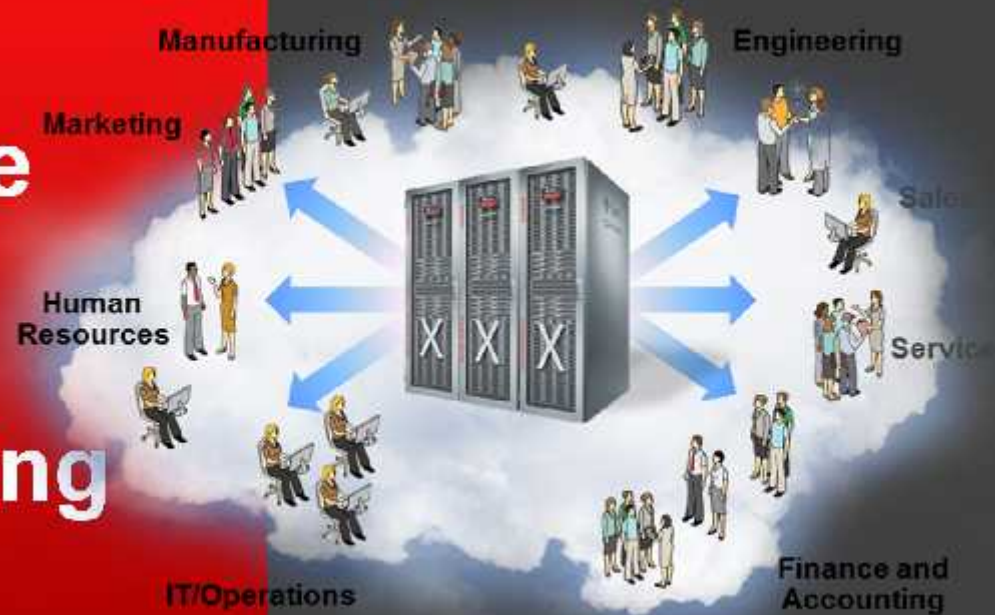


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# Creating DBaaS Service Catalog

## NYOUG 2016 Fall Meeting

Nicholas J Donatone  
Senior Manager Sales Engineers,  
Cloud and Infrastructure



## Safe Harbor Statement

The preceding 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, and timing of any features or functionality described for Oracle's products remains at the sole discretion of Oracle.

# Agenda

- Service Catalogs
  - DBaaS Evolution
  - What is a Service Catalog for DBaaS?
  - Service Catalog Design Process
- Availability
  - Describing availability
  - Oracle Database availability levels
- Case Studies
- Resource Management
- Security
- Oracle DB 12c Multitenant Architecture
- Capacity
- Service Catalogs enable the evolution to enterprise cloud

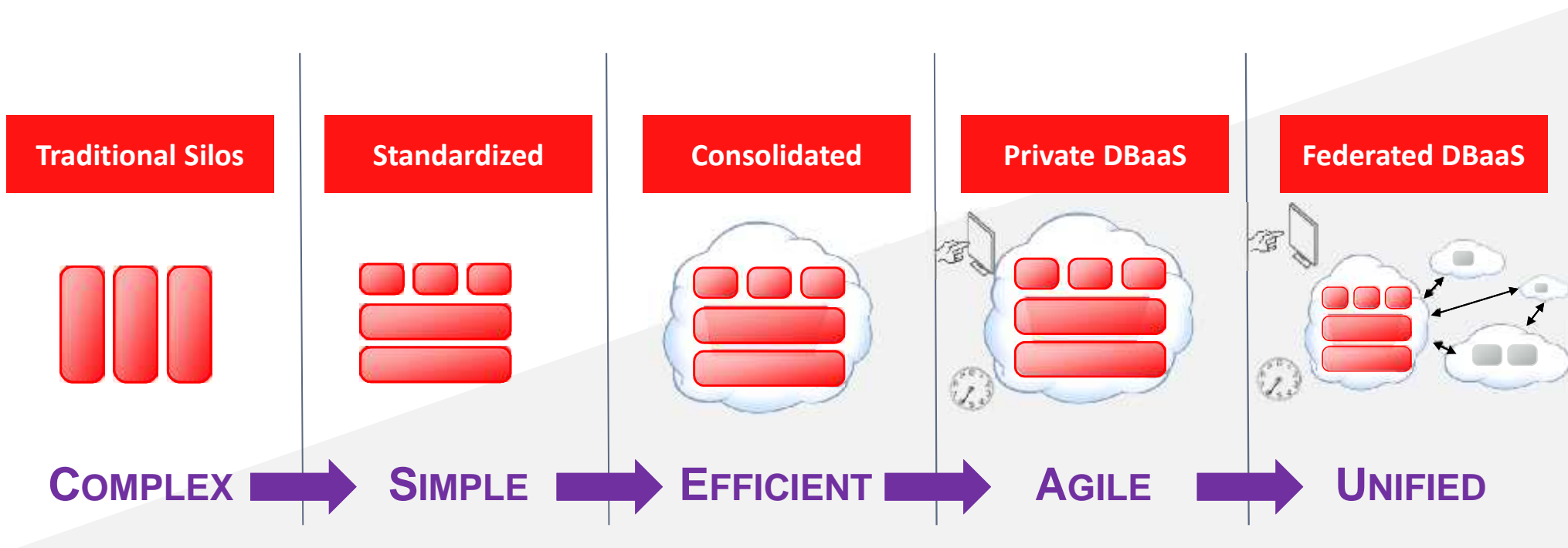


# Service Catalogs enable the evolution to enterprise cloud

- The promises of cloud computing
  - greater agility, less risk, and lower costs
- Making the full transformation to an enterprise cloud may take several years
- Many enterprises have successfully organized their transformation into a phased approach—an evolution to enterprise cloud.

# Database as a Service is an Evolution

Getting There Involves a Series of Projects



# Database Services the Old Way

Creates Server and Software Sprawl



## Costly

- Dedicated server + storage per database
- Dedicated IT staff
- Servers oversized for high water mark

## Unpredictable

- Difficult to enforce standards and best practices
- IT priorities dictate timing

# Database Services the Old Way

## Encourages Organizations to Seek Alternatives



### Users Get

- Weeks-months to provision a new DB
- Costly charges for dedicated resources
- Incented to seek alternatives (public cloud, open source)
- Every implementation is custom

### IT Gets

- Ever-expanding support burden
- Little funding left for innovation

# What is a Service Catalog for DBaaS

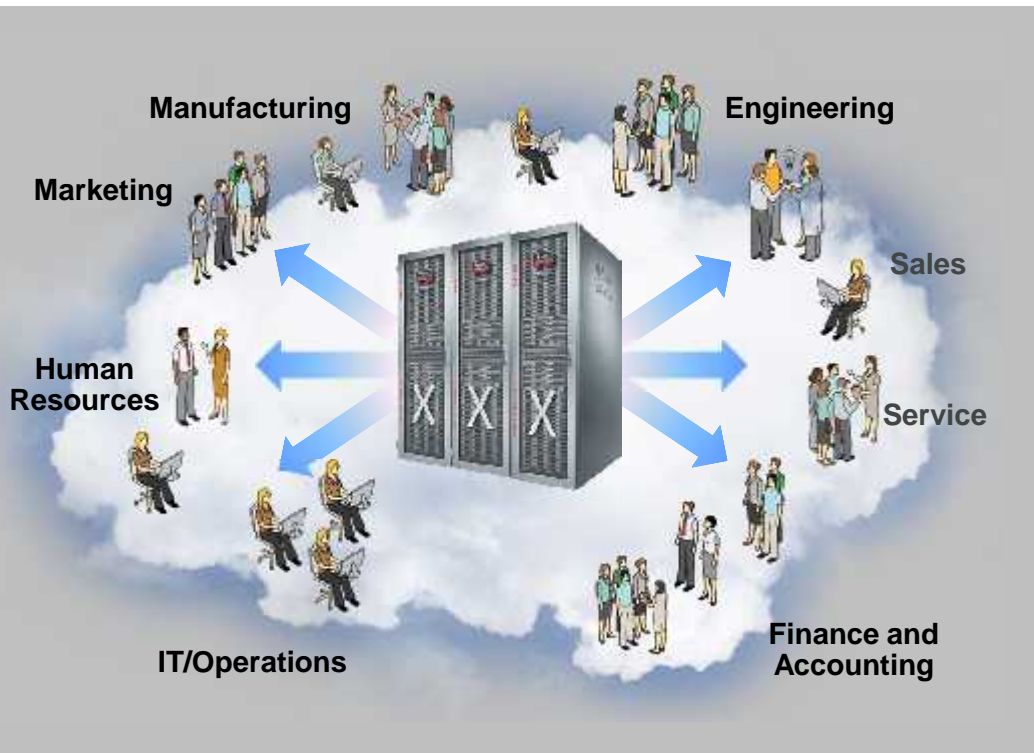
Combines Best Practices and Purpose-Built Technology

- **It Documents a Standard Way to Deliver Database Services**
  - Consolidate databases into a private cloud
  - Standardize database services, technologies, SLAs
  - Implement self-service provisioning, metering and chargeback
  - Apply governance to meet committed SLAs
- **The Foundation for a Purpose-Built Cloud Infrastructure**
  - Scalable platform optimized for highly-available, mixed workloads
  - Multitenant database for maximum consolidation density
  - Defines DBaaS lifecycle management



# Private Cloud DBaaS

Reinvents the Role of IT as a Service Provider



## Users Get

- Fast web-based self-service provisioning
- Lower costs and usage-based pricing
- Higher, predictable quality of service

## IT Gets

- A simpler, standardized environment to maintain; no more server sprawl
- New role – cloud services provider
- More job security

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# DBaaS Best Practices are Essential

## Oracle Enterprise Architecture

People. Process. Portfolio.

### Proven patterns. Lessons learned.



#### Cloud Computing and Shared Services

When laying the groundwork for cloud computing services, business direction is just as important to the architectural vision as advances in data center technologies.

-  **Webcast:** Database as a Service: Design, Deploy, Deliver
-  **Webcast:** Designing the Database Cloud - for Architects
-  **White Paper:** Delivering Cloud Services to the State of Texas (PDF)
-  **Presentation:** Lessons Learned In Cloud Architecture (PDF)
-  **White Paper:** Achieving the Cloud Computing Vision (PDF)
-  **White Paper:** Database as a Service Reference Architecture (PDF)
-  **White Paper:** Architectural Strategies for IT Optimization—from Silos to Clouds (PDF)
  -  **Article:** Roadmap to Rationalize, Standardize, and Consolidate the IT Portfolio

Oracle White Paper  
June 2014

### Service Catalogs: Defining Standardized Database Services

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# There's a Lot to Gain from DBaaS

Lower Costs and Risk with Increased Business Agility

## ↑ Agility

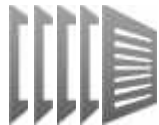
Self-Service Provisioning

Predefined Services

Fast Scale-Out



Service Catalog



Elastic Scale-Out

## ↓ Cost

Denser Hardware Utilization

Reduced IT Intervention

Usage-Based Cost Allocation

Standardization, Automation



Metering



Automation

## ↓ Risk

Standardize Security, HA, QoS

Automate Compliance

Orderly End-of-Life Resolution



Tighter Security



High Availability

## Metrics

OpEx Saved

CapEx Saved

% Utilization

% SLA Compliant

Time to Provision

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# DBaaS is Embodied in Service Catalogs



## Self-service Catalog

**On demand** portal of selected items from the Business Catalog



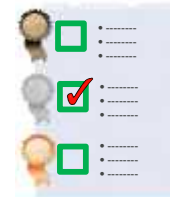
## Exception Handling (< 10%)

- Custom build to requirements
- Custom pricing

## Business Catalog



**What** does the service provide



- Service levels and costs
- Hides deployment complexity

## Technical Catalog



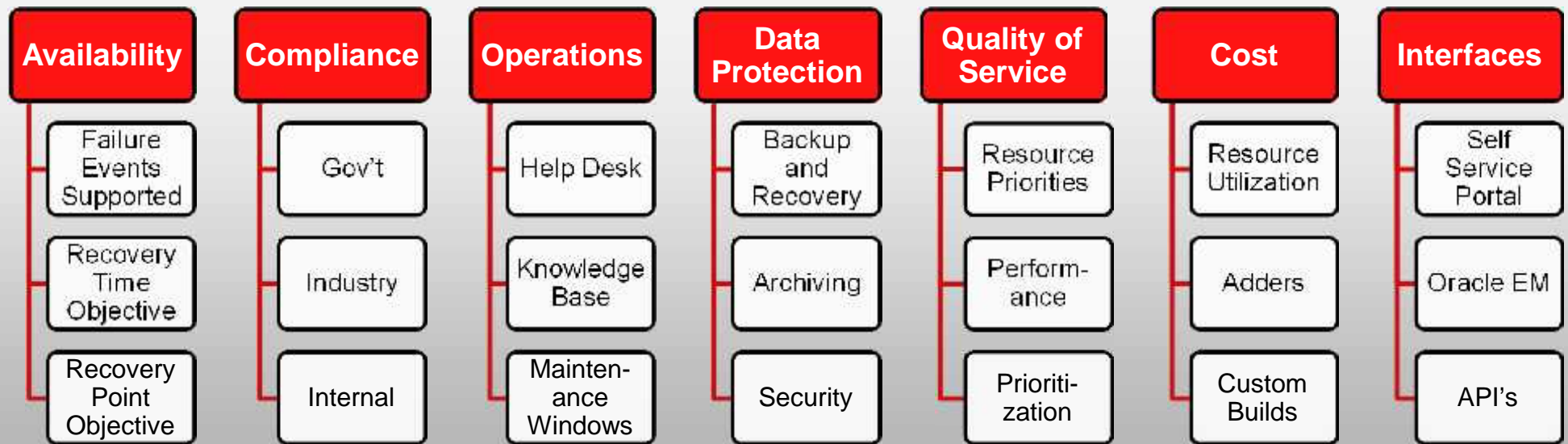
**How** is the service provisioned and maintained

- Deployment templates
- Processes / Plumbing



# Catalogs Detail Service Definitions

There Can be Many Elements of a Business Service Definition



The Service Definition is a formal statement of service capabilities, policies, and procedures from the DBaaS consumer's perspective. This is IT's "contract" with the LoB

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# DBaaS Architecture Drivers

Workload
OLTP
OLAP
OLQP
Batch
Stream
Messaging

SDLC
Development
Test
UAT
Q/A
Production
D/R

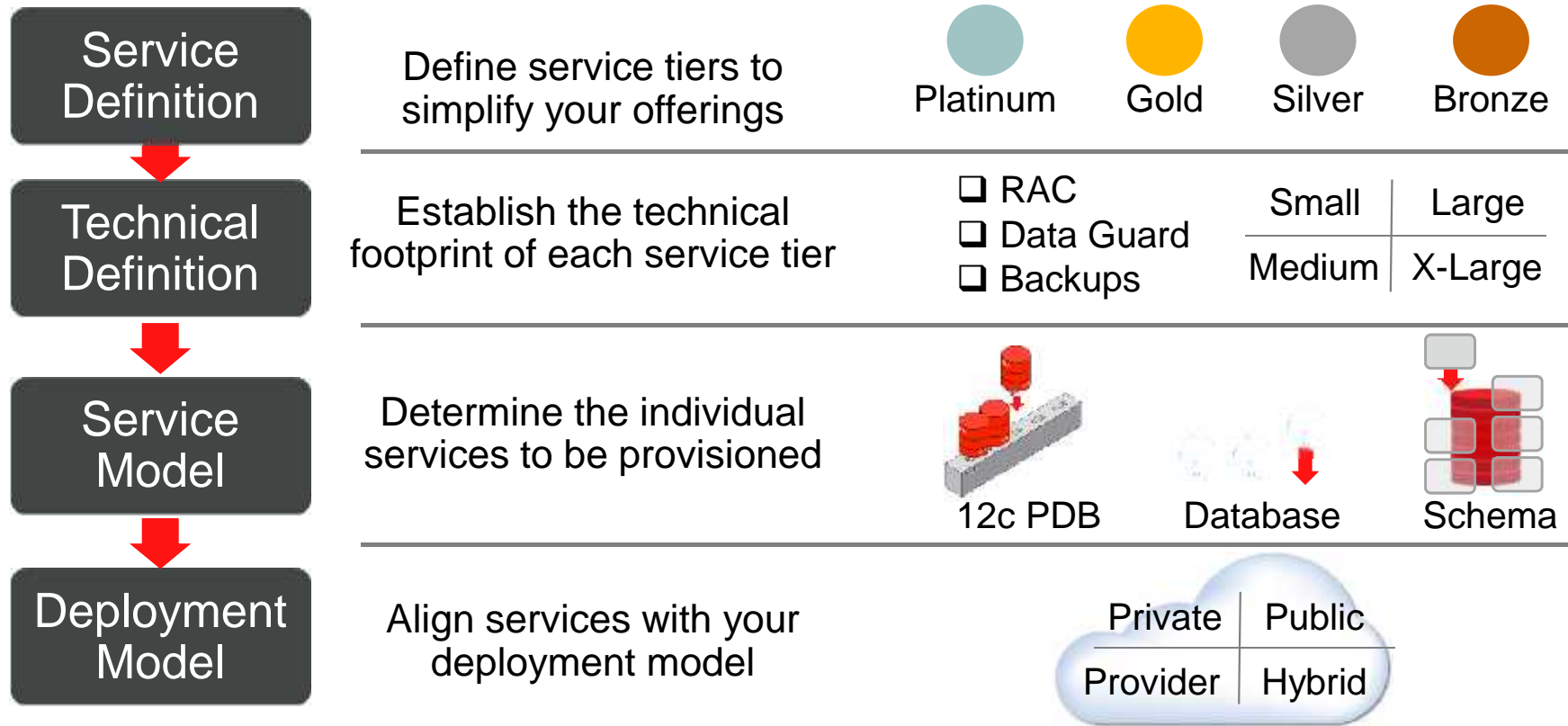
Environment
Internet
Extranet
Intranet
Departmental
Security & Privacy
Hosted / Multi-tenancy

Criticality/ Business Continuity
"Critical Infrastructure"
Seasonal
24 x 7
24 x 5
8 x 5
Best Effort

Dependencies
COTS
Turnkey Systems
DB Version
O/S Version
Integrations
App Dependencies

# Service Catalog Design Process

Service Tiers Simplify the Technical Implementation



# Example Database Service Catalog

DATABASE		MIDDLEWARE		
		SMALL	MEDIUM	LARGE
		<ul style="list-style-type: none"> <li>• 2 threads</li> <li>• 4 GB mem</li> <li>• 10 GB storage</li> </ul>	<ul style="list-style-type: none"> <li>• 2 cores</li> <li>• 8 GB mem</li> <li>• 20 GB storage</li> </ul>	<ul style="list-style-type: none"> <li>• 4 cores</li> <li>• 16 GB mem</li> <li>• 100 GB storage</li> </ul>
<b>PLATINUM</b>	<ul style="list-style-type: none"> <li>• 5 min response</li> <li>• Zero data loss DR</li> <li>• 99.999% availability</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>GOLD</b>	<ul style="list-style-type: none"> <li>• 30 min response</li> <li>• Near zero data loss DR</li> <li>• 99.99% availability</li> </ul>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
<b>SILVER</b>	<ul style="list-style-type: none"> <li>• Dual node or dual site HA</li> <li>• 2 hour response</li> <li>• 24x7 support</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<b>BRONZE</b>	<ul style="list-style-type: none"> <li>• Single node</li> <li>• Weekly full, daily incrementals</li> <li>• 12x5 support</li> </ul>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



# Oracle MAA Availability Tiers

Availability Service Levels for Unplanned and Planned Outages

## PLATINUM

Zero Outage for Platinum Ready Applications  
Zero data loss, Guaranteed QoS

## GOLD

Comprehensive HA and Disaster Protection  
Near-zero data loss, QoS protection

## SILVER

Single Site High Availability (HA)  
Optional Cross-site Data Protection, Best effort QoS

## BRONZE

Single Instance Database  
Data protected as of last backup

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# Oracle MAA Availability Tiers

## Oracle Database Solution Components

### PLATINUM

Application Continuity, Active Data Guard Far Sync, GoldenGate Zero Downtime Upgrades, Edition-Based Redefinition, Global Data Services

### GOLD

Oracle RAC and Active Data Guard or GoldenGate, Site Guard

### SILVER

Oracle RAC, RAC One Node

### BRONZE

Single Instance Oracle Database, RMAN, ASM, other included features

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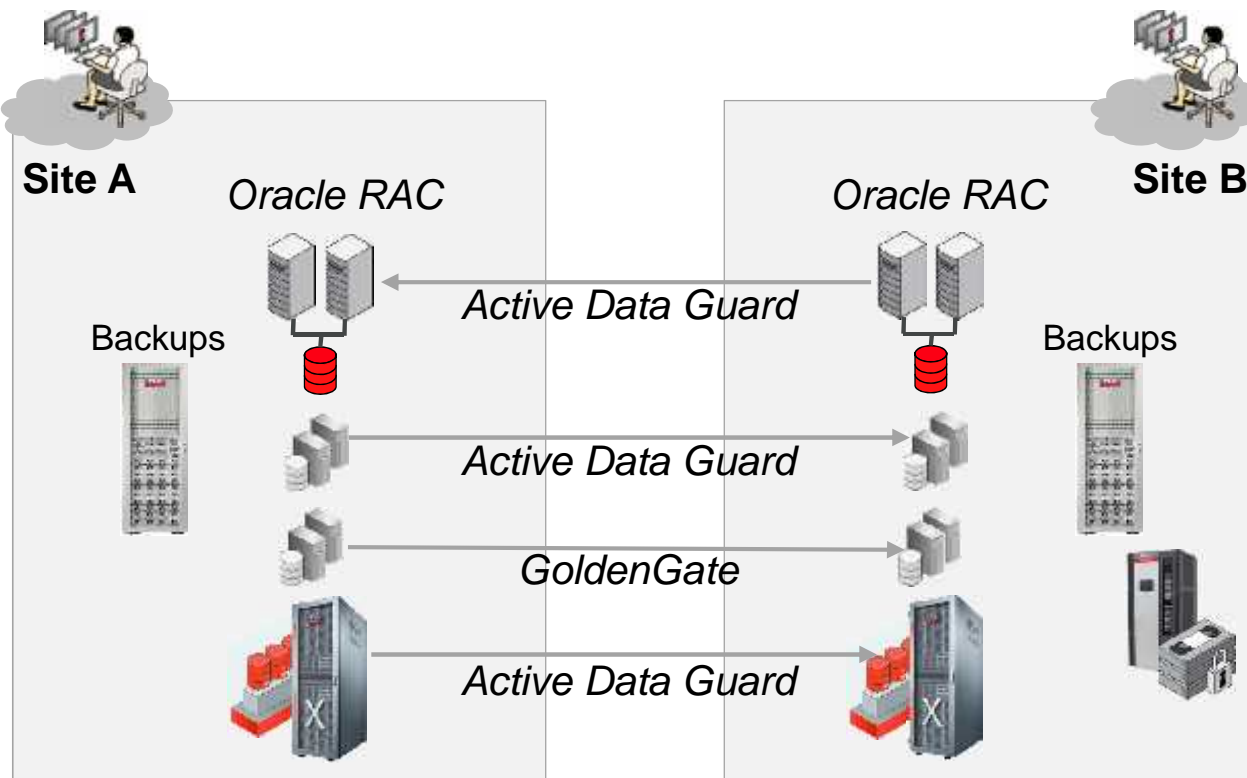
# DBaaS Example Spreadsheet

## Service Catalog

Example:						Filled out with our Worksheet	
<b>DBaaS SIZE</b>	Extra Small	Small	Medium	Large	Extra Large	<b>DBaaS SIZE</b>	Extra Small
Processor Cores	1	2	4	8	16	Processor Cores	
Memory	2	8	16	32	64	Memory	
Storage Capacity (GB)	200	500	1000	1500	2000	Storage Capacity (GB)	
Address	Cores/GB RAM/GB Storage					Address	Cores (4) + 1
<b>SERVICE DEFINITIONS</b>		Bronze	Silver	Gold	Platinum	Titanium	<b>SERVICE DEFINITIONS</b>
Database H/A Level	Local Primary	1-node DB	2-node DB	2-node DB	2-node DB	2-node DB	Local Primary
	Local Failover	No	No	No	No	2-node DB	Local Failover
	Remote Failover	No	No	1-node DB	2-node DB	2-node DB	Remote Failover
Disaster Recovery	RTO	Best Effort	8 hr	4 hr	2 hr	~0	RTO
	RPO	Best Effort	24 hr max	8 hr max	4 hr max	1 hr max	RPO
Data Files H/A	DB Files Mirror	Dual	Dual	Dual	Triple	Triple	Data Files H/A
Database Backup	Tape / Disk	Tape	Tape	Disk	Disk	Disk	Database Backup
DBaaS Service Uptime		Best effort	98%	99%	99.99%	99.99%	DBaaS Service Uptime
DBaaS Service Access		8x5, 24x5, 24x6, 24x7					DBaaS Service Access
Data Security/Privacy		Access Control / Disk,Net,Tape Encryption / Masking / Authentication / Authorization / Audit					Data Security/Privacy
Data Retention		1 yr, 2 yr, 5 yr, 10 yr, Lifetime					Data Retention
Database Version		10g, 11g, 12c					Database Version
Operating System		Windows, OEL, Solaris					Operating System

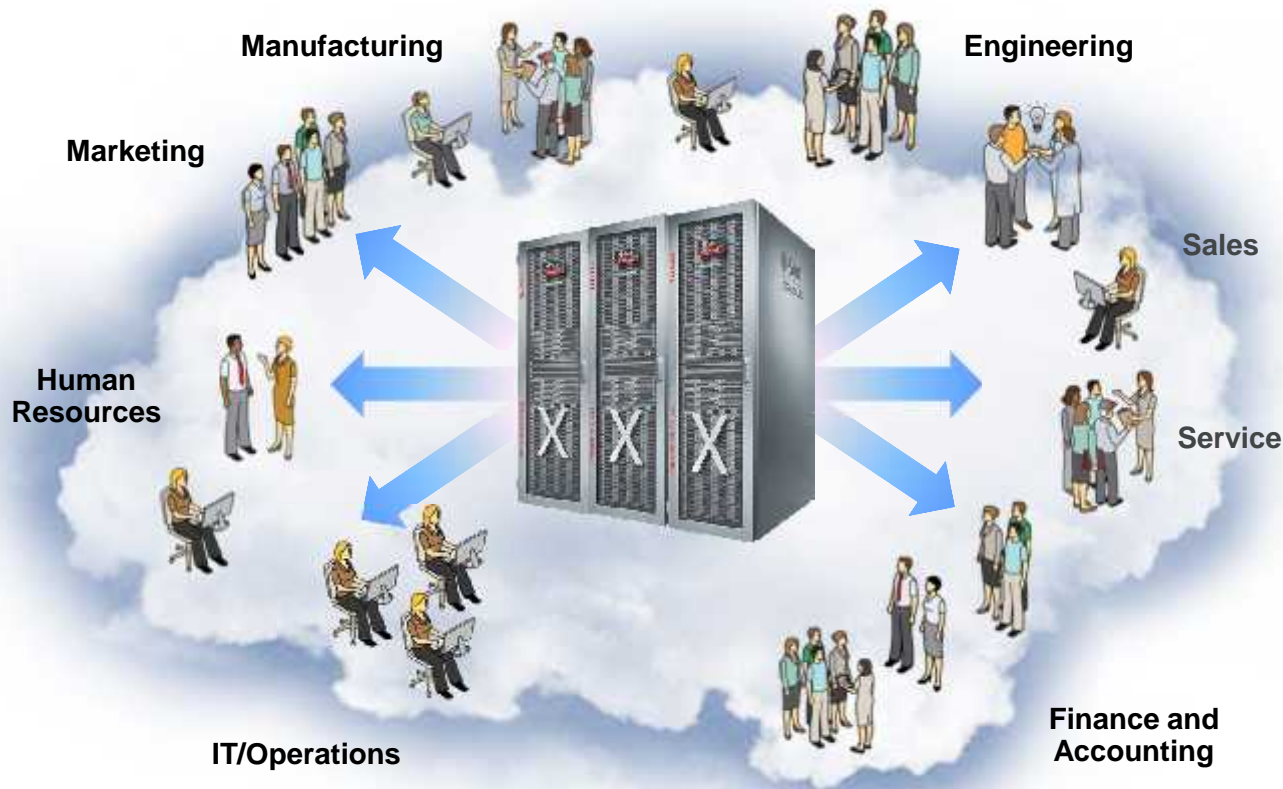
# (Example) Gold Tier: Comprehensive HA/DR

RTO of Seconds to Minutes, RPO of Zero or Near-Zero



- Real-time data protection and DR using Active Data Guard
  - Comprehensive corruption protection
  - Choice of zero or near-zero data loss
  - Automatic database failover
  - Offload read-only and backups
  - Database rolling maintenance
- Flexible logical replication using Oracle GoldenGate, target open read-write
  - Additional options for reducing planned downtime. Uni-directional replication for greater simplicity.
- Coordinated site failover using Oracle Site Guard

# Exadata: The Cloud Platform for DBaaS\*



## DBaaS Challenges

- Many databases of all sizes
- Unpredictable volumes
- Mixed workloads
  - OLTP/Web commerce
  - Reports/Ad hoc queries
  - Data marts/Warehouses
  - Development/Test
- Outages are costly
- Security is mandatory

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# IT Organizations that have embraced DBaaS



- State of Texas Dept of Info Resources
- University of Minnesota
- KPN Netherlands
- PNC Bank
- State Street Corporation
- UBS
- Commonwealth Bank of Australia
- HDFC Bank

# Univ. of Minnesota: DBaaS



## Benefits

“We consolidated dozens of database servers onto Exadata and freed up many of our admins for more strategic tasks. Standardizing our database services and configurations has yielded benefits across many dimensions.”

- Andy Wattenhofer, Database Administration Manager, University of Minnesota

### Server Consolidation

40 servers → 2 Exadata



235 databases → 29

### Reduced Administration



5 DBAs → 3

### Standardized Configurations

Security, Backup, HA/DR

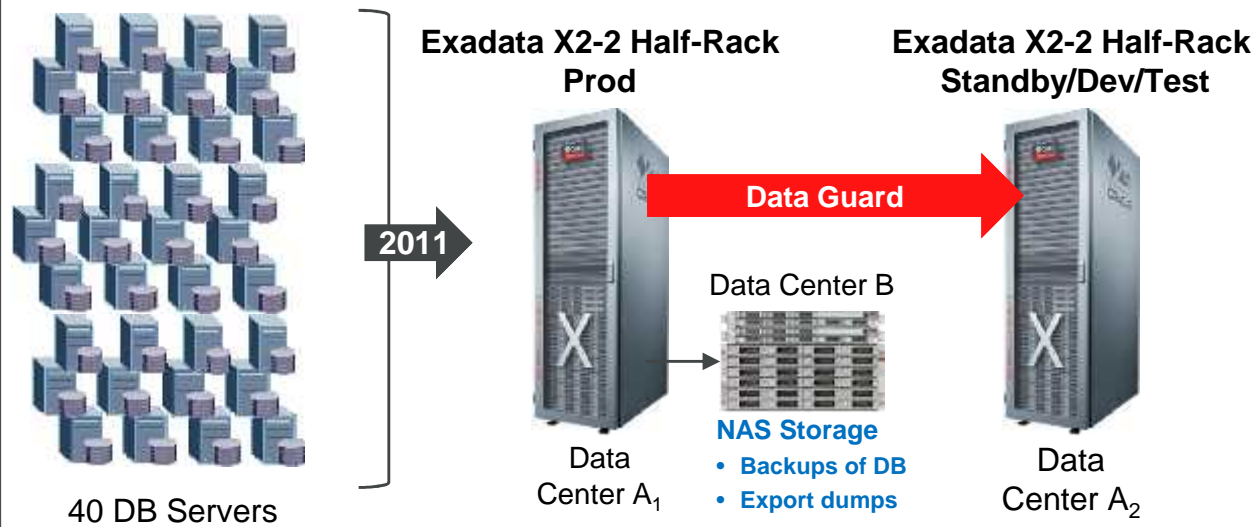


## Business Objectives

- Eliminate server proliferation
- Provide consistent service levels
- Free up redundant administrators
- Standardize roles and permissions

## Solution

- Consolidate 40 DB servers onto 2 Exadata X2-2 Half-Racks
- Create a standard Schema-as-a-Service with 150+ schemas in 8 databases, serving all departments



# University of Minnesota

“We consolidated dozens of database servers onto Exadata and freed up many of our admins for more strategic tasks.”

**Andy Wottenhofer**

DBA Manager,  
University of Minnesota



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# Comprehensive Resource Management

## Mandatory for DBaaS



## Workload-based allocation of...

1. CPU Resources
2. Network Bandwidth
3. I/O Bandwidth

Prioritize from the application to the database, O/S, network and storage – allocated to services, modules, actions or users.

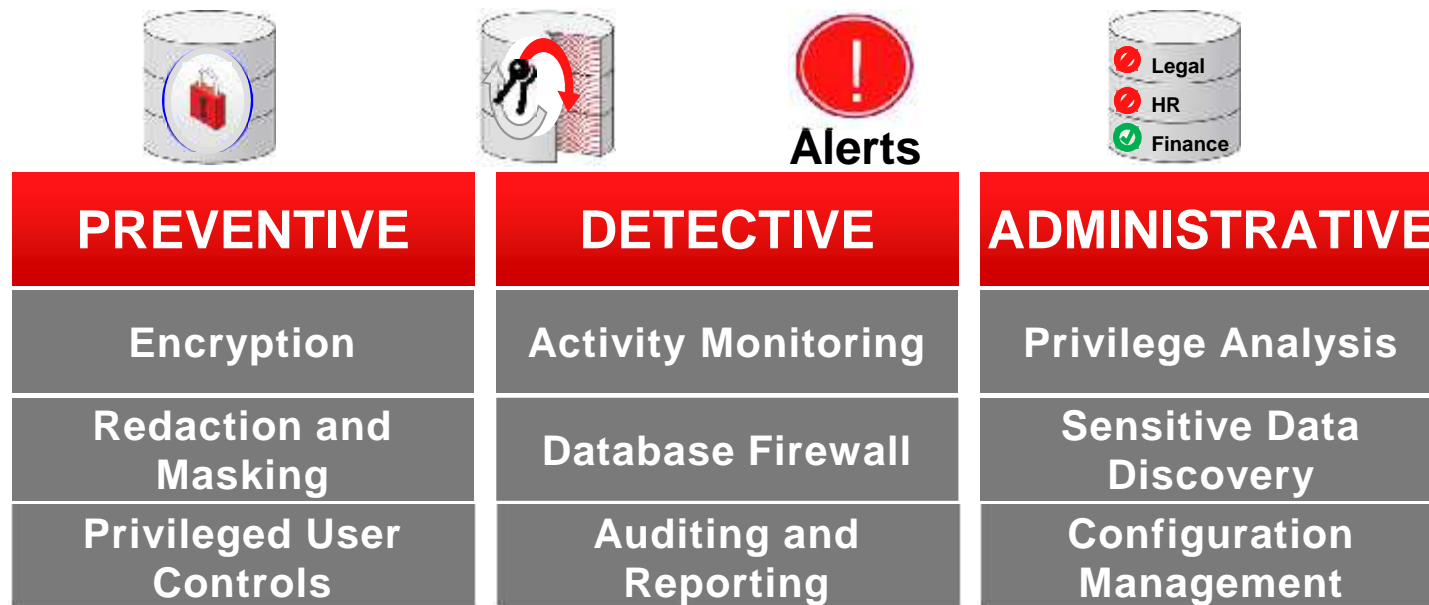
### Example:

**Web-commerce transactions** have priority over ad-hoc queries during the day.

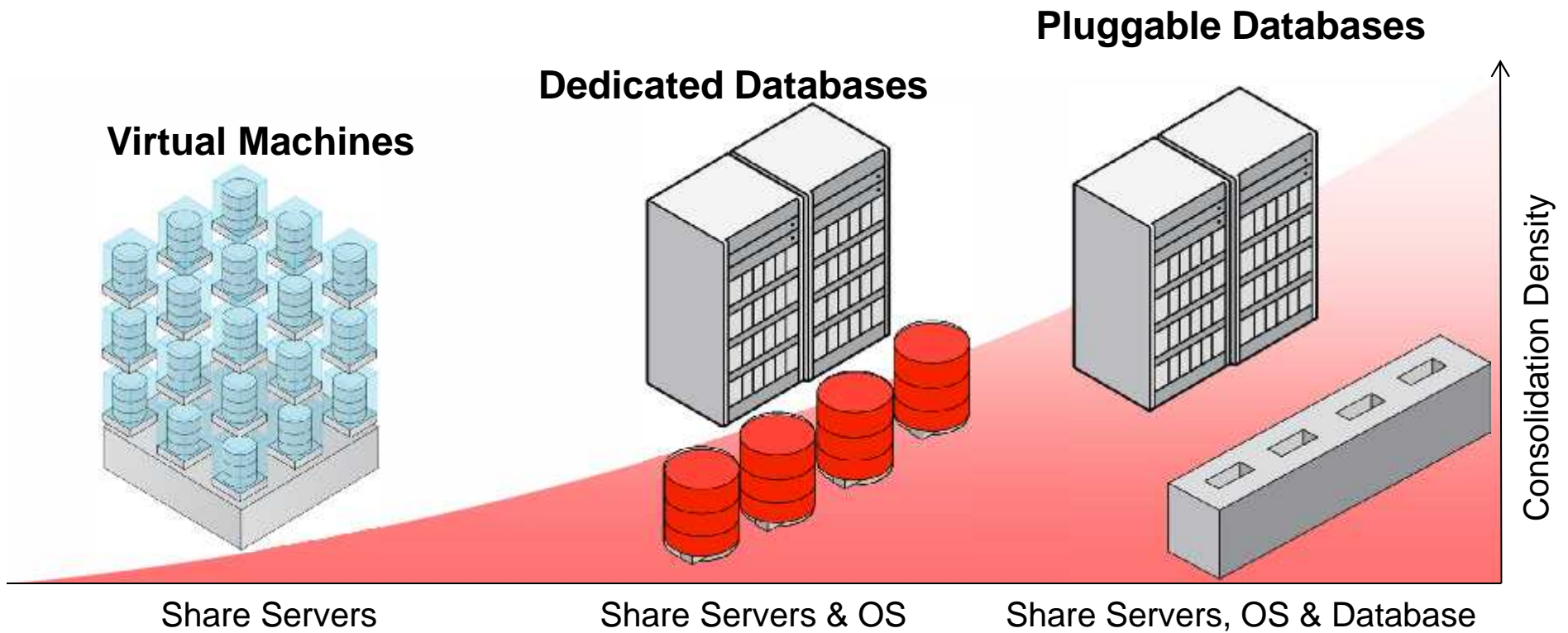
**Batch replenishment jobs** have priority at night.

# Secure DBaaS Platform

## Complete Security Portfolio



# Private Database Cloud Architectures

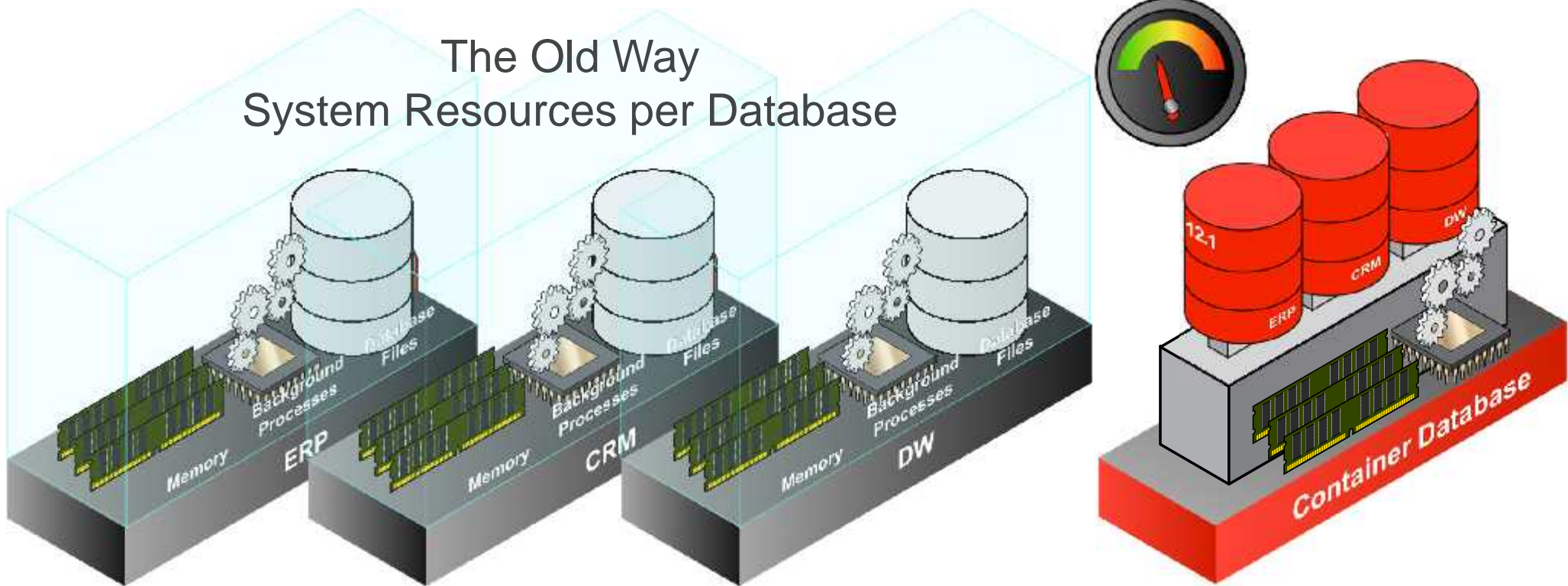


# Oracle DB 12c Multitenant Architecture

## Container Database Consolidates System Resources

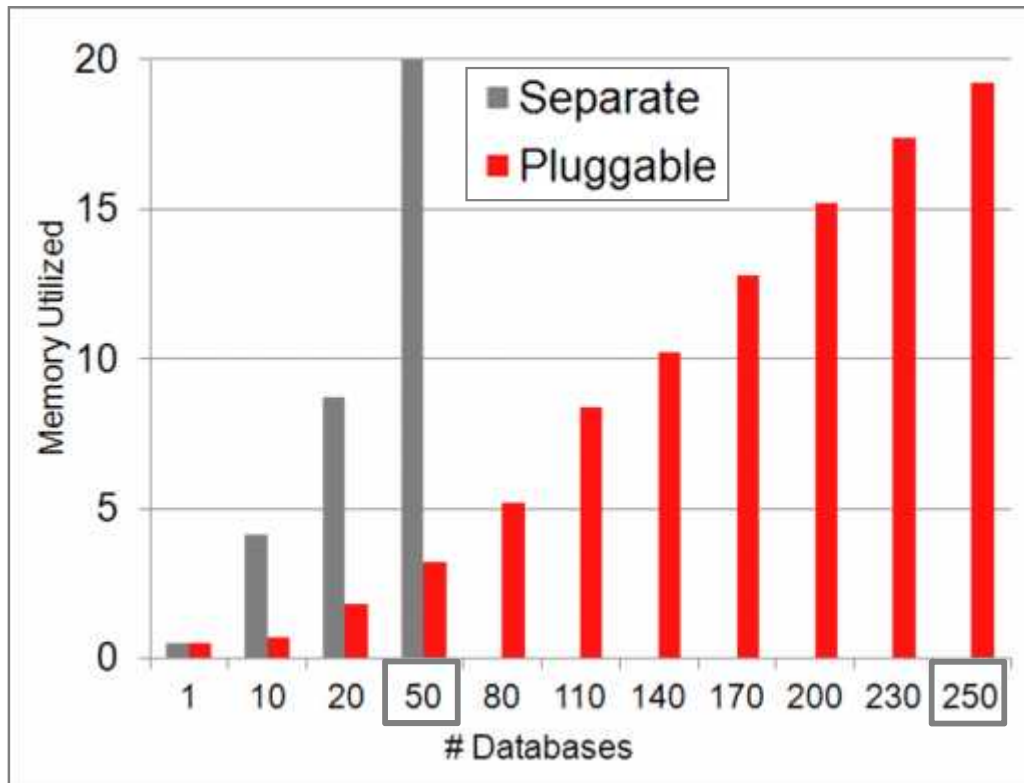
System Resources

The Old Way  
System Resources per Database



# 12c Multitenant Increases Consolidation Density

250 Pluggable Databases | Only 50 Standalone Databases

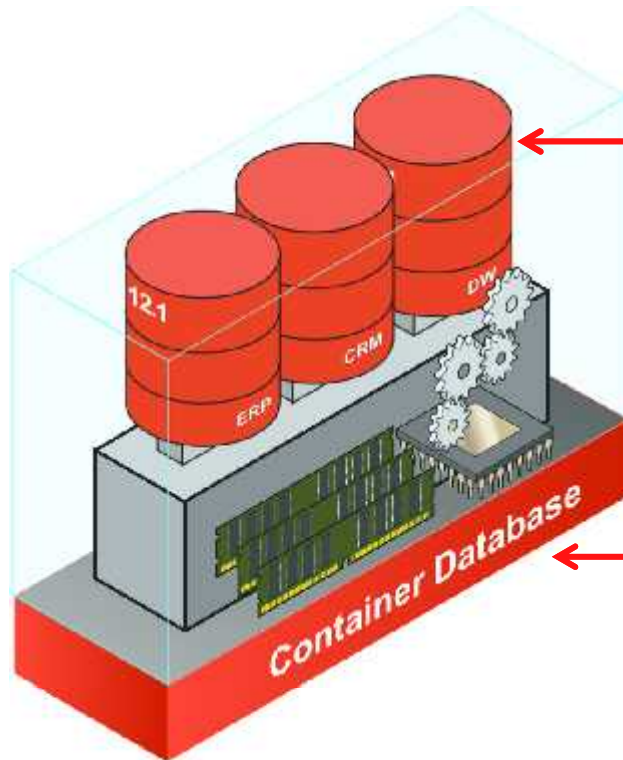


“...multitenant architecture scaled to over 250 DBs while separate database instances maxed out at 50 DBs on the same platform.”

**A 5x increase in capacity**

# Advantages of DB 12c Multitenant

Consolidation Density | Increased Agility | Reduced Administration



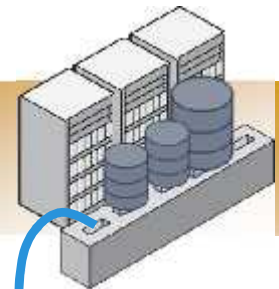
**5:1 Consolidation Density**

**Rapid Provisioning and Portability via Unplug/Plug**

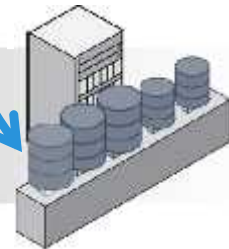
**Manage Many DBs as 1**

- Upgrade the container
- Patch the container
- Backup the container
- Monitor the container
- Setup HA for the container

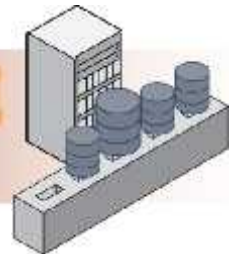
**GOLD Container**



**SILVER Container**



**BRONZE Container**

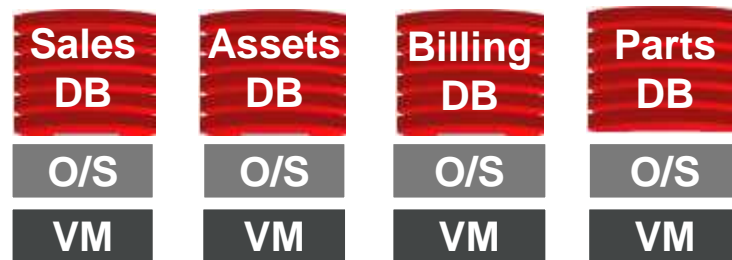


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# Avoid the VM Sprawl with DB 12c Multitenant

Superior Consolidation Density & Easier Administration

Many Databases  
Each in an OS & VM



VS

Single  
Multitenant Database



4 x Database  
4 x O/S  
4 x VM

12 entities  
to manage



2 entities  
to manage

1 x Database  
1 x O/S

# DBaaS Lifecycle Management

Plan, Deploy, Manage, Meter

## 1 Plan & Setup the Cloud

- Capacity & Consolidation planning
- Policy and Governance Setup

## 4 Meter, Charge, Governance

- Metering, Chargeback
- Optimize QoS, Service Performance



## 2 Build & Deploy DB Services

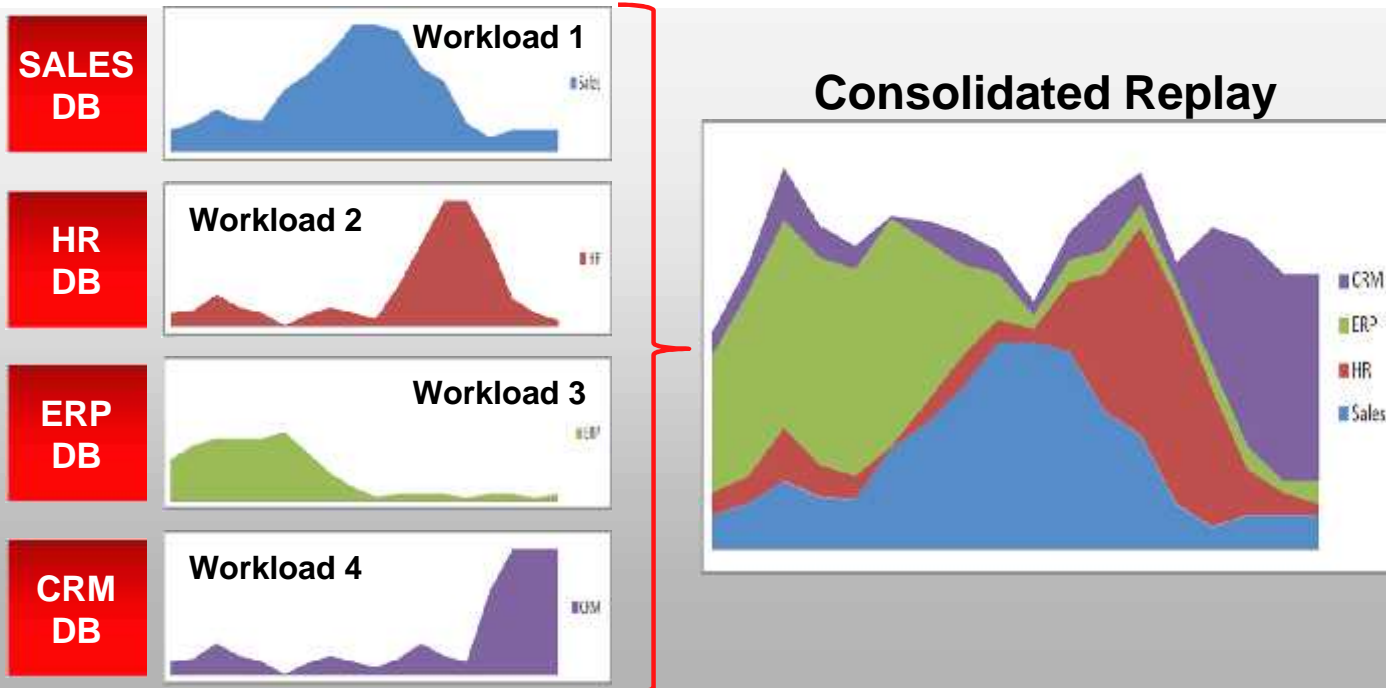
- Self-Service DB Service Creation
- Package Database Services

## 3 Manage & Monitor

- Define Service Priorities and Limits
- Monitor Database Services



# Planning and Migrating to DBaaS

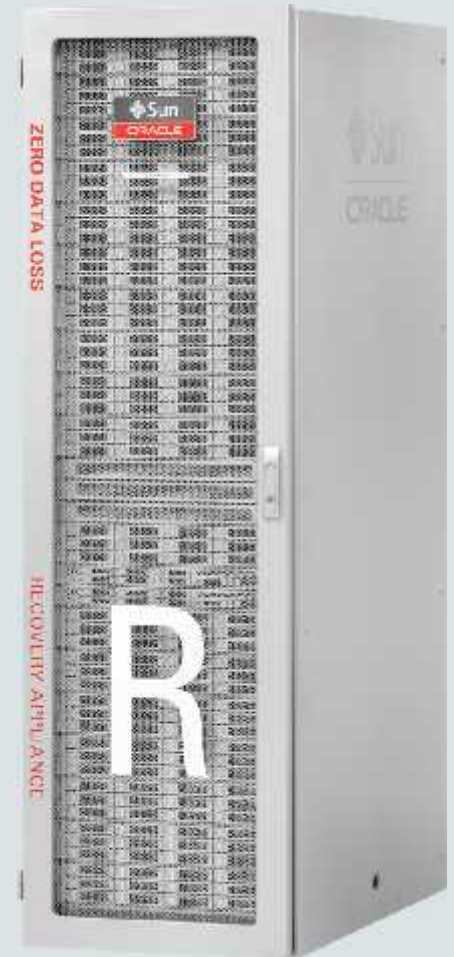


# Service Delivery

## Time to provision a new database(server) in Days

Activity	Current	Near Future
MIS team fill out Tech IT Questionnaire	2	0.5
Discussion / Approvals	15	0.5
Procurement / Delivery of Infrastructure	30	0
Server Installation / OS Configuration	15	0
Storage Allocation	2	0
Software Installation / Configuration	10	0
Database Creation	3	0.5
Load Application Schema	3	3
<b>Total Time (Days)</b>	<b>80</b>	<b>4.5</b>

# Zero Data Loss Recovery Appliance

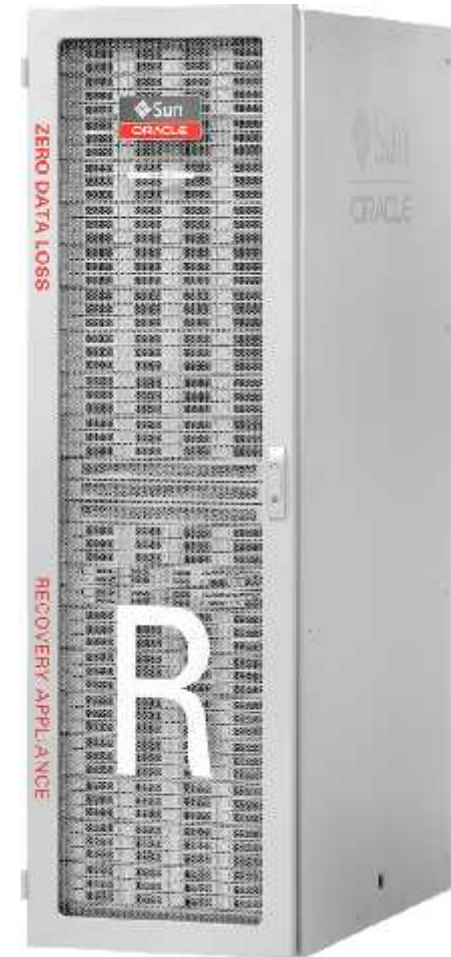


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# Need a Fundamentally Different Approach to Protect Business Critical Database Data

## Zero Data Loss Recovery Appliance



# Recovery Appliance Unique Benefits for Business and I.T.



## Eliminate Data Loss

Real-time redo transport provides instant protection of ongoing transactions



## Minimal Impact Backups

Production databases only send changes. All backup and tape processing offloaded



## Database Level Recoverability

End-to-end reliability, visibility, and control of databases - not disjoint files

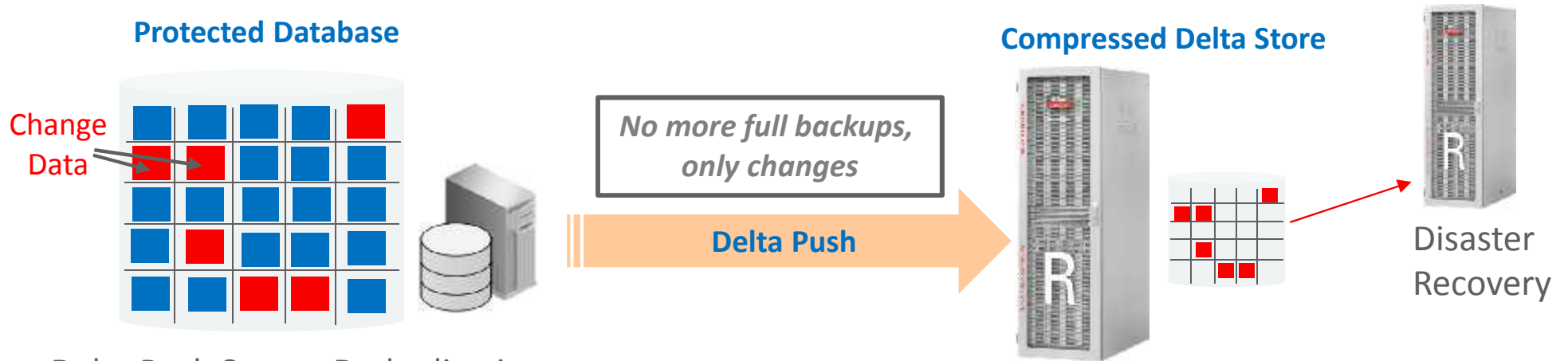


## Cloud-Scale Protection

Easily protect all databases in the data center using massively scalable service

# Delta-Only Architecture

## No More Full Backups: Database Optimized Incremental-Forever



### Delta Push Source Deduplication

- Fast Incremental Backup
  - Never reads duplicate blocks
  - Never sends duplicate blocks
- Eliminates Undo Blocks for committed transactions
- Eliminates Unused Blocks

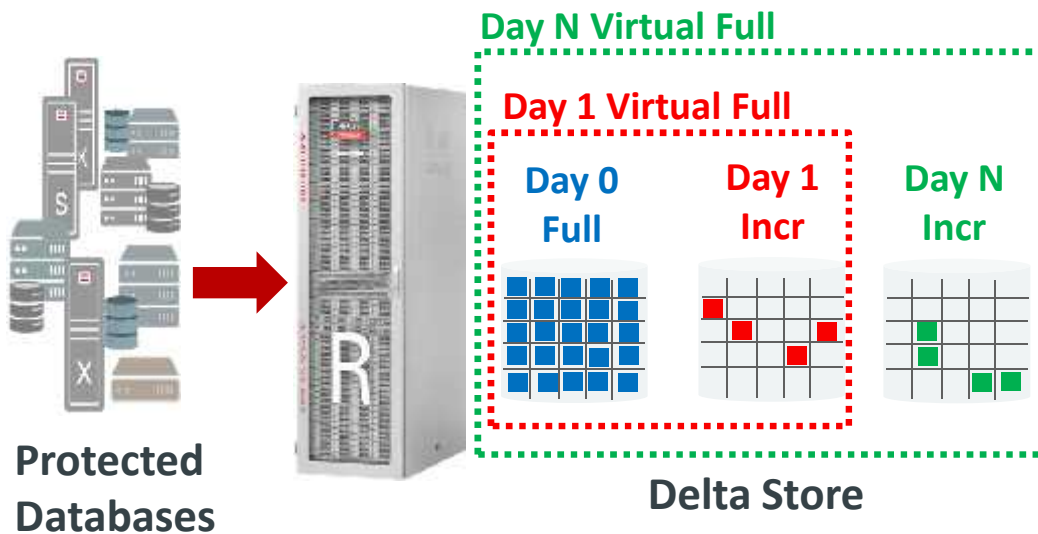
### Delta Store Backup Management

- Stores only change data
- Compresses at block-level
- Ships only Deltas to Replica

***Dramatic Database I/O & Network Savings***

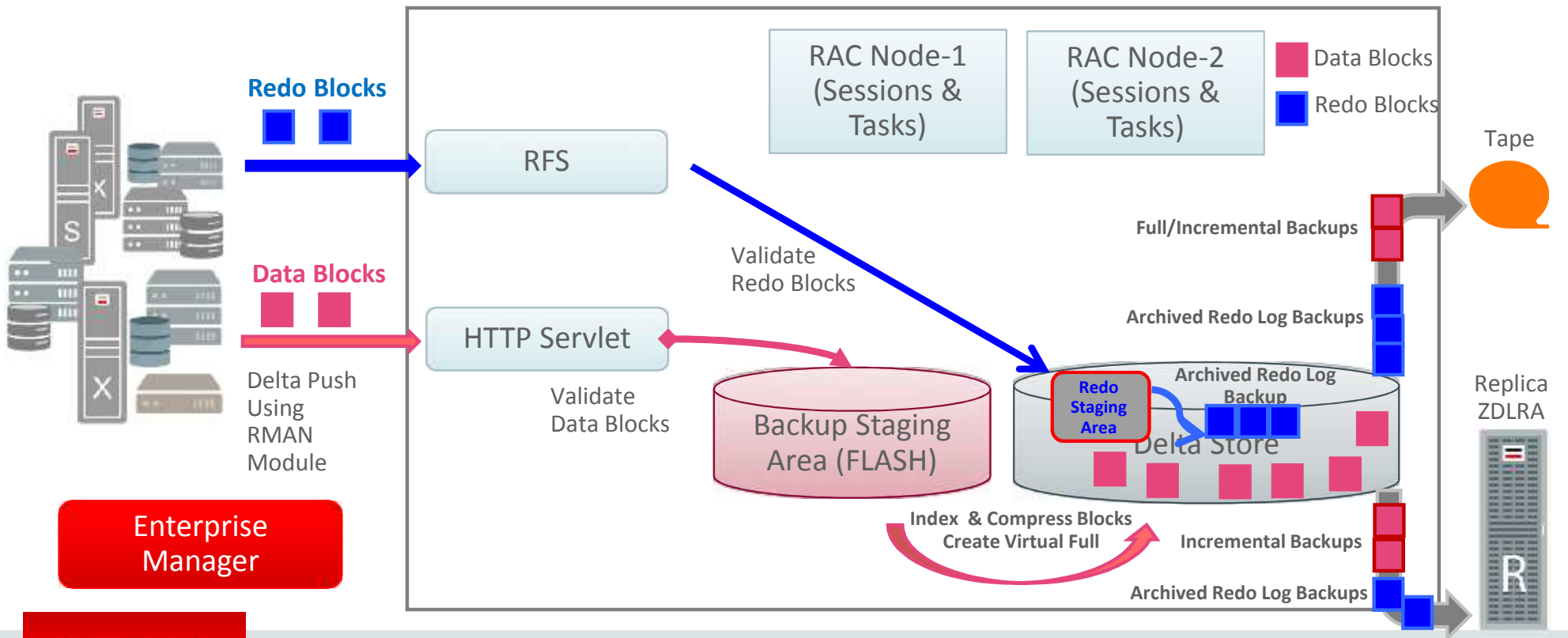
# Space-Efficient “Virtual” Full Backups

## No More Full Backups: Incrementals Forever Architecture



- After one-time full backup, incrementals used to create ***virtual*** full database backups on a daily basis
  - Pointer-based representation of physical full backup as of incremental backup time
  - Virtual backups typically 10x space efficient
  - Enables long backup history to be kept with the smallest possible space consumption
    - “Time Machine” for database

# Backup (Delta Push) Workflow





# Policy-Based Cloud-Scale Database Protection

## Gold Policy – Customer Critical



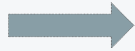
Disk: 35 days  
Tape: 90 days



## Silver Policy – Internal Critical



Disk: 10 days  
Tape: 45 days



## Bronze Policy - Test/Dev



Disk: 3 days  
Tape: 30 days



Tape



Replica

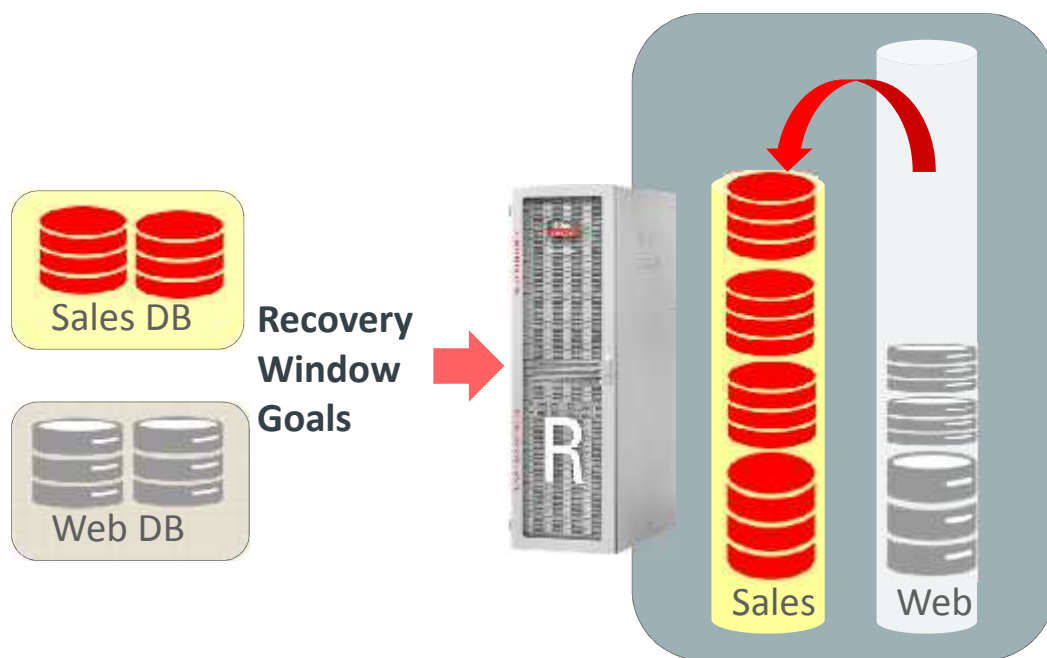


Replica Recovery  
Appliance also  
Policy-Based

## Recovery Appliance Protection Policies

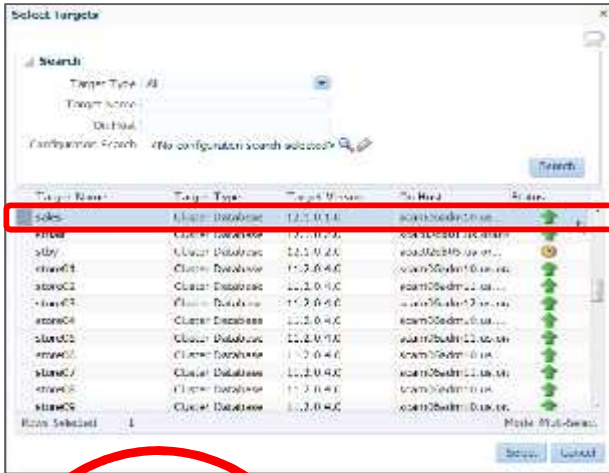
- Standardized recovery window, tape retention, replication policies

# Dynamic Policy-Based Space Allocation

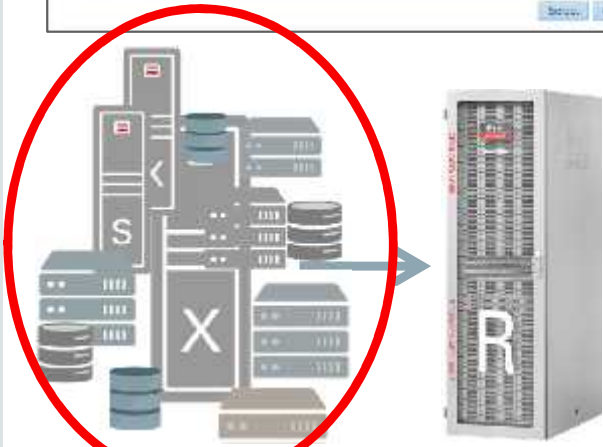


- Space dynamically reallocated between databases to meet recovery window goals
  - E.g. Recover to any time in the last 35 days
- Avoids storage islands and over-allocation typical of host or LUN oriented provisioning

# Easy to Provision Databases for Recovery Appliance Protection



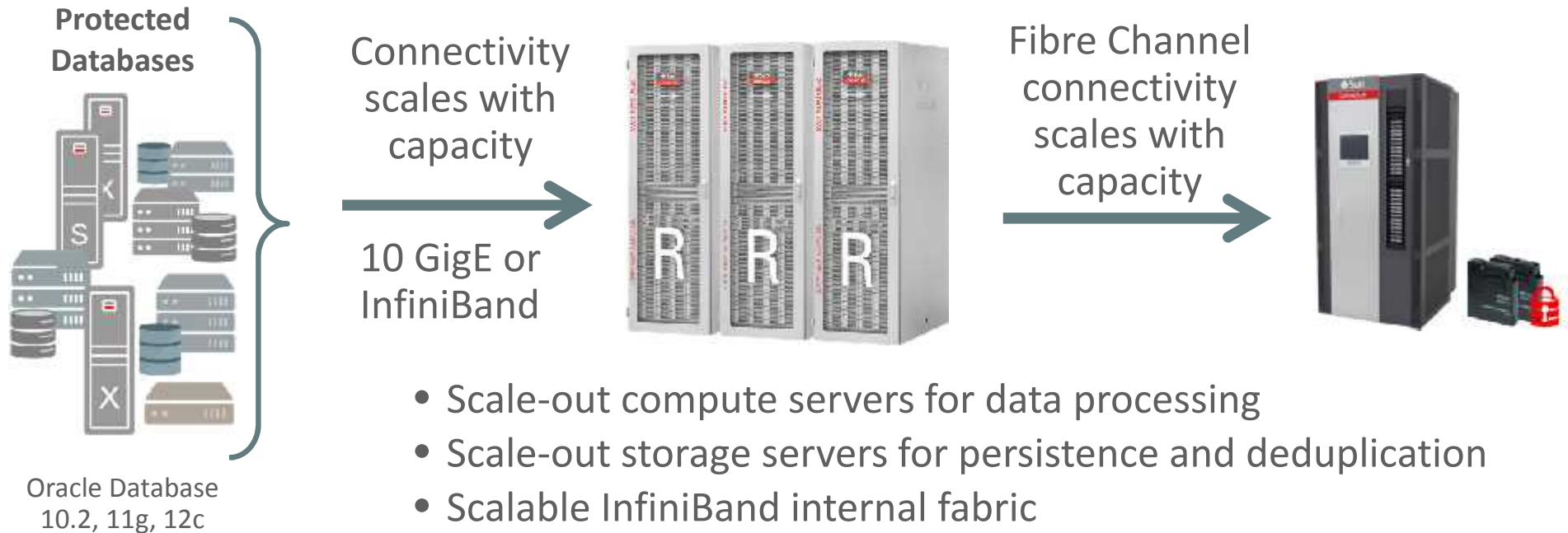
- Recovery Appliance Administrator
  - Chooses new database in Enterprise Manager list
  - Assigns protection policy
  - Sets new database credentials
- Database Administrator
  - Selects Recovery Appliance target in Enterprise Manager
  - Enables real-time redo transport



**New Database  
Fully Configured  
in Recovery Appliance**

# Modern Cloud-Scale Database Protection

## No Bottlenecks, No Single Point of Failure



**Single System Scales to Protect an Entire Data Center**



# Service Catalogs enable the evolution to enterprise cloud

- The promises of cloud computing
  - greater agility, less risk, and lower costs
- Making the full transformation to an enterprise cloud may take several years
- Many enterprises have successfully organized their transformation into a phased approach—an evolution to enterprise cloud.



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