
Creating Utah's Cloud Infrastructure

Enterprise IT Management

State of Utah

May 2010

CREATING UTAH'S CLOUD INFRASTRUCTURE

A. EXECUTIVE SUMMARY

In August 2009, Utah CIO announced that the state of Utah was preparing a private cloud that would deliver “hosted email and web applications” to cities and counties within the state. In fact, Utah’s cloud strategy has its roots long before that time and the strategy is much deeper. The technology climate that has developed in Utah government made it a natural place to create the first state cloud strategy. In 2005, the state had consolidated its technology assets into a single department, moving all state IT personal under the state Chief Information Officer. The legislature also required that all IT contracts be managed through the Department of Technology Services (DTS). In 2007, the CIO created the Architecture Review Board as a mechanism for developing and approving statewide technology standards. When CIO, Steve Fletcher, announced that Utah would begin developing cloud services, a strategic cloud plan was developed and approved by the Architecture Review Board.

In the introduction to Utah’s strategy, the state acknowledges that provisioning Information Technology (IT) services to enterprises has traditionally been burdened with complexity for customers and characterized by many complex IT platform and service implementations. This is not a viable approach to IT service provisioning for results-focused business customers. The concept of a computing cloud has the potential to simplify and add value in some new and useful ways.

In order to achieve its overall vision for cloud computing, Utah needed to accomplish 3 things:

- Change the IT culture to accept a new type of computing environment
- Implement a highly available, highly-scalable computing platform to support private cloud services
- Initiate a process for identifying, selecting, and contracting for public cloud services

This project is primarily about creating the central infrastructure that would support an enterprise-level private cloud that is secure, extensible, and open. It includes major upgrades to both the central hosting and storage environments, as well as significant upgrades SAN networking.

In February 2009, like most states, Utah was facing some major budget issues. In this setting, Utah took the major step to begin consolidating 37 data centers and over 1700 servers into its two primary data centers.

B. DESCRIPTION

Faced with budgetary challenges, the Utah Department of Technology Services and the Utah Legislature agreed to find a way to reduce the technology budget by four million dollars. The state had also been approached by a growing number of local governments who were seeking less expensive and secure ways to deliver an increasingly complex array of digital services. Although information technology personnel had been consolidated into a single department in 2005, servers and data center functions were scattered across 38 separate locations.

This led to costly support, high utility costs, and inconsistent standards for hosting services. DTS had developed service level agreements with every state agency and needed a way to ensure a consistent, high quality of service for all users of its data center and hosting services. DTS is meeting these objectives by consolidating data centers, virtualizing servers, and preparing a cloud platform that will meet the demands of swift provisioning required by Utah government.

Solution Description

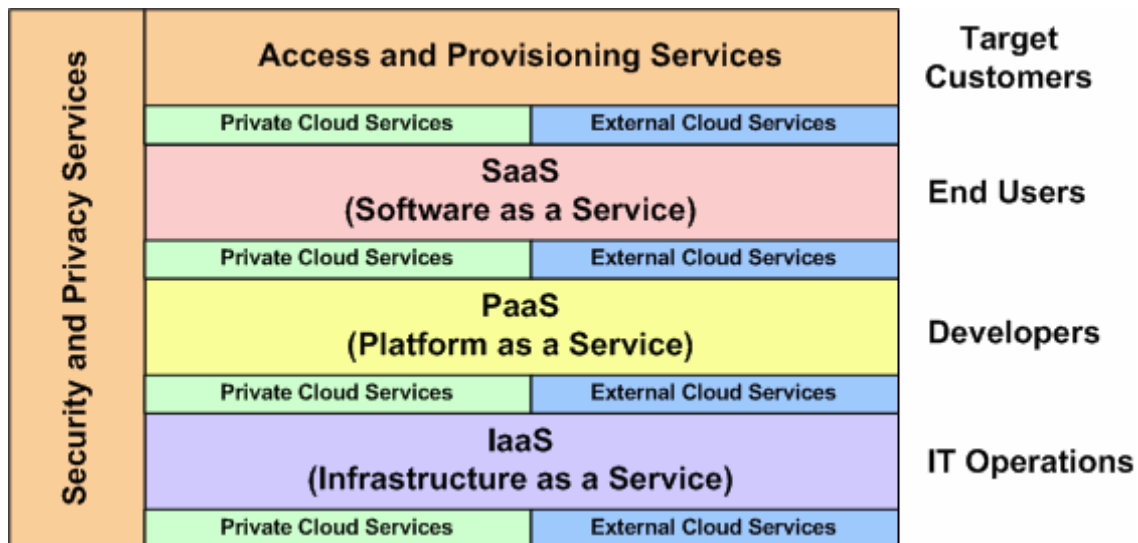
Utah's solution to providing cloud services leverages the advantages of both public and private cloud computing resources. It is based on a hybrid cloud approach that was approved by the Utah Technical Architecture Review Board.

Utah's cloud model is based on the following characteristics:

- Located off-site in State data centers, or offered through third-party service providers
- Solution-based and solution-packaged, meaning that all supporting elements for a given cloud solution are bundled and managed by the service provider
- Accessed via the Internet, using standard TCP/IP protocols, with a Web browser as its primary user interface, while offering its main system interfaces via Web services APIs
- Require minimal IT skills to order and implement
- Available in a way that supports self-provisioning and self-service requesting, with 24/7 availability for order placement and near real-time deployment
- Offer dynamic and fine-grained scalability
- Offer pricing options which also are fine-grained, based on usage (capable of being measured and metered as necessary)
- Use shared resources and common versions (one-to-many), with any customization (which should be minimal) built around the shared services.

The state's private cloud infrastructure provides a multi-tiered approach to cloud provisioning:

- Infrastructure as a service - customers have access to near-real time provisioning of virtual servers
- Platform as a service - customers can access several standard application stacks, including LAMP,
- Software as a service - customers can self-provision access to a growing number of state-provided software solutions such as fleet management, finance



Utah's cloud initiative supports access to a growing number of self-provisioned public cloud services. Many of these are identified in Utah's Internet-Based Collaboration Tools standard. This standard was approved on April 29, 2009.

Prior to its approval, many agencies were reluctant to use public cloud applications.

Creating the infrastructure

In 2009, Utah completed the implementation of its cloud infrastructure project. This project involved the consolidation of 36 data centers into two data centers, virtualizing the state's server environment, establishing a highly available, redundant SAN for enterprise storage, and beefing up the core state network to support this new infrastructure model.

By the summer of 2009, the Department of Technology Services had developed a central solution after completing several important objectives:

- Selection of an enterprise virtualization environment
- Implementation of an Enterprise Backup / Archive and Disaster Recovery
- Major enhancements to core network services to meet increased bandwidth and switching requirements

- Installation of an enterprise Storage Area Network that would meet the rigorous demands of all state agencies.
- Training of a centralized technical support team.

Technical Details of the Private Cloud Infrastructure

- Two data centers, primary in Salt Lake City, secondary in Richfield (different earthquake zone in Utah)
- Virtualization: Enterprise VMWare, including ESX server automatic building, storage procedures, and process checklists
- Processing: HP and IBM enterprise “Nehalem” Blade Centers
- Storage: 300 TB Sun / Hitachi SAN
- Networking: Cisco 9513’s

Length of Time in Operation

The virtualized platform initiative for private cloud computing was initiated in February 2009. By summer, the infrastructure was ready to begin provisioning services in the central data center. The solution has been in place for just over 11 months. Since that time, it has grown to support every executive branch agency in state of Utah government. By December 2009, 510 servers had been moved to the virtualized infrastructure. By May, 1686 physical servers had been provisioned virtually in the new environment.

D. SIGNIFICANCE TO THE IMPROVEMENT OF THE OPERATION OF GOVERNMENT

This project changes everything about the way state agencies approach information technology projects. It also significantly changes the role of the individual information technology directors that support those agencies for DTS. Prior to this project, one of the primary roles of the IT director was to manage physical hardware. The purchase of servers was a time consuming matter that was duplicated many times across the state. Today, with this process being fully automated, these directors now focus their efforts on providing solutions to the business challenges of the agency. They have more time to innovate and develop business focused solutions. Agencies will also now spend more time thinking about what they want to accomplish from a business perspective without being concerned about how to purchase servers and infrastructure.

- Reduced cost
- High availability
- Self provisioning
- Elastic environment
- Standardized service capabilities

E. BENEFITS OF THE PROJECT

Financial

- The implementation of the virtualized enterprise infrastructure has resulted in an ongoing annual savings of \$4 million to the state of Utah for hosting services.
- Moving the Utah Division of Finance from its own unix servers to the central private cloud infrastructure resulted in a one-time savings of over \$200,000.
- Moving the Utah Department of Workforces Services data warehouse to the central infrastructure resulted in a one-time savings of over \$100,000.
- Reduced costs for public cloud productivity services.
- UDOT saved \$41,000 by utilizing enterprise content filtering solution.
- Reduced energy costs (11,252,284 kWh per year savings)
- During the period that DTS was implementing this new platform, FTE's were being reduced due to overall decreases in tax revenues to the state. The new service is more supportable when accounting for these staff reductions.

In addition to an overall reduction in the energy costs to power the server farm, DTS has partnered with state facilities management to utilize the waste heat to heat the Capitol Campus. The previous cooling process ejected 17.3 billion BTU's of waste heat to the atmosphere every year. The finished project is estimated to save state agencies 14.7 billion BTU's of energy per year. That is enough to heat 95 homes for one year. The project will help the environment by reducing green house gases by 735 metric tons per year.

Ongoing financial benefits that have not yet been quantified are expected to accrue as a result of the following:

- Reduced time and effort to provision infrastructure and platform services
- Reduced desktop support costs due to real-time provisioning of cloud-based productivity services

Operational

- Real-time server provisioning - reduced time required to provision virtual servers for agencies.
- Improved security
- Improved data management
- Improved capability to implement single sign-on
- More consistent / standard deployment environment
- Enterprise testing and quality control

- More resources dedicated to innovation and solution delivery vs. counting and supporting widgets
- 23 data centers have been completely moved, freeing up floor space and resources in these agencies.
- Improved connectivity to services; the central data center
- Improved performance - some applications experienced as much as 2000% gain in performance
- Faster data access

References

Utah's Hybrid Cloud Strategy:

<http://www.utahta.wikispaces.net/file/view/Utah%20Hybrid%20Cloud%20ER%2010.4R.pdf>

Utah Collaboration Tool Standard: Internet-Based:

<http://www.utahta.wikispaces.net/Collaboration+Tools+Standard>