An Oracle Enterprise Architecture White Paper

February 2015

Delivering Cloud Services to the State of Texas

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Introduction

Most government organizations spend a significant portion of their technology budgets procuring and maintaining information technology (IT) infrastructure, platforms, and applications. Purchasing hardware, upgrading software, and hiring administrators is a major undertaking, often consuming resources needed for other activities.

The State of Texas is setting a progressive example for other state governments by relying on cloud service providers to provision IT resources to dozens of state agencies. Led by the Texas Department of Information Resources (DIR), the state is creating the Texas Cloud Marketplace, a private cloud that utilizes engineered systems such as Oracle Exadata and Oracle Exalogic to deliver new technology while fulfilling legislative mandates. Oracle is helping to transform the state's widespread infrastructure, which spans hundreds of databases and tens of thousands of applications. The billion-dollar consolidation project was designed to help 300,000 government employees serve 25 million citizens in a more flexible and cost-effective way (see article in *Profit*).

The State of Texas leveraged the Oracle Enterprise Architecture Framework to structure the Data Center Services program. Initial business drivers included the following:

- Establish an IT delivery model that reduces costs, meets demand, and fulfills the state's legislative goals

- Set up detailed OpEx business models to meet agency budget constraints

- Re-align current strategic initiatives and delivery models to match the alternate models established in a new Roadmap and Future State Architecture

- Develop a cloud service provider capability model, business architecture, and operating model for bringing state agencies into the cloud

According to Carl Marsh, Chief Operating Officer for the Texas Department of Information Resources, achieving best practices for technology delivery in the public sector requires identifying costs and having a roadmap for decreasing those costs. You also need an infrastructure that allows you to scale with customer demand at identifiable price points. Oracle Enterprise Architects proposed an overall enterprise architecture that provided a systematic, low risk way of approaching this extremely complex task.

"One way to lower the price of IT services for state agencies is to aggregate applications and data into a virtualized environment and then free up the old equipment to either be decommissioned or reutilized for different types of applications," Marsh says. "Oracle demonstrated how we could transform our existing

information systems to offer cloud-based IT services for applications, functions, and storage that could save costs and be far more efficient." Marsh continues. "Working with Oracle has been a great experience, from the up-front Enterprise Architecture process through post-purchase, implementation, and training."
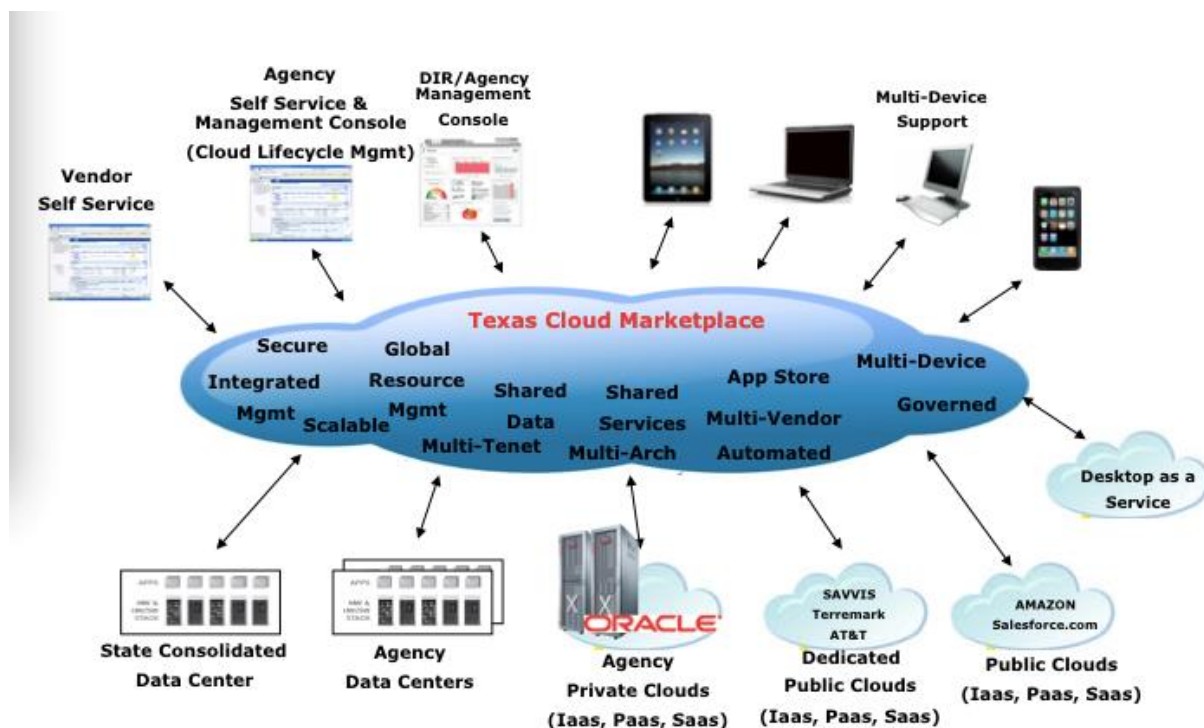

Figure 1. Envisioning the major components and capabilities of the Texas Cloud Marketplace.

Historical Context

The Texas Department of Information Resources (DIR) provides statewide leadership and oversight for management of government information and communications technology in the state of Texas. The department supports 125 agencies and 45 higher education organizations. One of its leading programs is the Data Center Services program, which was launched to rationalize and consolidate tens of thousands of information systems throughout the state. The program focuses on shared services and shared platforms based on engineered systems.

In 2005, the state passed legislation mandating that 28 of the largest agencies in Texas could no longer purchase their own IT. Instead they were required to consolidate their infrastructure.

In 2007, DIR began to consolidate the 28 largest state agencies into two state data centers. The program encountered problems, including not meeting consolidation target dates, cost overruns, and several data breach/loss incidents.

In 2010 DIR reposted the DCS contract and began looking for new technology partners. Oracle stepped in to join Xerox and CapGemini to create a private cloud based on engineered systems.

Roadmap to Cloud

Figure 2. Path to progress: The logical progression from IT silos to cloud computing.

Throughout the summer of 2012, the Oracle Enterprise Architecture (EA) team worked with DIR to validate the cloud model as a means to enable IT consolidation, increase customer satisfaction, and give the individual agencies greater choice into the proposed set of cloud services. Led by Franck Goron, Oracle Transformation Director, the Oracle team conducted a Transformation engagement that focused on the following deliverables and artifacts:

- Vision and Value Proposition

- Current State Architecture

- Future State Architecture

- Strategic Roadmap

- Financial Analysis/Business Case

- Cloud Cost Recovery Model

- Business & Technical Plan

- Solution Components

Guided By Enterprise Architecture

The main purpose of Enterprise Architecture (EA) is to align business goals and objectives with IT infrastructure and solutions. Enterprise architects define solutions that are adaptable and agile enough to fulfill continually shifting business needs while simplifying the process of maintaining and managing those solutions.

Vision/Value Proposition

The state's primary objective with the new cloud was to improve overall efficiency and thereby reduce the cost of providing IT services to the state. They also wanted to offer more agile information systems that would permit the various agencies to respond quickly to citizen demands. Public sector organizations must continually balance the cost of providing agile IT services against the public's desire to keep government small and overall costs in check.

"Previously, each state agency had its own organization and IT processes, leading to excessive costs," says Goron. "We set out to help the state turn all of those silos into a shared service organization and to develop best practices so they don't reinvent the wheel every time there is a new service request. Texas sees the benefit in moving to a central, unified, shared service delivery model."

Working with DIR, the Oracle EA team began by defining a vision for "IT as a Service," an operational model in which the IT organization acts as an internal service provider. In this model, IT simplifies and encourages service consumption, provides improved financial transparency for IT services, and partners more closely with lines of business—in this case, Texas state agencies—to meet their technology needs. This effort guided the formation of a business model and accompanying business architecture for a private cloud, including fundamental business goals and objectives, business functions, and an accounting of the key organizations/personnel involved. The main purpose of the Business Architecture phase is to establish business context and to understand the business drivers behind the information needs such as better analytics and trend analysis, faster IT deployments, lower IT costs, and greater IT resource utilization. Oracle built a strategy map to help the state fully understand how these goals could be realized by connecting strategic objectives in explicit cause-and-effect relationships, as shown in figure 3.
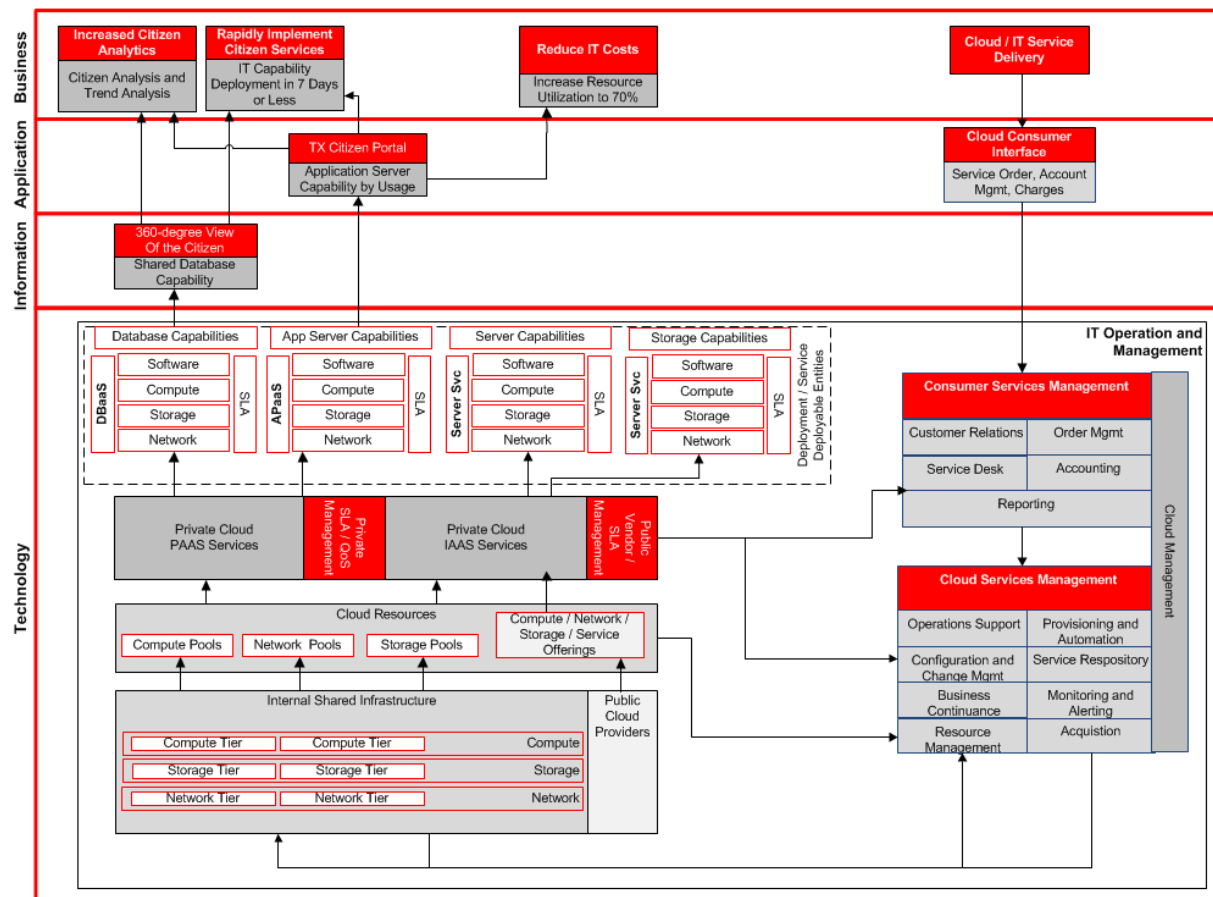

Figure 3. An Oracle Enterprise Architecture (OEAF) diagram that aligns the operational capabilities of cloud services with the corresponding business capabilities and objectives.

Oracle provided artifacts, templates and guidelines to capture the business architecture information. One of the most important artifacts was the Oracle Architecture Development Process (OADP), a proven method for

aligning business operations and infrastructure with business mission and strategy. According to Paul Andres, Director of Enterprise Architecture at Oracle and the lead technical architect for the State of Texas project, OADP helps to mitigate complexity for large, transformative IT projects. It also helps an implementation team to communicate and collaborate, to understand what skills are required, and to prepare for the cultural changes that are in store for the organization.

Current State Architecture

During the Current State Architecture phase, Oracle used the OADP framework to assess the state's ability to meet the business objectives using its existing technology and infrastructure. The EA team validated the key requirements, identified the drivers for change, and assessed the current state architectural capabilities. "The Current State Architecture defines where you are now, from an IT standpoint," explains Goron. "We helped the state develop an accurate architecture plan based on this assessment. This served as the foundation for building a business case that includes a Capability & Operating model, Infrastructure snapshot, and centralized governance model, driven by DIR."

Future State Architecture

While the future state of a business may be easy to envision, determining how to achieve that state is not always obvious. During the Future State Architecture phase, Goron and the EA team developed a set of recommendations based on the following inputs:

- Capability & Operating Model
- Business Service Catalog
- Logical Architecture
- Technical Service Catalog
- Cost Recovery Model
- Governance

The objective was to highlight the gaps between the current and future state architectures. Working closely with DIR and Xerox, the Oracle team approached this effort with a highly collaborative and iterative mindset. Working with representatives from DIR, Xerox and key stakeholders within state agencies, they identified key cloud services that would be offered, including the following:

- Database-as-a-Service
- PeopleSoft-as-a-Service
- UNIX-as-a-Service
- Identity-as-a-Service
- GIS-as-a-Service
- Infrastructure-as-a-Service

Strategic Roadmap

A Strategic Roadmap is a progressive plan that helps an organization evolve toward the future state architecture. It maximizes the value from each phase of the roadmap, minimizes the risk of the proposed solution implementation, considers technology dependencies across phases, and provides the flexibility necessary to adapt to evolving business priorities and technology changes.

Oracle itemized the risks and costs for each cloud service and defined a high-level transition plan for adopting these new services. Then they broke down the architecture recommendations into phases based on business priorities and dependencies, producing the following key artifacts:

- A prioritized list of architecture recommendations based on the future state architecture

- A set of transition architectures that progress the current state to the desired future state

- A project implementation plan for each transition

- A cost analysis and benefit analysis from each transition architecture
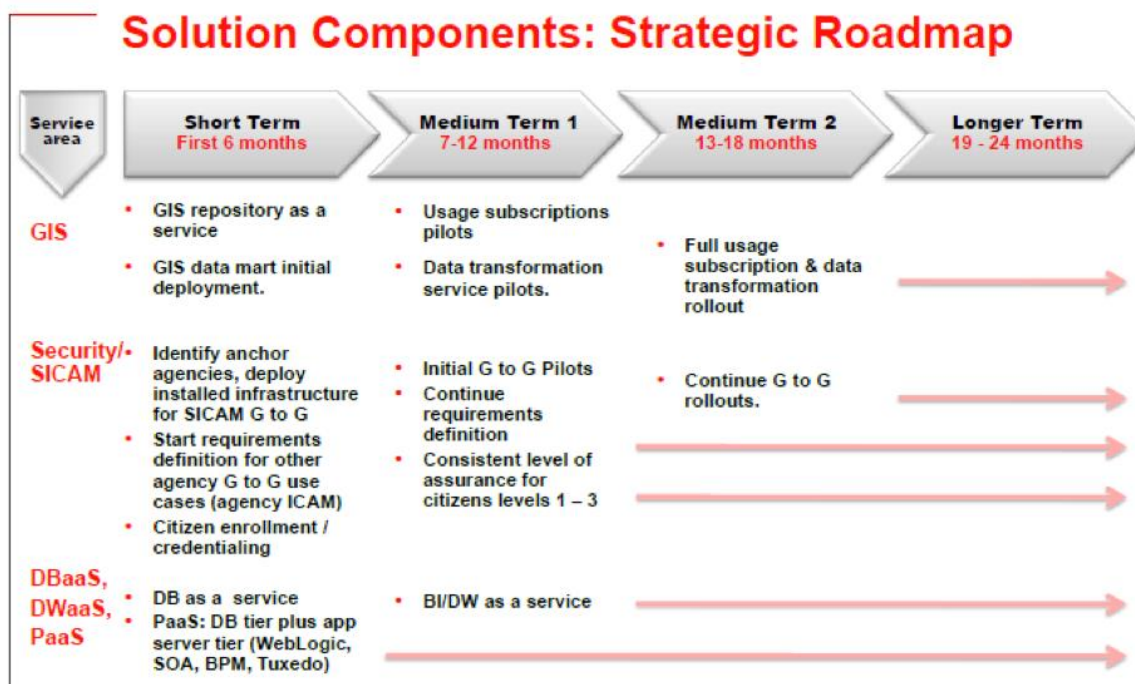
Figure 4. The Oracle EA methodology creates a strategic roadmap with a timeline for deployment.

Financial Model/Business Case

Oracle developed a series of business cases both for the initial investment in a cloud solution and for the individual Texas agencies that would utilize the new services. The team also established a Cost Recovery Model to break down the operational costs associated with each cloud service. They used this information to establish a pricing catalog that would enable Xerox and other cloud service providers to meet their financial objectives while providing cost-effective technology services to the state.

The EA team used various tools and techniques to develop these cost-recovery models for cloud services, such as Monte Carlo statistical algorithms that reveal potential break even points based on various levels of cloud adoption. The example in Figure 5 shows that break-even would occur when 10% of the databases had been migrated to the cloud.

Breakeven At 10% Adoption

Potential 5-Yr Benefits

Net Present Value	$0	$1
Reduce Storage Costs	$0	$1
Reduce Server Costs	$0	$0

5 Year Total Savings (NPV)

Assumptions

- # of Databases Located Outside of Consolidated Data Center - 600
- 10% Of Potential Databases (60) Needed For Breakeven
- 100% Adoption Based In Year 1
- Need First Tenant With 40 cores and 10 TB of Oracle

Figure 5. A sample business case that identifies the potential savings associated with consolidating hundreds of databases to Oracle Exadata. The Net Present Value between $0 and $1 reveals the approximate point at which the State would fully recover its costs and begin to realize a positive return.

EA Iterations

Enterprise architecture helps to structure large projects through a series of overlapping steps, or iterations. Each step is governed by the OADP framework to yield a standard set of deliverables approved by the state and its service provider partners. On a micro level, these iterations are also applied to each specific cloud service, which typically include multiple IT environments to handle development, testing, and so forth. EA provides a systematic process that determines how these environments should be created, with attention to the business, technical, and operational implications.

Executive Governance

One of the key purposes of EA Governance is to ensure a successful transition to the desired Future State Architecture. The governance structure helps to align the various project implementations with the overall business objectives, architecture principles, and roadmap.

The Oracle team presented a detailed implementation plan to Karen Robinson, executive director of Texas Department of Information Resources and CIO for the State of Texas, along with other executive stakeholders. To govern this project, she created a Business Executive Leadership Committee (BELC) with three levels of decision-makers. The first level includes DIR staff members, representatives from the state's vendor partners, and agency IT directors that are familiar with the technology. The middle level includes IT managers and directors from all the various agencies. The top level includes executive directors and commissioners.

Robinson, Marsh, and other key members of the committee carefully reviewed the ideas and outcomes from the Transformation exercise and used them as foundations to establish architectural best practices within the data center.

"We didn't initially discuss technology, so much as the business model, which identified a new way to provide IT services for government," explains Goron. "Once we had agreement on the business architecture, we

demonstrated how Oracle Engineered Systems could provide a simpler, more efficient way to consolidate the state's IT assets and offer cost-effective cloud services."

Cloud Infrastructure

Based on BELC's recommendations, the state decided to start with the implementation of two half racks of Exadata to support DBaaS: one in its Austin data center, the other in its San Angelo data center. The systems are architected to be highly redundant and available, with one platform replicating to the other as a "hot stand by" for business continuity and disaster recovery purposes, as shown below.
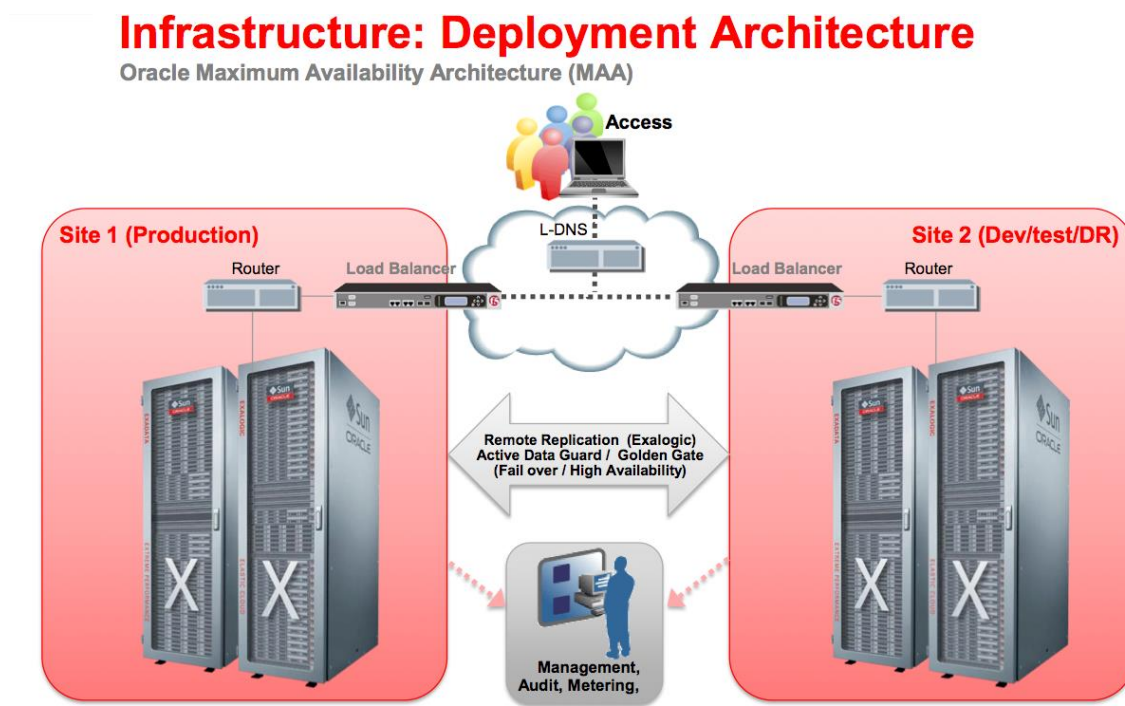
Figure 6. A high-availability architecture connects Oracle Engineered Systems in two data centers.

Xerox -made the up-front capital investments in the Exadata systems and other IT equipment. They will recover their money over time, thanks to the unique chargeback model that the Oracle EA team helped to develop for the state. The chargeback model permits state agencies to consume cloud services on a "pay-as-you-go" basis. Instead of a flat pricing structure, where the capital costs are divided up and paid back in full over several years, the cost of the platform is commensurate with the use of the platform. Each department and agency only pays for what it uses.
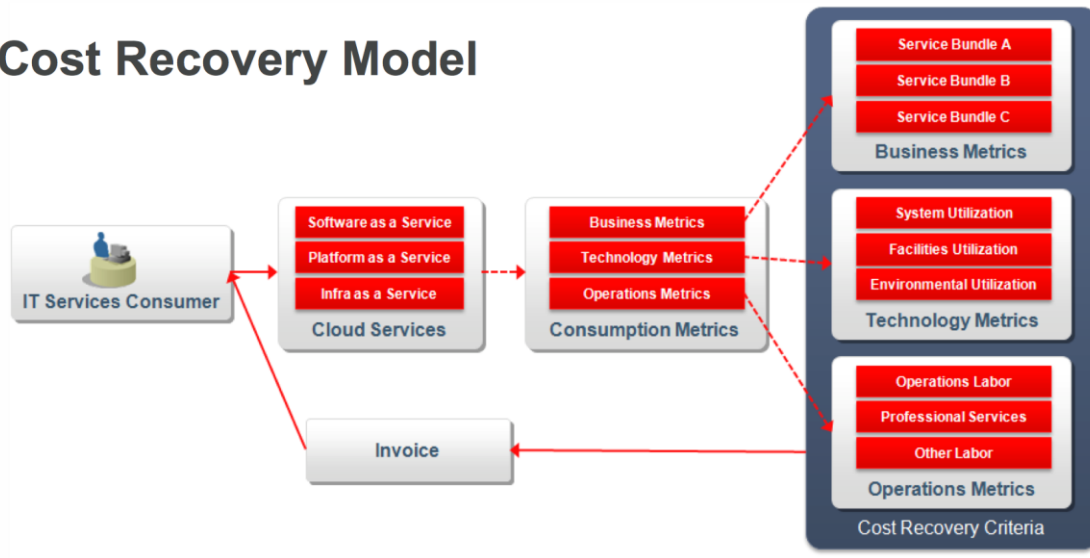
Figure 7. Oracle helped the state develop a chargeback model so agencies could consume services on a pay-as-you-go basis.

Solution Components

Oracle worked closely with Xerox to identify the solution components and spec out the details of the various services the state would offer, as shown in Figure 8.
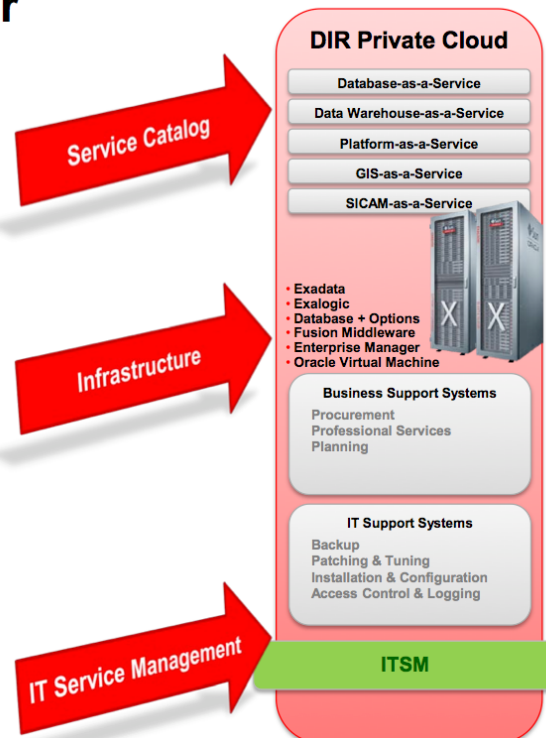

Figure 8. The Transformation engagement defined a catalog of critical applications and services.

For example, leaders at DIR decided to use the cloud technologies to provision a shared "**PeopleSoft as a Service**" environment that the agencies can consume in a simple, straightforward way. The goal is to rationalize multiple PeopleSoft implementations throughout the state while providing an easier point of access to enterprise application for small agencies. They also developed a **Database-as-a-Service** and **Data Warehouse as a Service** Catalog that specifies the following cloud based allotments:

- Small Database – Entry-level database environment for departmental applications

- Medium Database – Standard database environment for Agency DB consolidation

- Large Database – Optimal service for large, complex database and data warehouse

 environments.

Each of these cloud allotments has three possible service levels, as shown in figure 9.

Service Level	DB H/A	Business Continuity	Storage	Backup	DR	Outage RTO (estimate)	DR RTO
Bronze	Single Node (Primary Site)	N/A	No Mirror	Tape	D4-D3	48 Hr Max	+72 Hr
Silver	Dual-node RAC (Primary Site)	N/A	Mirror	Tape	D4-D2	24 Hr Max	+24 Hr
Gold	Dual-node RAC (Primary Site)	50% Capacity (Geo Site)	Multi-cell mirror at both data centers	Rep Storage	D4-D0	8 Hr Max	+8 Hr

Figure 9. Agencies can choose the level of database service they require based on their specific needs and requirements.

The project is well underway, with the ultimate goal of migrating nearly 700 database servers to a consolidated Exadata environment. Another new service will provide **geographic information system (GIS)** functionality to supply everything an agency needs to privately store GIS data for maintenance and solution development. This service includes a secure, read-only geo-data mart for agencies to publish their data, and access to all available public data.

In a separate endeavor the technology partners embarked on the **Statewide Identity Credential Access Management**, a set of standard services to identify, authenticate, and authorize individuals to use the state's IT resources. SICAM establishes a foundation for trust and interoperability in conducting electronic transactions both within a state and across the 50 States and the Federal Government including private sector adopters. This **Security-as-a-Service** offering replaces dozens of identity management methodologies with one cohesive system.
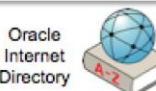
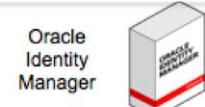## SICAM: Enabling Statewide Trust with Oracle

Requirement	Oracle Product Mapping
Token	Oracle Virtual Directory · Oracle Internet Directory · Oracle Master Data Management
Identity Proofing	Oracle Identity Manager · Oracle SOA Suite
Authentication	Oracle Access Manager · Oracle Adaptive Access Manager
Assertion	Oracle Identity Federation · Oracle Enterprise Gateway

Figure 10. An Oracle Identity Management architecture enables secure authentication and access for hundreds of thousands of state employees.

The Oracle team is currently finalizing the specs for a SPARC SuperCluster based **Infrastructure-as-a-Service** offering that will consolidate the state's SPARC infrastructure and ultimately support a variety of **Unix-as-a-Service** offerings.

From Pilot to Production

In September 2011, the Texas Department of Information Resources established a twelve-month pilot project with three of its customers: the Office of the Secretary of State, the Texas Water Development Board, and the Texas Department of Transportation. The goal was to gain a deeper understanding of cloud-based offerings within a public-sector context. Along with DIR, these pilot agencies could request a solution from a variety of pre-approved cloud service providers through a self-service web portal. The Texas cloud architecture supports the five essential capabilities defined in the National Institute of Standards and Technology (NIST) cloud reference architecture:

1. On-demand self-service

2. Broad network access

3. Resource pooling

4. Rapid elasticity

5. Measured service

The pilot went well, encouraging other agencies to join. So far, numerous agencies have signed up to use DIR's Exadata-based cloud services including the Texas Education Agency, Department of Assistive and Rehabilitative Services, Department of Family Protective Services, Texas Department of Insurance and the Department of Public Safety. In 2013 the doors will be opened to all of the other agencies to join.

"Our goal with the private cloud is to deliver a simple solution that exceeds the customer's needs and financial expectations," says Todd Kimbriel, director, eGovernment, State of Texas Department of Information Resources. "Success breeds demand. If we can satisfy the first 28 agencies then we are legislatively enabled to offer services to all the remaining agencies. Transforming IT in Texas will save a tremendous amount of money for taxpayers."

Kimbriel says the State picked Oracle because it was a solid brand and a viable company that was recommended highly by Gartner. "All of this makes Oracle an easy pick," he adds.

Going Forward

EA principles continue to guide the cloud implementation. For example, if the Controllers office wants to adopt PeopleSoft as a Service and share it with other agencies, the EA team begins by creating use-cases that reflect the needs of each agency. They consider the profiles of the various agencies and develop a business service catalog that lists the functions these agencies need. Each service bundle in the catalog lists the product capabilities along with various service levels. Each agency can buy as little or as much of each service as they need and also specify the degree of availability, disaster recovery, and service uptime requirements. For example, platinum service levels are based on a maximum availability architecture that includes automatic failover among clusters in two data centers. Oracle enterprise architects utilize Oracle Maximum Availability Architecture (MAA) in conjunction with the reference architectures developed for the state to respond to the requirements set forth in the business service catalog.

"We create a business service catalog, which translates the technical service catalog onto the IT infrastructure and a Cost Recovery Model," explains Goron. "This provides precise directives for setting up virtual instances of databases and applications and then configuring the technical and business environment. Each agency can specify just what they need and what level of service they require."

The business service catalog also specifies what skill sets the agency will need, what kind of operational structure is in order, and recommended training to take full advantage of the service. "Our stakeholders love the consistency of the EA approach," Goron adds. "The team always uses the same methods and framework. The state and Xerox are now insisting that we stick with the model for new projects. The OADP process ensures a consistent and systematic approach."

Oracle leverages the industry-standard ITIL management framework to simplify operation and management of the cloud. ITIL provides a practical framework for identifying, planning, delivering and supporting IT services to the business.

The Oracle team continues to consider other types of innovation and automation. For example, the team recommended a new billing and revenue management system that would simplify metering, billing, chargeback, dispute mediation, and resource tracking. "We have implemented all of the capabilities of the cloud as defined by NIST," sums up Andres. "Oracle has a portfolio of products and best practices that will continue to help the state realize those capabilities and operationalize them through efficient deployment and management practices."

Best Practices for the Public Sector

Texas is setting an example for other state governments throughout the nation by utilizing a private cloud that offers cost effective, cutting edge technology while fulfilling State mandates. Its private-cloud model is well suited to public agencies that must comply with numerous laws, policies, and regulations for mission-critical applications. Hosted behind an agency's firewall, the cloud provider can deliver services and applications that meet agency compliance requirements and enhance flexibility and responsiveness to changing business needs.
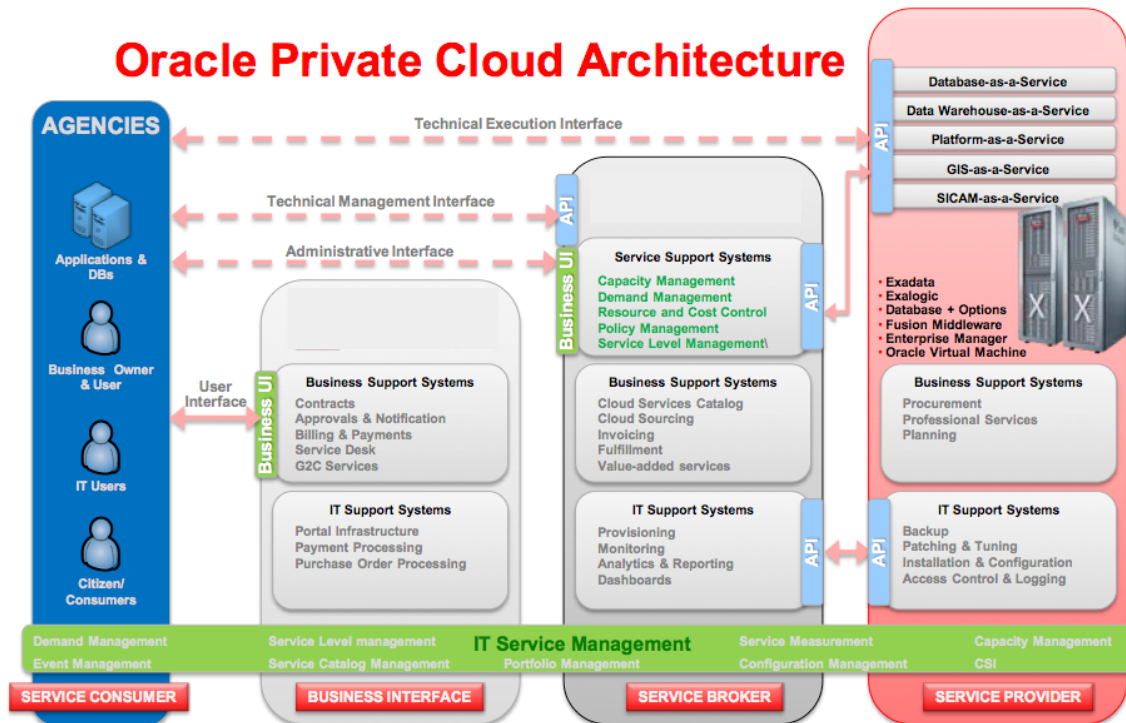
Figure 11. A sample high-level representation of a private cloud that connects state agencies with IT resources and services.

"We are not only looking at how to effectively consolidate data centers across the state, but also how to decrease our unit price while still meeting demand," explains Marsh. "We wanted to consolidate disparate infrastructure and allow our customers to utilize a consumption-based model for database services. Oracle Engineered Systems will help us expand our services to meet the needs of all of the agencies."

Peter Doolan, Oracle CTO for Public Sector, foresees the Texas cloud model being repeated among other local, state, and even federal agencies. "Cloud business models are just as important as cloud technologies," he emphasizes. "Clearly, there is tremendous potential for this model within other state governments, since the state didn't have to purchase the platform. The vendors are comfortable with this arrangement because they can see the demand. They made the up-front capital investment and then structured a workable recovery model. The state bills the agencies, and then pays the vendors. In his view, Cloud is really just another form of virtualization. The change is in the means of delivery, rather than in the technology."

Oracle Public Sector plans to repeat this process and reuse these Enterprise Architecture assets in other states and municipal governments. According to Doolan, innovative and disruptive technologies such as Oracle Exadata and Oracle Exalogic become the building blocks upon which to build tomorrow's IT architecture. One popular Platform as a Service model is shown below.
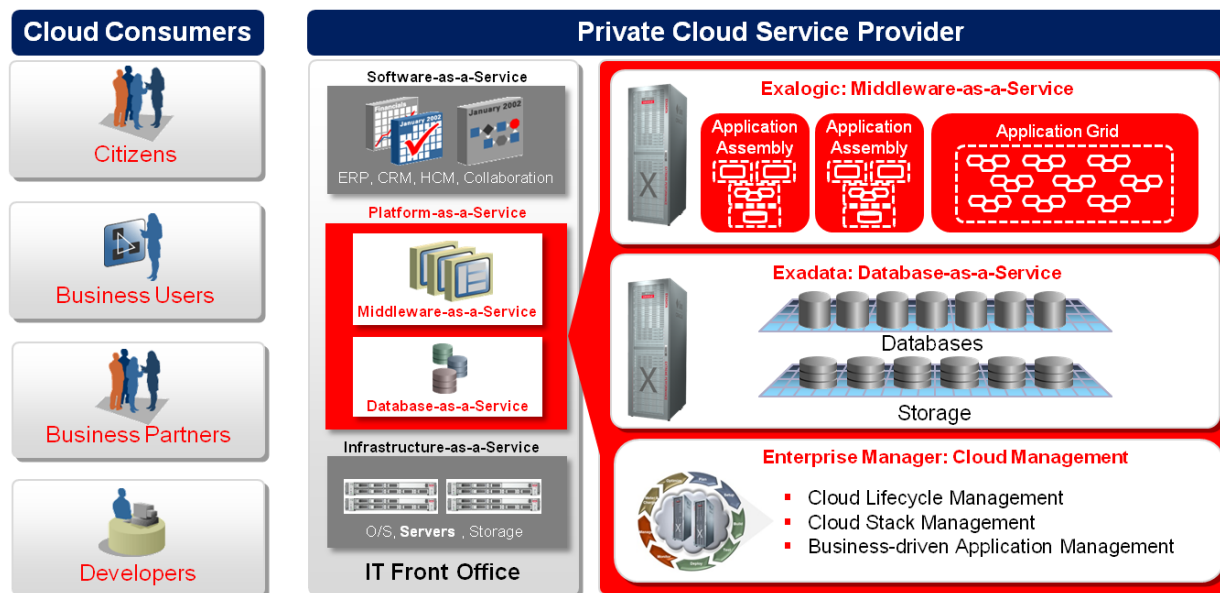
Platform-as-a-Service: Exa* Cloud Model

Figure 12. A shared IT platform based on Oracle Exalogic and Exadata engineered systems.

"It is all about simplification and standardization around a common portfolio of services," says Doolan. "Those services are measurable; we can account for them and charge for them with transparent pricing so the customers—the various agencies and departments within the state—know exactly what they are getting for their investments."

Marsh agrees. "I think that we have very progressive thinking in our agency, and we're absolutely focused on virtualization and cloud. We will continue to move the State of Texas in a direction that best utilizes information technologies to help our customers deliver cost-effective services to the citizens of the state."

Doolan expects to see similar state initiatives along the same lines as what has been done in Texas. "Cloud computing implies elastic capacity and pay as you go pricing based on performance based metrics," he concludes. "The technology must be consumable by the state in a very simple fashion. In the past implementations often took several years. Now, thanks to the guidance of Enterprise Architecture, we are seeing much tighter timeframes, often as quick as 30 days."

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