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Georgia Technology Authority

Technology Summit 2014

Aligning Infrastructure to Meet New Needs – A Roadmap to Successful Private Cloud Services

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Glenn Miller, Oracle Enterprise Architect
Public Sector Enterprise Strategy Team

OEA

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A Roadmap to Successful Private Cloud Services

Agenda

- Private Cloud Strategies
- Database-as-a-Service Architecture
- DBaaS Strategy Execution
- State of Georgia Examples

Private Cloud Strategies

It All Starts With The Business

I need to modernize our citizen services and provide better citizen access to the services

I need to roll out additional citizen services, but my budget continues to shrink

I want to consolidate and standardize my IT resources

I need a more efficient, cost-effective, and secure way to collaborate and share with other agencies

My employee productivity is bogged down by slow and outdated procedures and processes

Patterns: Business and IT Pain Points

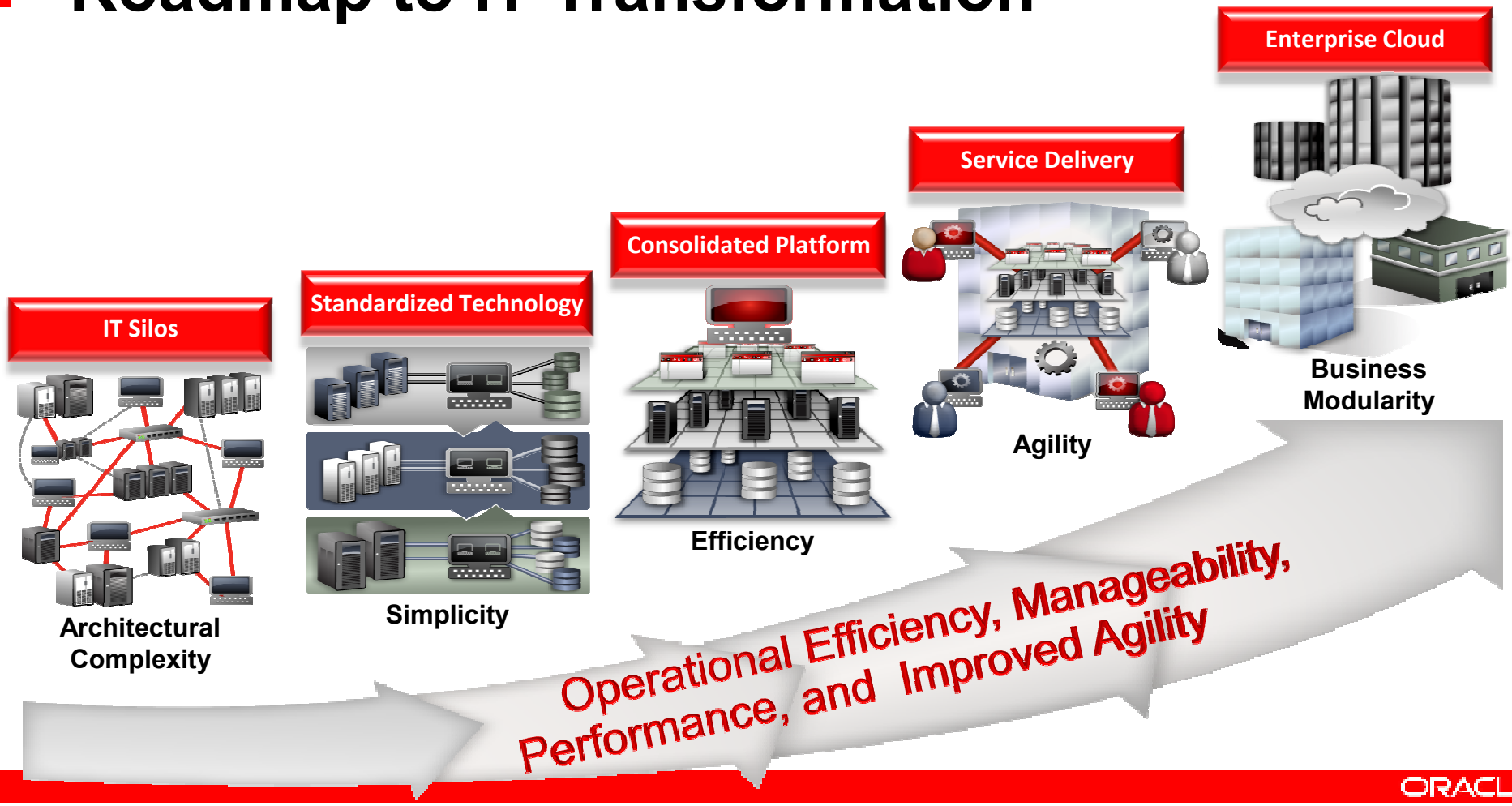
Redundancy

- Business projects with similar IT requirements
- “Color of Money” budgeting constraints
- Applications and databases with similar workloads and data
- Redundant product capabilities across IT vendors
- Multiple replicated or diversified IT organizations

Inefficiency

- Tactical consolidation “strategy” focused on server reduction
- Manual and undocumented IT processes
- Technology refreshes performed in silos
- Dev & Test environments manual, insecure, and unreliable
- Production systems running in oversized, yet underutilized servers

Roadmap to IT Transformation



Evolution to Private Cloud

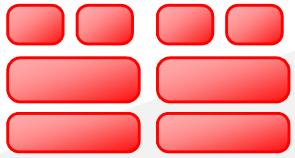
Traditional Silos

- Physical silos
- Dedicated, heterogeneous deployments
- Architectural complexity and inefficiency

Siloed

Standardized Technology

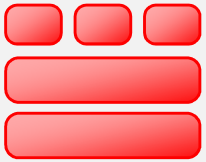
- Standardized hardware and software stack
- Standard deployment configurations
- Architecture simplification, improved manageability



Standardized

Consolidated Platform

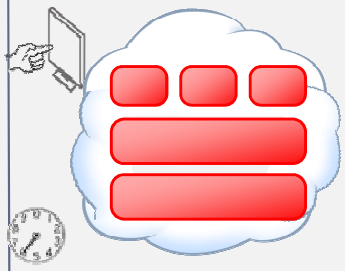
- Shared and secure central data infrastructure
- Dynamic optimizations and resource mgmt
- Automated systems management



Consolidated

Service Delivery Platform

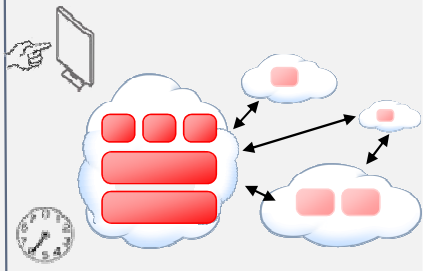
- Catalog of database services and service levels
- On-demand, resilient, and tiered self-service
- Metering, cost allocation and chargeback



Private DBaaS

Enterprise Cloud Platform

- Fully dynamic and unified resource pools
- Rapid service elasticity and automation
- Secure hybrid cloud integration (vendors, partners, etc.)



Federated DBaaS

Lower Risk → Lower OpEx → Lower CapEx → Higher Agility → Fully Optimized

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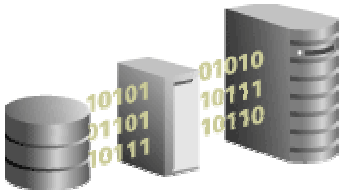
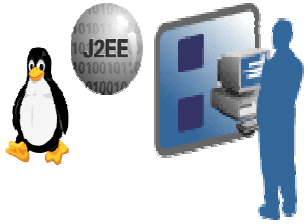
Private Cloud Services

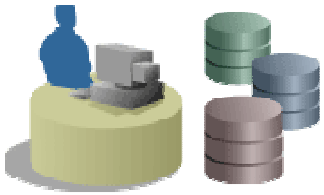


Server Consolidation

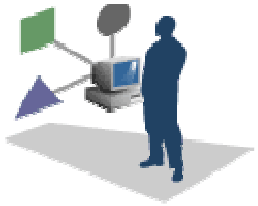
Application, Database Consolidation



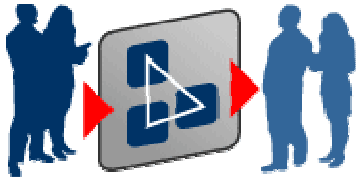
Dev/Test Shared Service



Database-as-a-Service (includes Security, HA, DR)

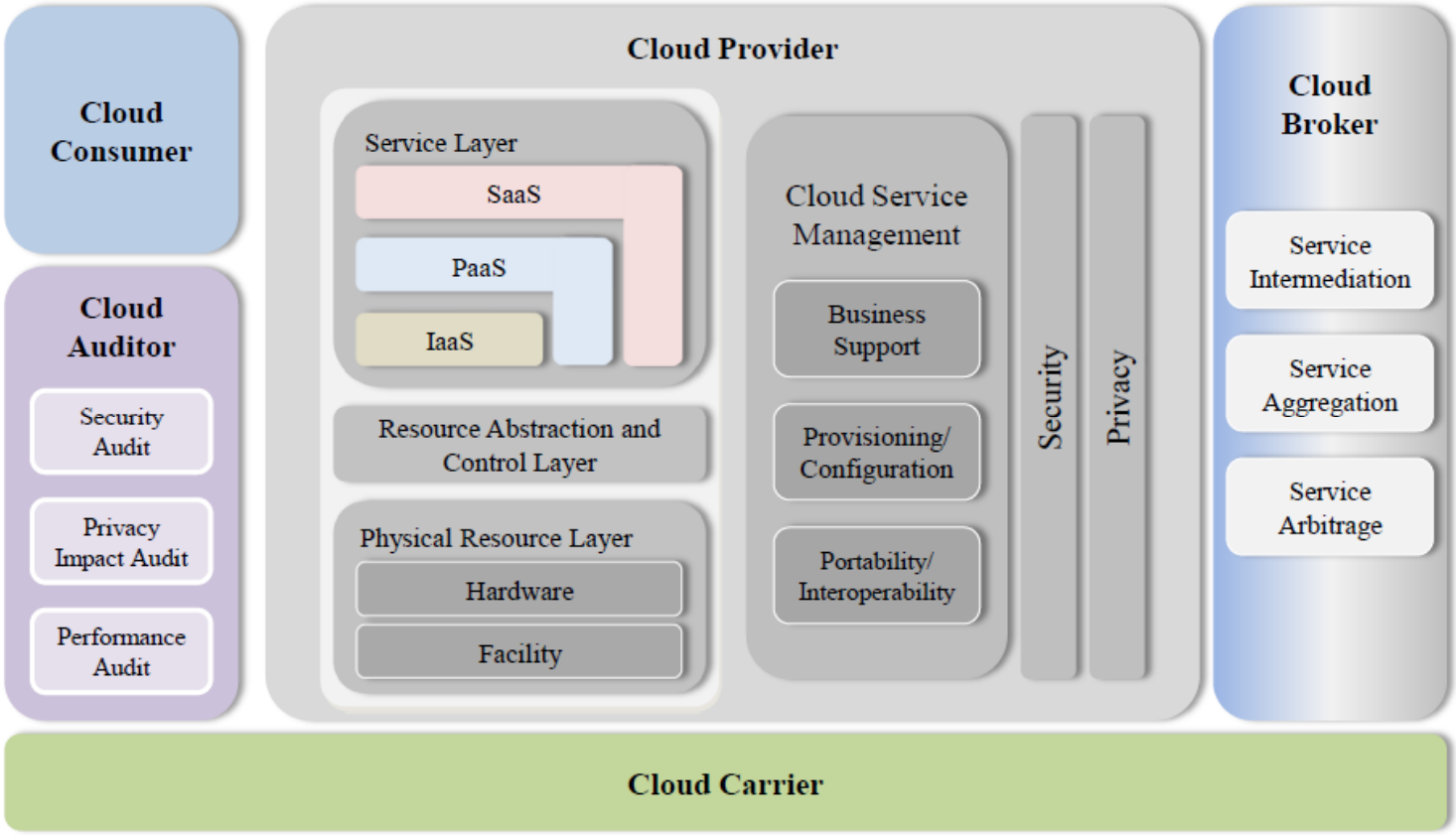


Middleware-as-a-Service (includes Integration, Process Flow)



BI-as-a-Service (includes Dashboards, Adhoc Query)

NIST Cloud Reference Architecture



Information Technology Laboratory Cloud Computing Program

NIST National Institute of Standards and Technology U.S. Department of Commerce

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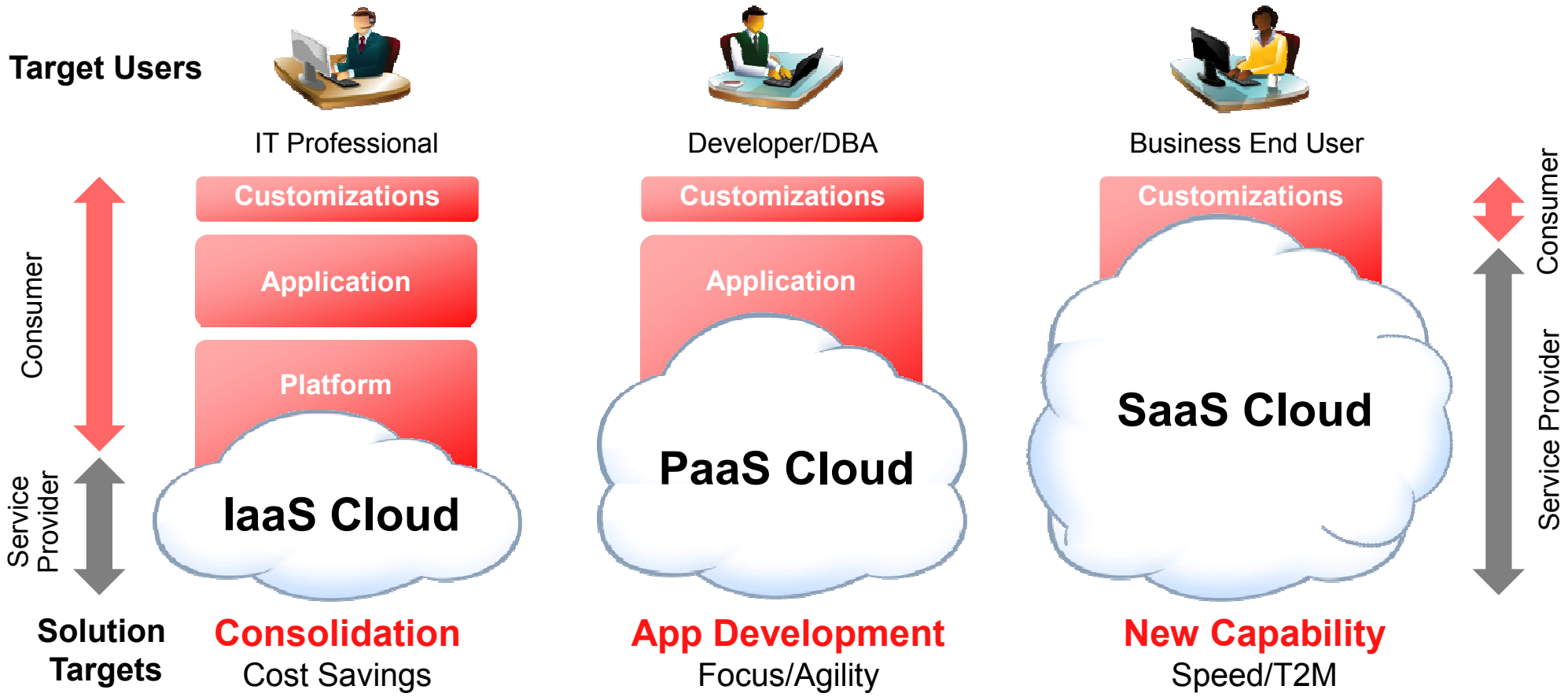
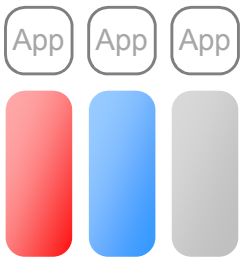
Service Types: IaaS, PaaS, SaaS



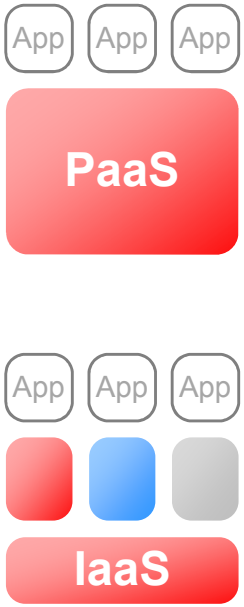
Consolidation at PaaS and IaaS Layers

Consolidate onto standard, shared and elastically scalable PaaS



vs.

Consolidate onto shared IaaS without standardization

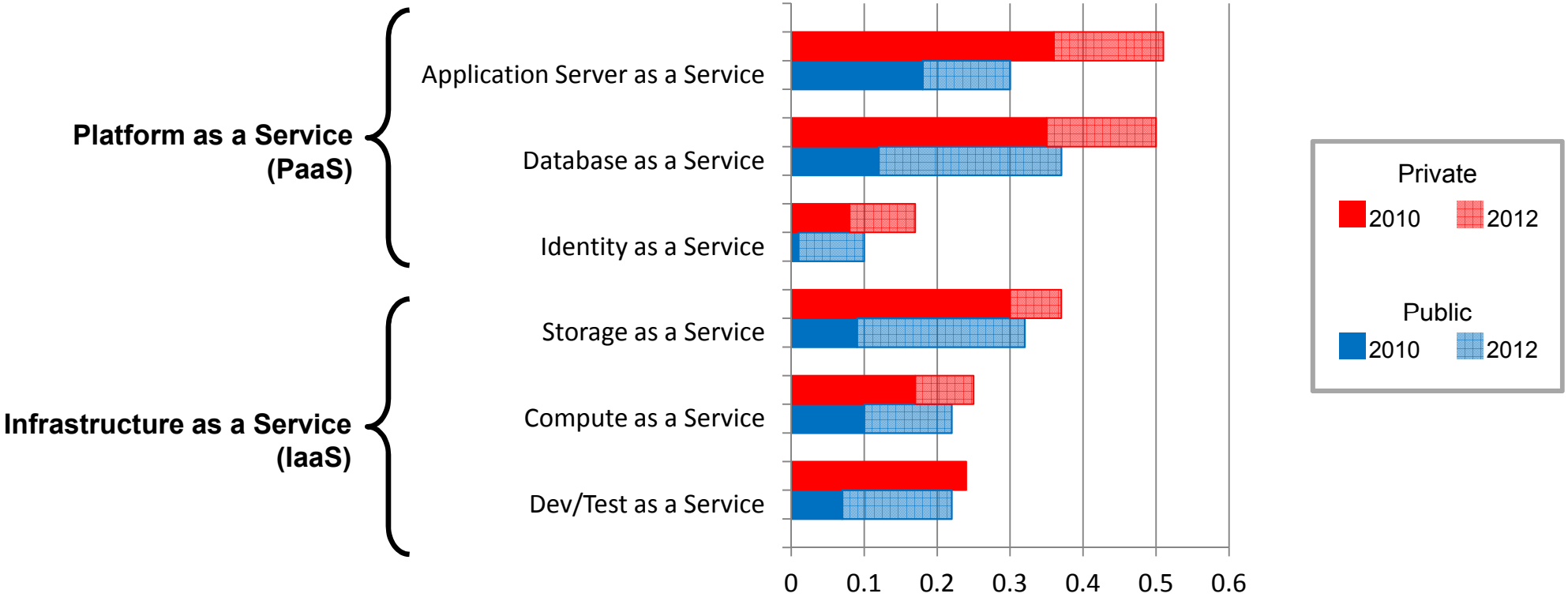


- Standardized PaaS for all applications reduces heterogeneity, cost and complexity
- Accelerated new application development
- Cost savings from less hardware, power and data center space

- Software stack heterogeneity, cost and complexity persists
- No administration (O&M) cost savings

- Cost savings from less hardware, power and data center space

PaaS Outpacing IaaS



Source: IOUG ResearchWire member studies on Cloud Computing, conducted in Aug-Sept 2010 and Aug-Sept 2012

IOUG ResearchWire

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PaaS Solution: Database-as-a-Service (DBaaS)

On Demand Database Services

- Faster Time to Value
- Business Agility

Improved Performance

- Increased productivity
- Continuity of operations
- Advanced monitoring

Standard Technologies & Best Practices

- Complete tool set, Standard processes, Simplification
- Higher Reliability, Simplification, better Support

Resource Pooling

- Increased Utilization,
- Efficiency
- Lower Costs

Predefined DB Configuration

- Quality of Service
- Productivity
- Lower Risks

Defined Capacity, Metering of Usage

- Transparency
- Predictability

Elasticity

- Agility
- Rapid Respond to Change
- Scalability

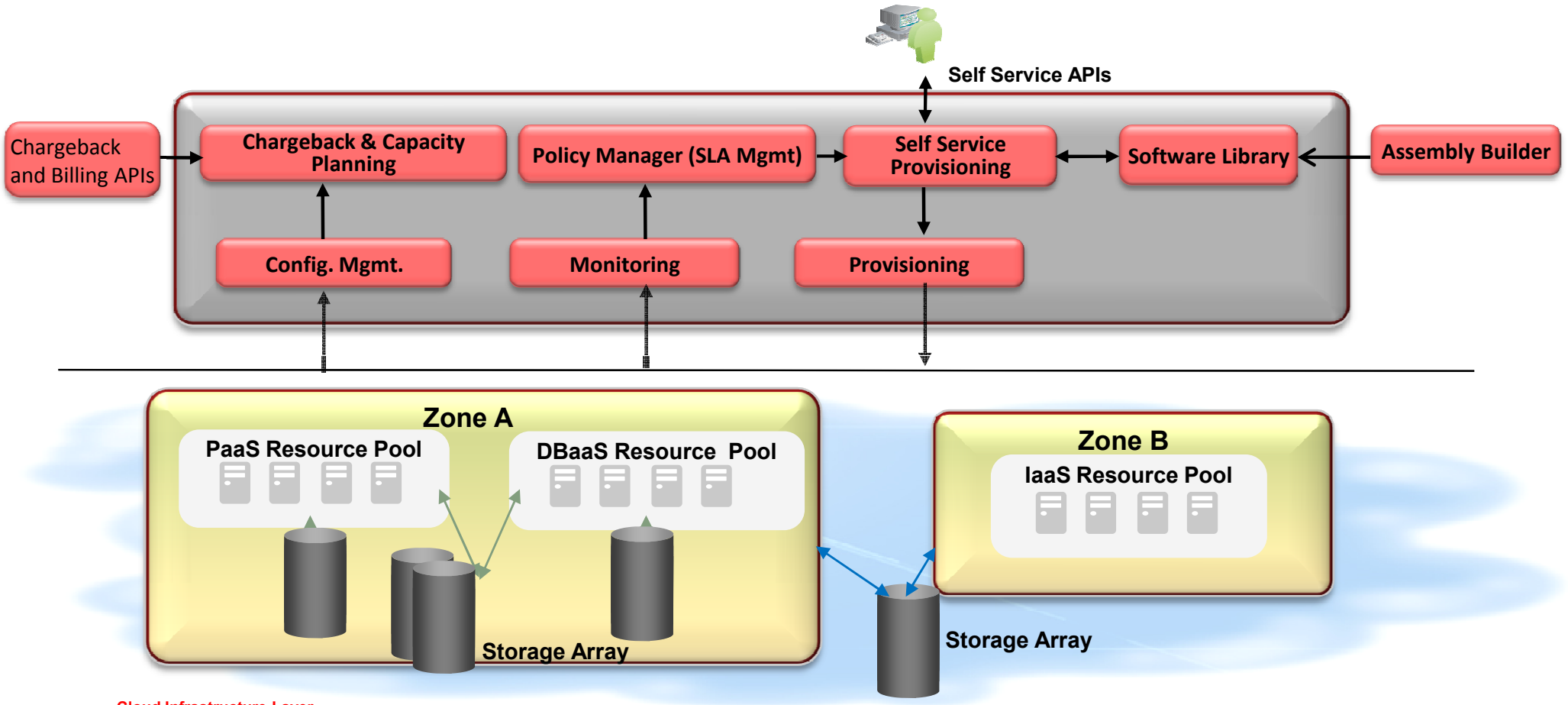
Data Security

- Protection for data at rest
- Data access isolation and control

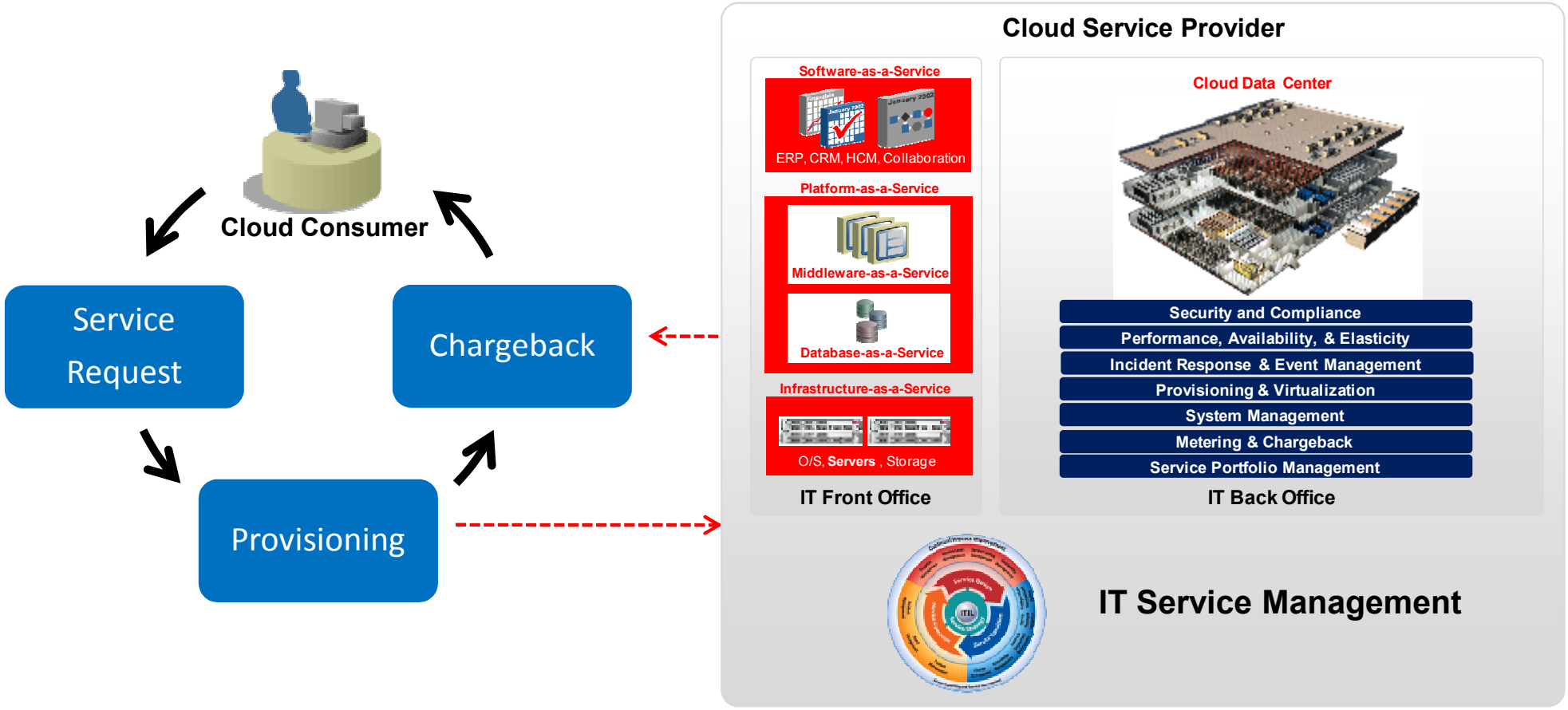
Cost Savings

- Faster time to value
- Optimized system
- Reduced licensing costs
- Reduced storage costs
- Single vendor accountability

DBaaS Cloud Architecture



DBaaS Services Lifecycle



Database-as-a-Service (DBaaS) Architecture

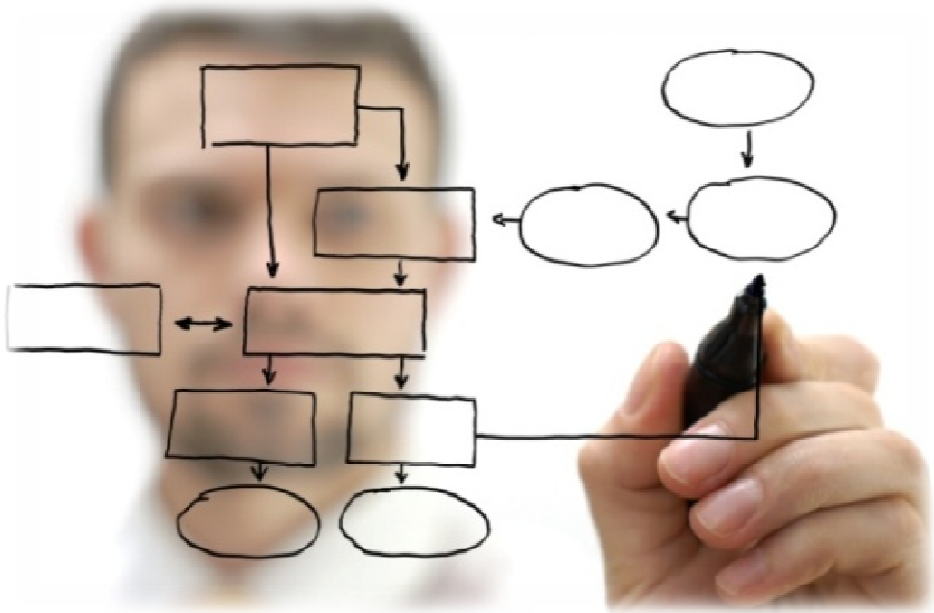
Architectural Strategies For DBaaS

Deployment Models

- Consolidation
- Isolation
- Capabilities

Operational Model

- Service Catalog
- System Architecture
- Management



DBaaS Use Cases

Configuration	Typical Deployment	Use Cases
Shared Server	First Step Consolidation	• Server Consolidation • Development and Test environments • High isolation or security requirements • Multiple operating systems required
Shared OS & DB Binaries	Most Common Config	• Single operating system to manage • Development , Test, and Production environments • Low security requirements
Shared Database	Large Single Customer	• Enterprise database platform for business applications (ERP, HR, etc) • Shared services for a standardized database platform • Simplified provisioning, orchestration, and management
Shared Table	Potential for DW/DM	• Data consolidation • Single source of truth without having to replicate data or databases • Data sharing with “need to know” row-level access

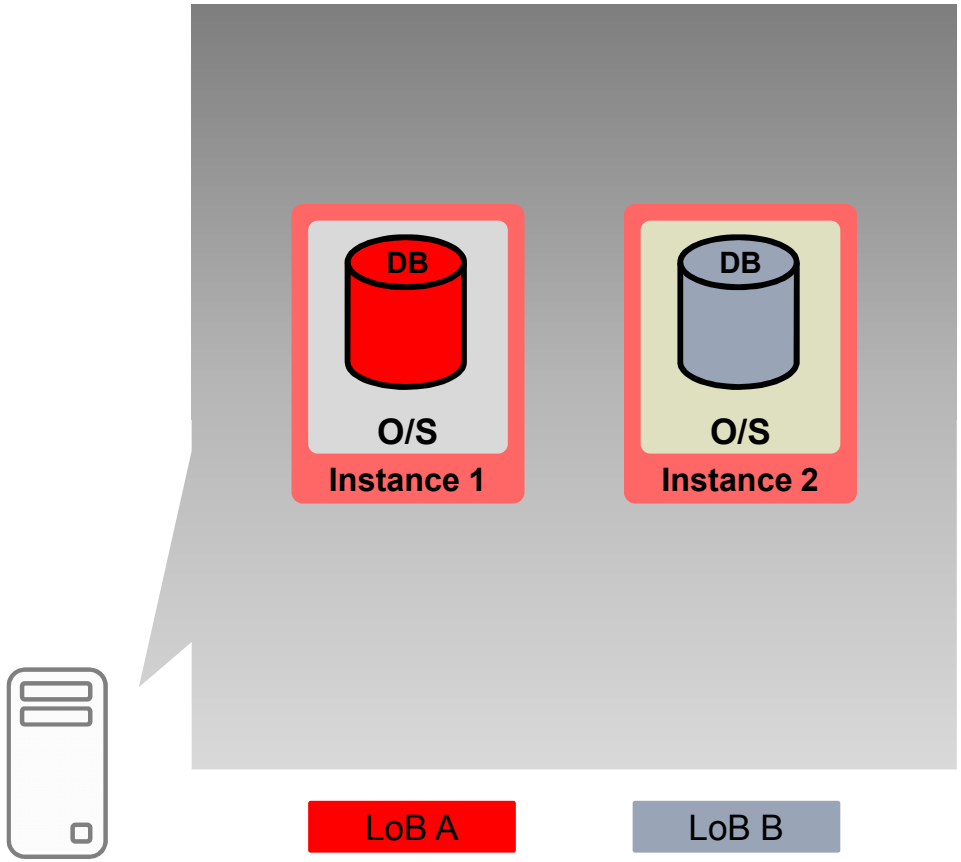
Shared Server - Binaries & Instances Isolated

BENEFITS

- Increases server utilization
- Reduces Cap Ex and environmental costs
- Most flexible O/S and DB configurations

FEATURES

- Single physical server
- Independent O/Ses
- Heterogeneous O/Ses
- Independent databases



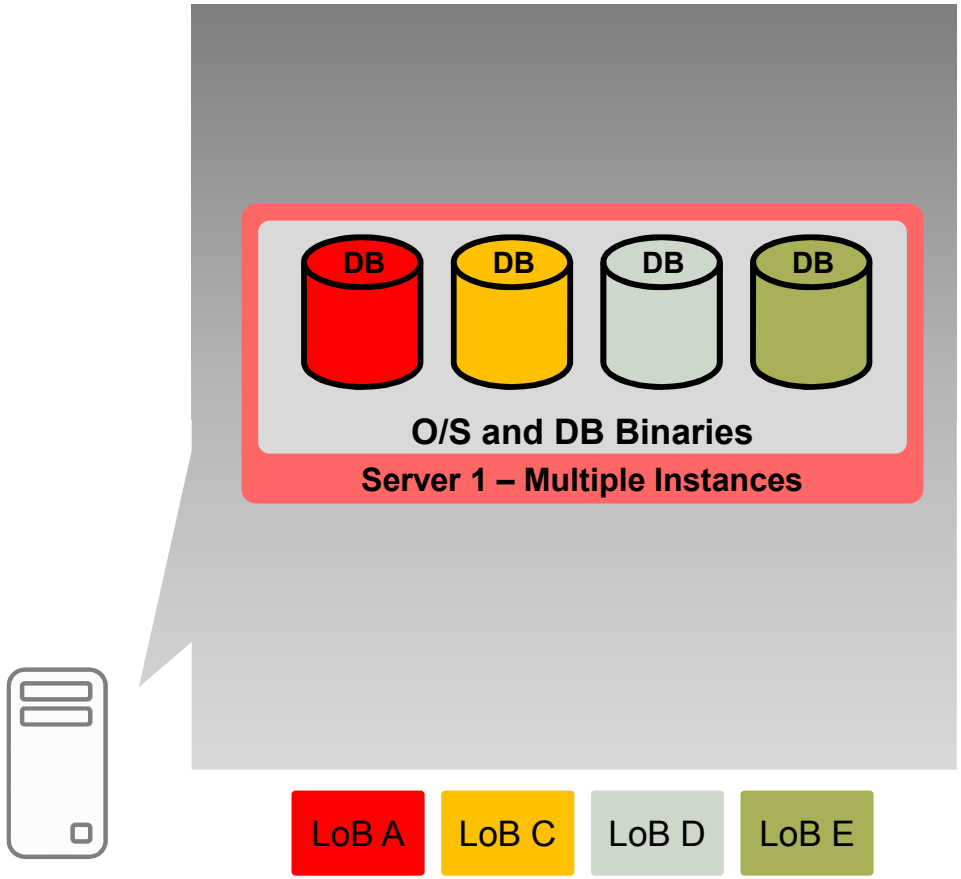
Shared OS & DB Binaries - Instances Isolated

BENEFITS

- Simplest deployment model
- Simplest system administration effort
- Standardizes operating system

FEATURES

- Single operating system
- Common binaries/executables
- Independent databases
- Most flexible DB configurations



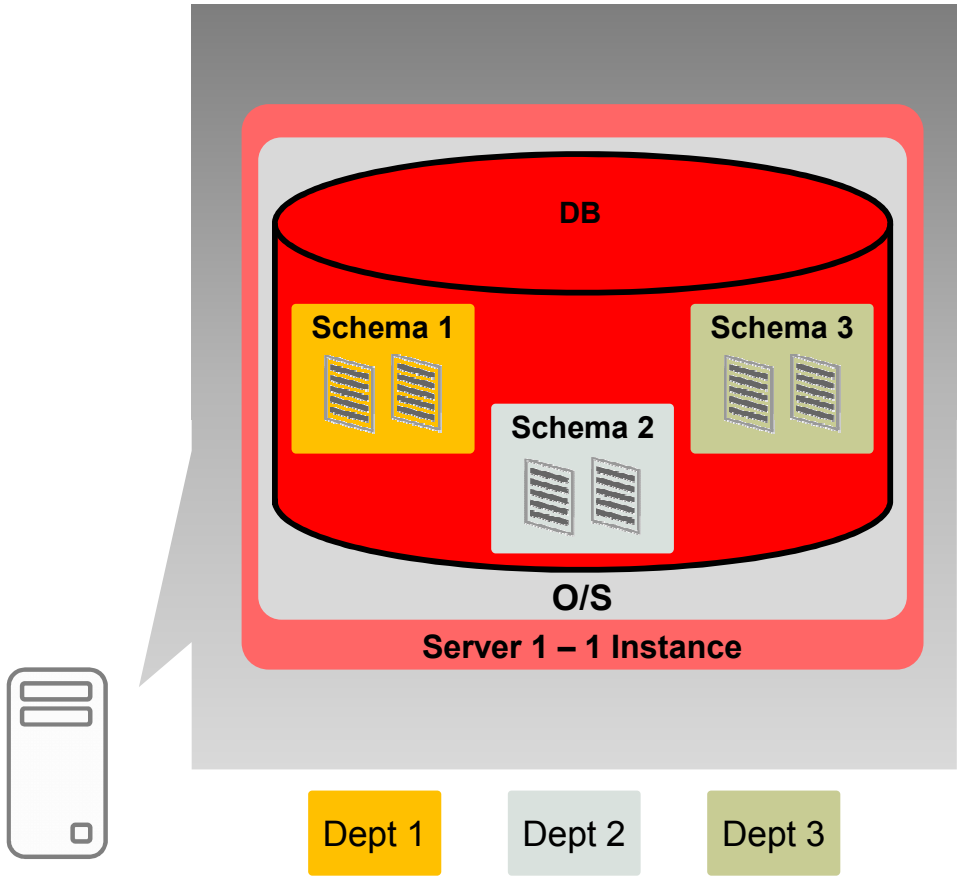
Shared Database - Schemas Isolated

BENEFITS

- Standardizes database platform
- Simplifies DB management requirements
- Offers the fastest provisioning process
- Common failover and scalability architecture

FEATURES

- Single database instance
- Shared SGA
- Independent schemas
- Schema-level security



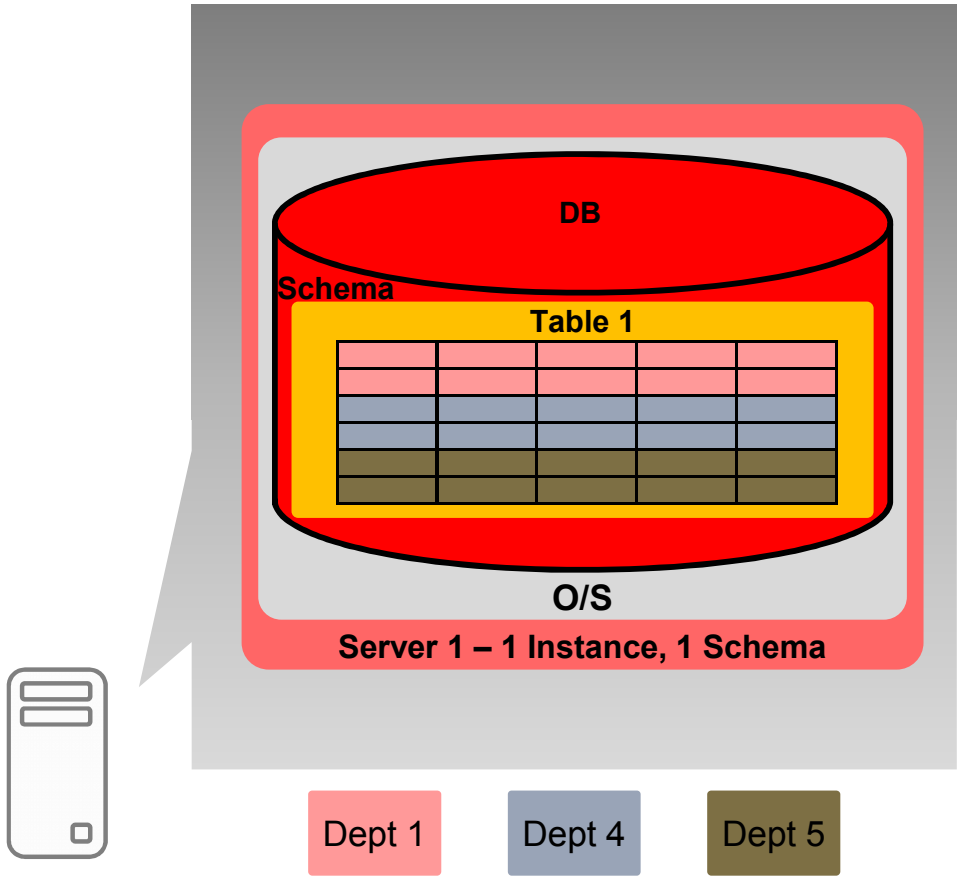
Shared Table - Rows Isolated

BENEFITS

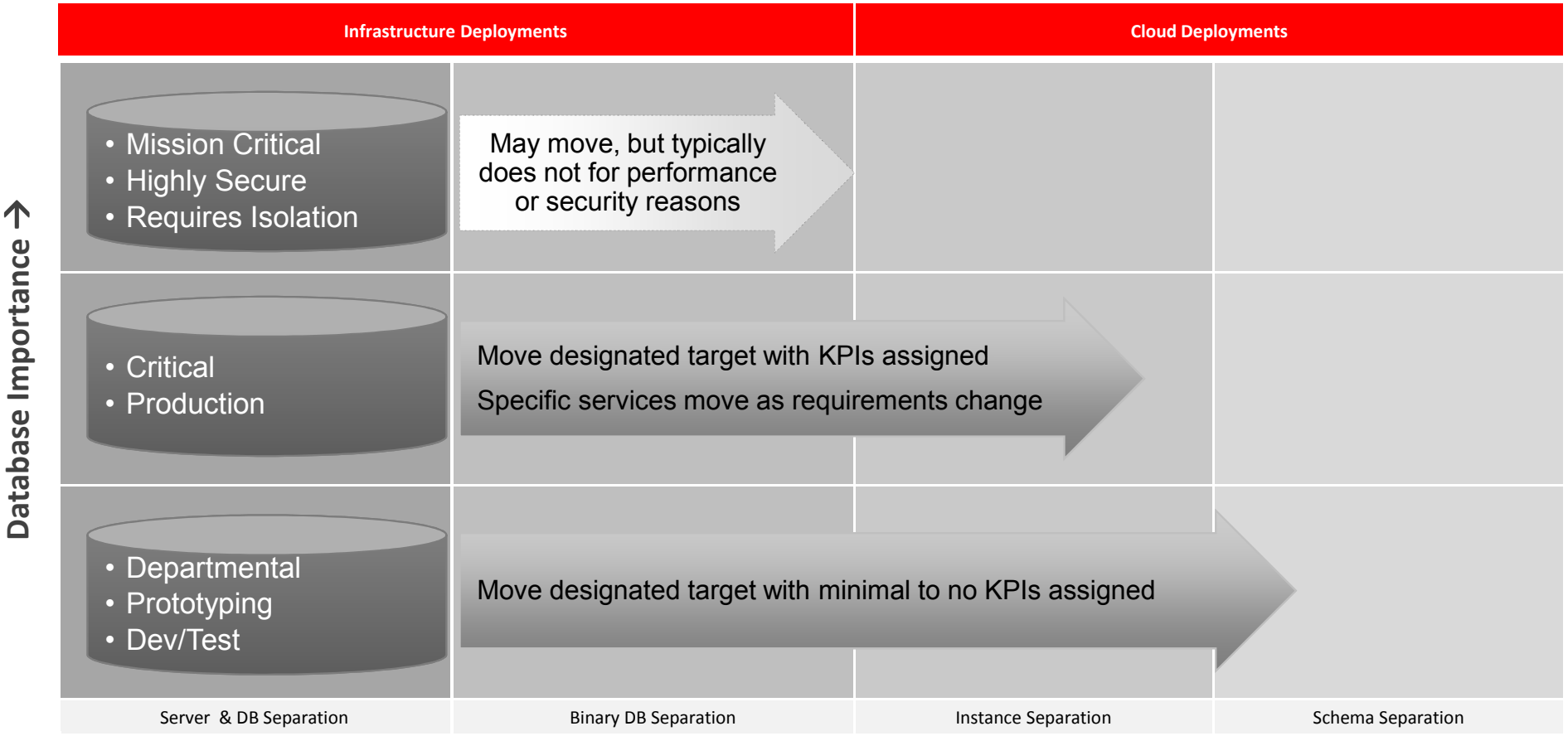
- Eliminates some business requirements to clone databases
- Enables “single source or single version of truth”
- Centralized data security and privacy policy
- Simplifies data consolidation for DW/DM

FEATURES

- Single table
- Shared objects
- Row-level isolation



Typical Customer Transformation Approach



DBaaS Strategy Execution

DBaaS Strategy Execution

- Communication Program
- Service Catalog
- Roles and Responsibilities
- Tenant Qualification Process
- Chargeback Model
- Migration Strategy

Communication Program

Communication Plan: Typical Stakeholder Roles

Typical Stakeholder Roles

Stakeholder Focus \ Stakeholder Perspective	Technology	Enterprise/ Internal	Business/ External
Strategic >12 Months	• Senior IT staff • External strategic technology partners	• Business-unit senior managers • Senior IT staff	• Organization leaders • Board of directors • Strategic business partners
Business Cycle 3 to 12 Months	• IT managers and project teams • External account executives • New recruits	• Business-unit line managers • IT relationship managers	• Business marketing units • Business-unit heads
Operational <3 Months	• Internal and external IT staff	• Business-unit staff • IT service delivery & project managers	• Customer-facing business staff • Business sales units

Source: Gartner (August 2005)

Service Catalog

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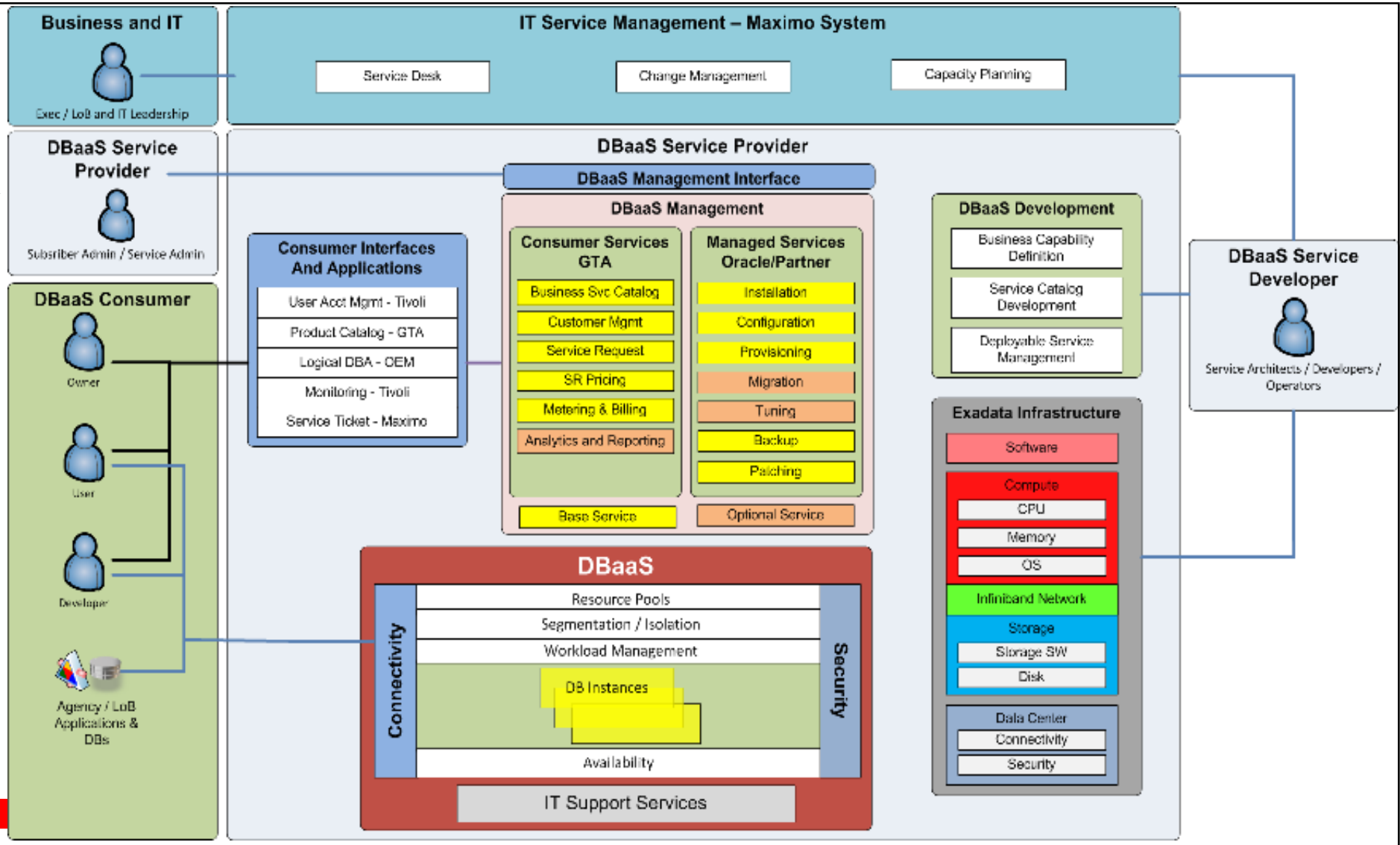
DBaaS Capability Model



Business Service Catalog

Exadata DBaaS Catalog

Offering Catalog	Cores	Memory	Storage
Small	2	20 GB	3.125 TB
Medium	4	42.GB	6.25 TB
Large	8	84 GB	12.5 TB

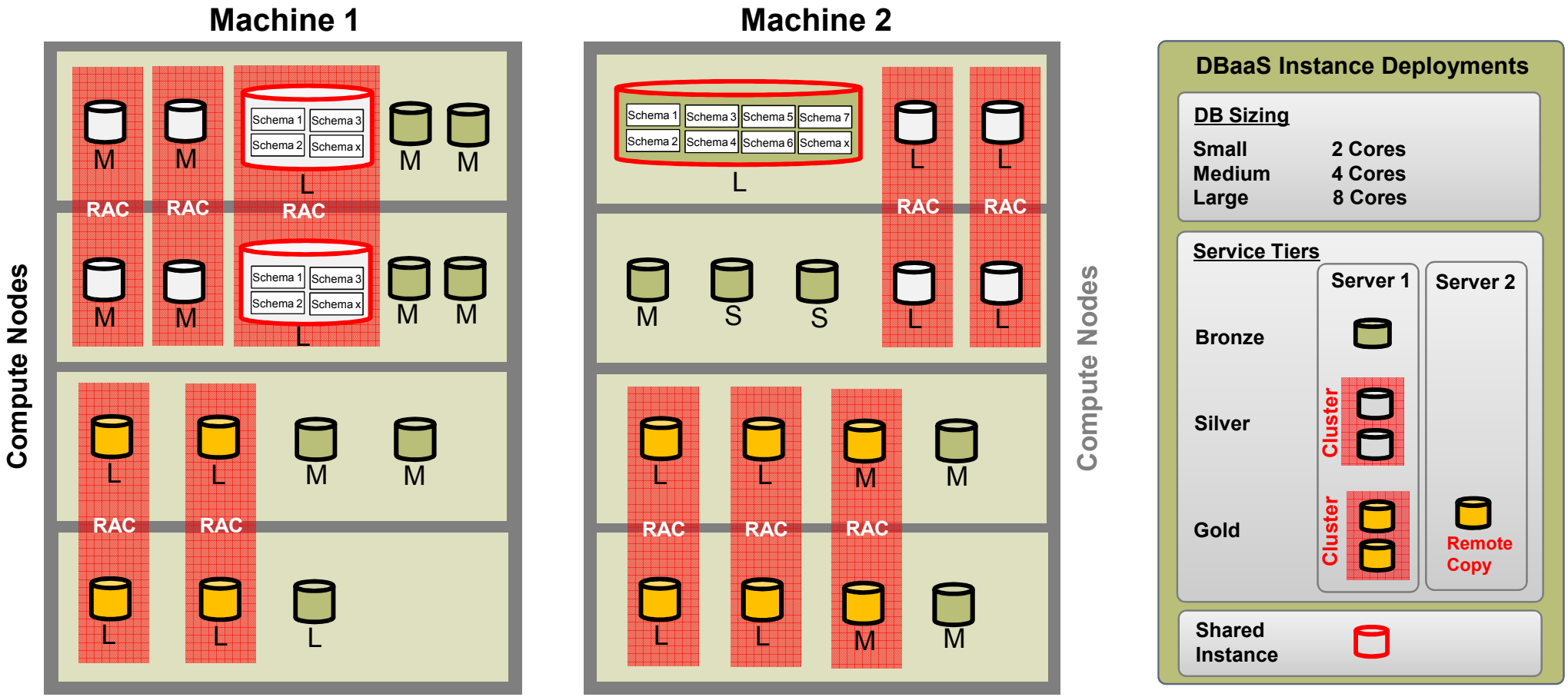
*Sizings can be combined to create custom configurations

Service Complexity	Operational Support	System Availability
Low	12 x 5	98.5%
Medium	> 12x5 & < 24x7	> 98.5 & < 99.9%
High	24 x 7	99.9%

Service Level	DB H/A	Business Continuity	Storage	Backup	Outage RTO	DR	DR RTO
Bronze	Single Node	N/A	Dual Mirror	Tape	Avg < 24 Hrs	Tape	2 Weeks
Silver	Dual-node RAC	N/A	Multi-cell Mirror	Disk	Avg < 8 Hrs	Tape	5 Business Days
Gold	Dual-node RAC	50% Capacity (Second Machine)	Multi-cell Mirror on Both Machines	Replicated Storage	Avg < 4 Hrs	Disk	32 Hr Max

Technical Service Catalog Example

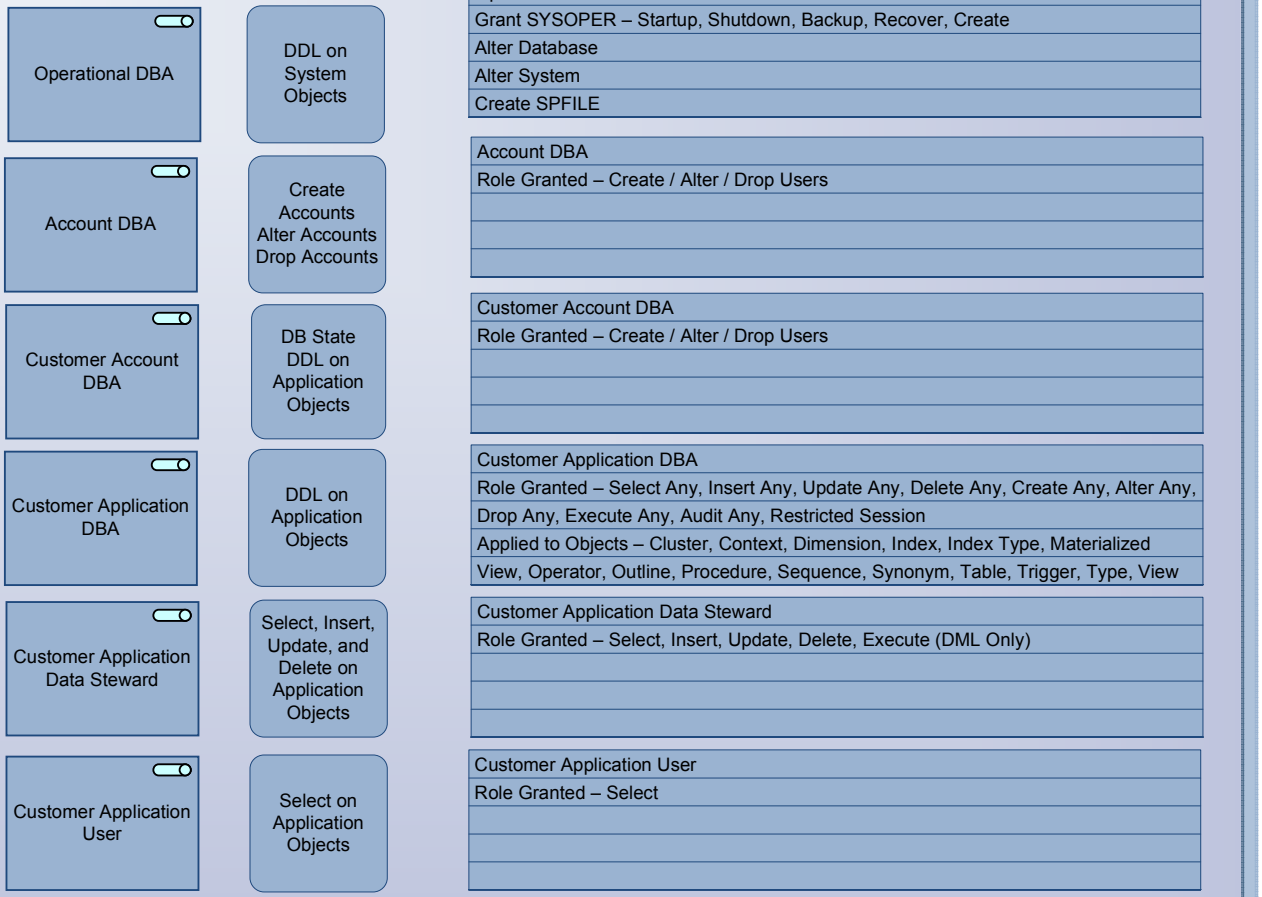
Dual Data Center Balanced Model



Roles and Responsibilities

DBaaS Roles and Responsibilities

DB Role Model



Tenant Qualification Process

DBaaS Internal Preliminary Questionnaire

Exadata Tenant Preliminary Questionnaire

To be completed internally with input as required from the target agency

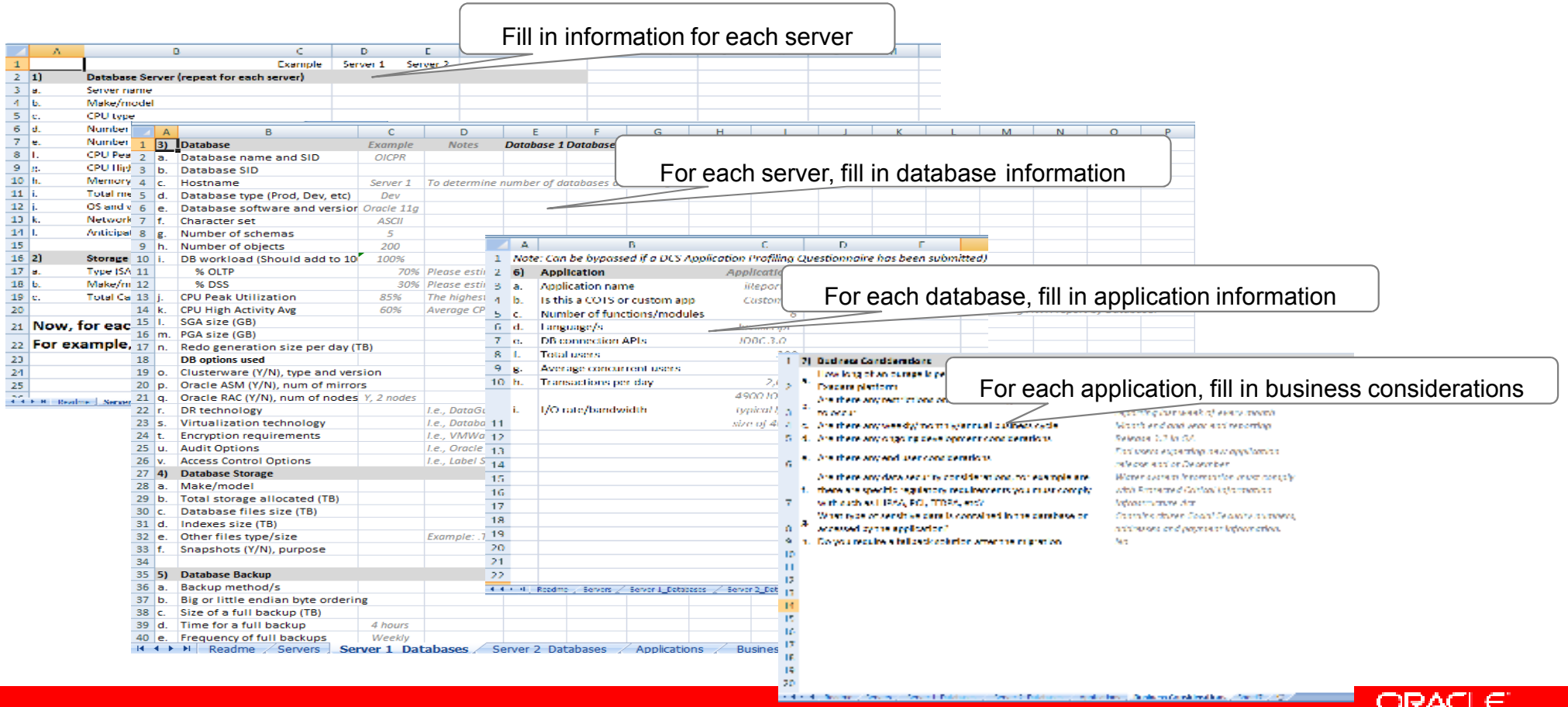
This checklist is used to help identify the agencies that are good candidates for migration to the Exadata platform. The higher the agency's score, the better suited the agency is for the Exadata platform. After validation as a good Exadata tenant, a more detailed information gathering exercise will be used to prepare for the migration effort.

Agency/Application Name: _____

Characteristics of a Good Exadata Tenant	Potential Points	Points that Apply
Agency currently owns Oracle Enterprise Edition database licenses	20	
Agency currently owns Oracle DB options licenses (RAC, OEM Packs, etc...)	10	
Agency running Oracle Database 11.2	20	
Running Oracle Database 11.1 and willing to upgrade to 11.2	10	
Running Oracle Database 10.x and willing to upgrade to 11.2	20	
ISV application certified with Oracle Database 11.2	10	
Agency is running on Linux	10	
Agency is using ASM	10	
Agency is using Oracle RAC	10	
Agency is using other Oracle DB tools (OEM, DataGuard, RMAN, etc...)	10	
Agency needs a hardware refresh or upgrade.	10	
Agency is using a virtualization technology	10	
Agency has an existing functional application that they are not planning to make major changes to at the same time as deploying on Exadata platform	10	
Agency is looking at building a new application and has time scheduled for deploying on Exadata platform	10	
Agency is not currently using storage snapshots for testing and backups	10	
Agency is interested in reducing 3rd party solution components (Storage software, cluster software, array based replication, etc...)	10	
Agency has a requirement to encrypt and/or remotely replicate database data	10	
This is not an exhaustive list and the points are approximate, but the higher the agency's score, the better the odds of success.	**Total out of 200**	

Updated: Oct 29, 2012

DBaaS Technical Questionnaire



Chargeback Model

DBaaS Chargeback Model

Process Flow

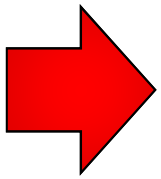
Cost Consideration

DBaaS Costs
- Infrastructure
- HW and SW
- Maintenance
- DBA + Administration
- Facilities
- Power

+ Labor Cost
- Setup
- Architecture
- Tuning
- Migration

+ COOP Cost
- Backup and Restore
- Disaster Recovery

+ DB License Cost
- DB SW License
- DB SW Support

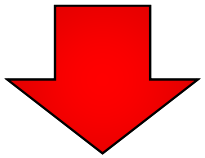


Service Catalog

The consumption of resources (cores, memory, storage) for each service

Calculation

Allocate cost over 5 years to Provisioning Scenario/Model based on Service Catalog



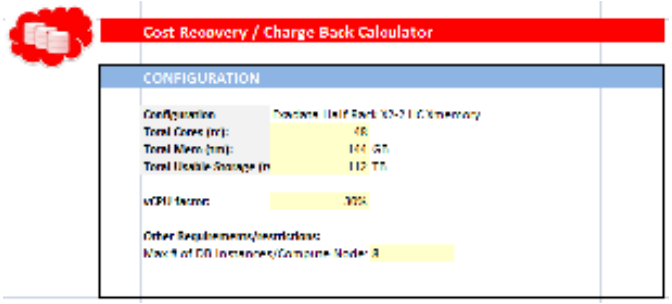
Rate for each Service

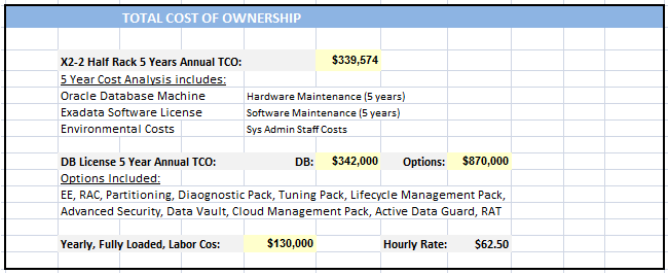
Chargeback Model

DBaaS Chargeback Calculator

The calculator inputs are:

- **Infrastructure Configuration**
- **Costs (TCO) - Example**:
  - HW License Cost
  - SW License Cost
  - Maintenance Cost
  - Labor Cost
  - COOP Cost
  - Environmentals
- **Technical Service Catalog:**
  - The consumption of resources (cores, memory, storage) for each service

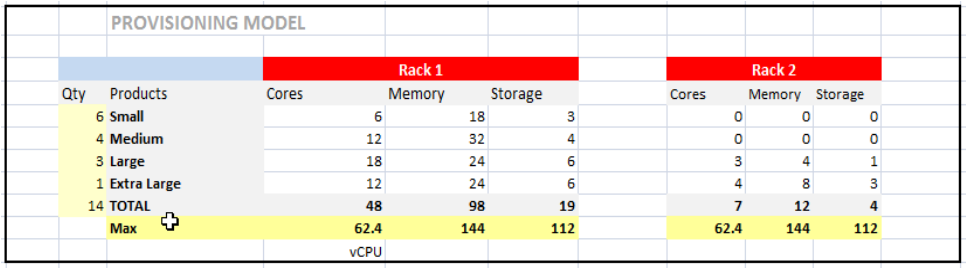




Chargeback Model

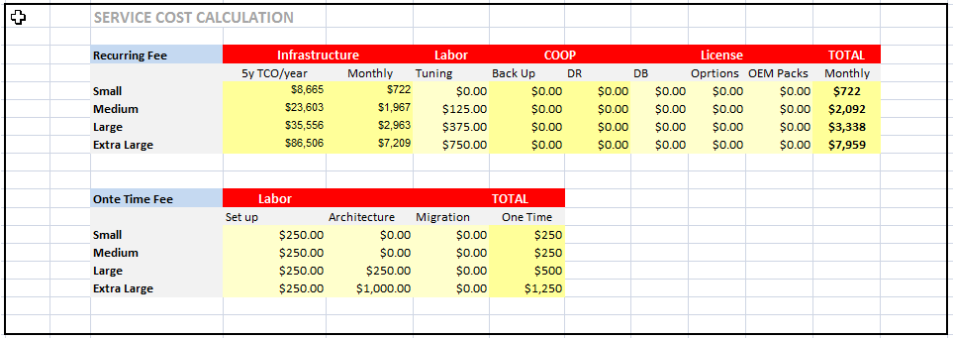
Calculator Outputs

- **Provisioning Model**
  - Allows the customer to build scenarios by which the services from the Service Catalog can be combined to fully provision the Exadata infrastructure (over-provisioning is supported)
- **Infrastructure Sharing Ratio**
  - Calculates how the resources (hence the costs) are divided between each service or per core/TB based on the Provisioning Model
- **Service Cost Estimation**
  - The recurring (annual or monthly) cost for each service based on the provisioning model
- **Deployment Model**
  - Rate of deployment monthly over 5 year cost model
- **Service Catalog Pricing Model**
  - Service and per core/TB pricing models



PROVISIONING MODEL

		Rack 1			Rack 2		
Qty	Products	Cores	Memory	Storage	Cores	Memory	Storage
6	Small	6	18	3	0	0	0
4	Medium	12	32	4	0	0	0
3	Large	18	24	6	3	4	1
1	Extra Large	12	24	6	4	8	3
14	TOTAL	48	98	19	7	12	4
	Max	62.4	144	112	62.4	144	112
		vCPU					



SERVICE COST CALCULATION

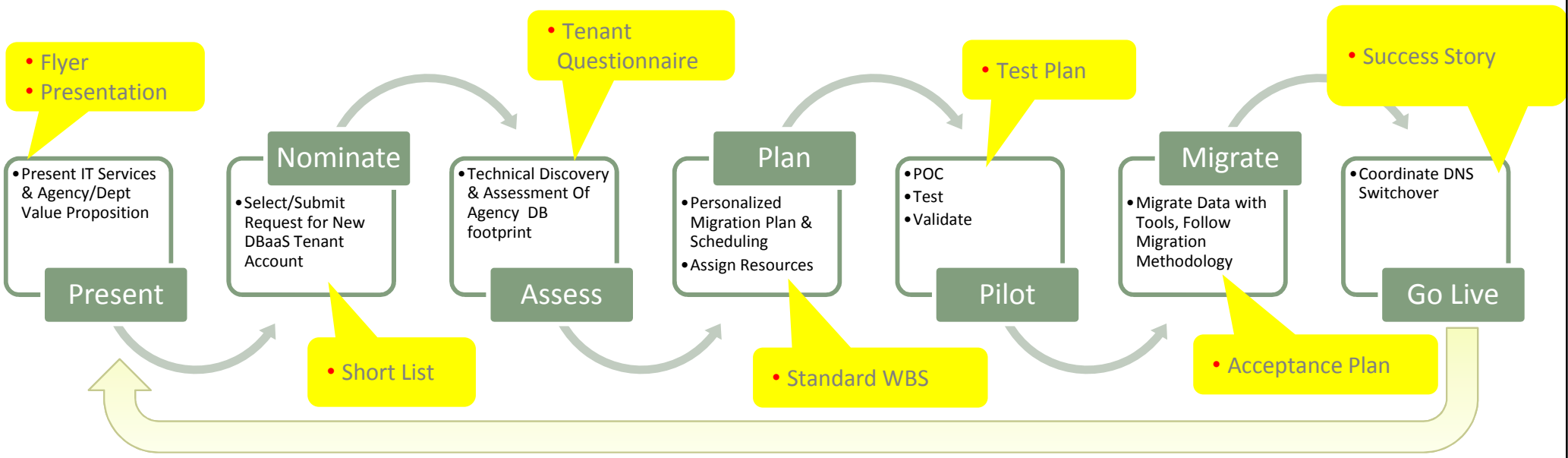
Recurring Fee	Infrastructure		Labor	COOP		License			TOTAL
	5y TCO/year	Monthly	Tuning	Back Up	DR	DB	Oprtions	OEM Packs	Monthly
Small	$8,665	$722	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$722
Medium	$23,603	$1,967	$125.00	$0.00	$0.00	$0.00	$0.00	$0.00	$2,092
Large	$35,556	$2,963	$375.00	$0.00	$0.00	$0.00	$0.00	$0.00	$3,338
Extra Large	$86,506	$7,209	$750.00	$0.00	$0.00	$0.00	$0.00	$0.00	$7,959

Onte Time Fee	Labor			TOTAL
	Set up	Architecture	Migration	One Time
Small	$250.00	$0.00	$0.00	$250
Medium	$250.00	$0.00	$0.00	$250
Large	$250.00	$250.00	$0.00	$500
Extra Large	$250.00	$1,000.00	$0.00	$1,250

Migration Strategy

DBaaS Migration Strategy

Process Overview



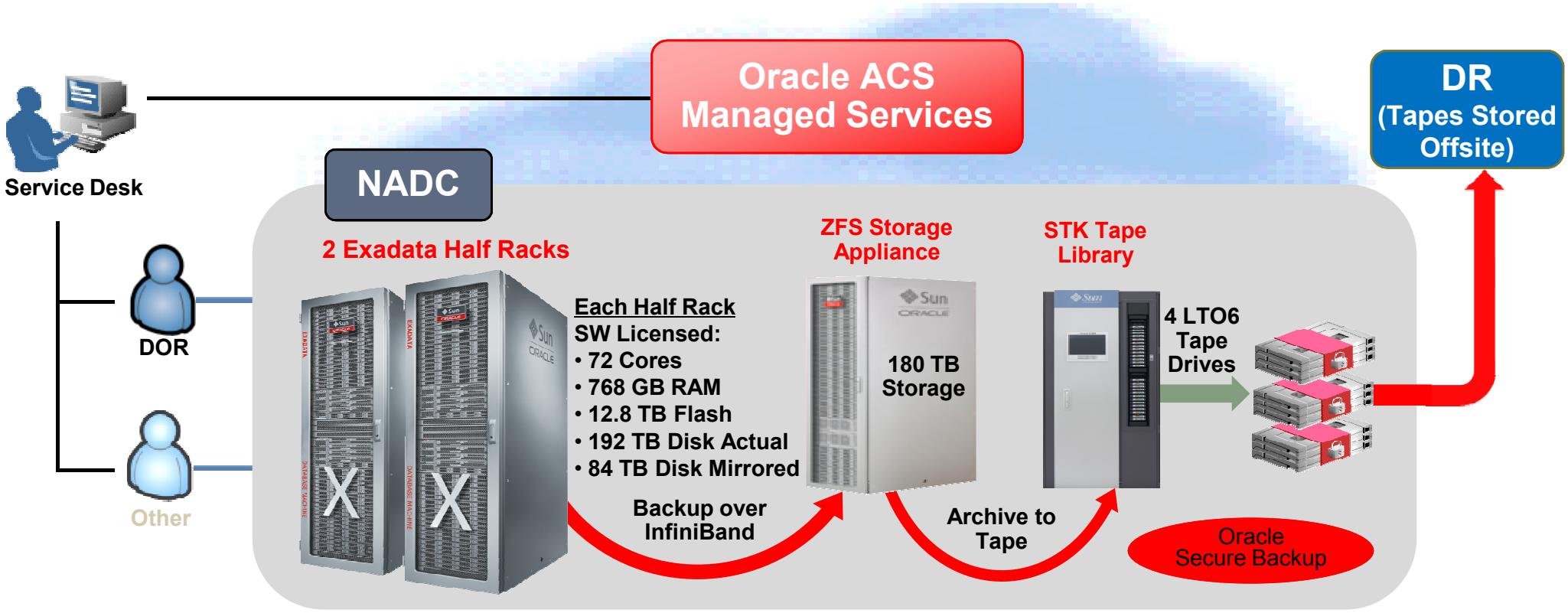
DBaaS Strategy Execution

- ✓ Communication Program
- ✓ Service Catalog
- ✓ Roles and Responsibilities
- ✓ Tenant Qualification Process
- ✓ Chargeback Model
- ✓ Migration Strategy

Example: State of GA - Dept of Revenue Oracle DBaaS

Oracle DBaaS Architecture

Solution Overview - 2 Exadata X4 Half Racks, ZFS and STK Machines



Example: State of GA - Dept of Transportation DW

32 Cores – DB Machines

36 Cores – Storage Cells

512 GB – Memory (DB Machine)

4.8 TB – Flash Capacity (Storage)

High Capacity Drives

Exadata X3-2
Quarter Rack

Production

Oracle Active Data Guard

16 Cores – DB Machines

18 Cores – Storage Cells

512 GB – Memory (DB Machine)

2.4 TB – Flash Capacity (Storage)

High Capacity Drives

Exadata X3-2
Eighth Rack

Business Continuity

16 Cores – DB Machines

18 Cores – Storage Cells

512 GB – Memory (DB Machine)

2.4 TB – Flash Capacity (Storage)

High Capacity Drives

Exadata X3-2
Eight Rack

Development / Test

Oracle Exadata Environment

- ✓ Three X3-2 Exadata racks, 1 Quarter, 2 Eighth
- ✓ Active Data Guard for Business Continuity
- ✓ Integrated with SharePlex and NetBackup
- ✓ Grow into Oracle DBaaS Solution

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Thank You

Hardware and Software

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