MiCloud Services
Solution Details 5/27/2011

Michigan's cloud computing strategy, the first published state government cloud computing strategy in the nation, focused on leveraging emerging cloud computing technologies and business models to deliver the necessary increase in IT agility. A dramatic increase in IT agility was identified as a key requirement of Michigan's business process transformation strategy. The resulting program was dubbed, "MiCloud", Michigan's cloud computing service program.

The MiCloud steering committee approved an orchestrated program of projects. Each project was to achieve dramatic increases in IT service delivery agility and dramatic reductions in IT service cost. The projects were sequenced, so that each built upon the innovative capabilities established by its predecessors.

By design, MiCloud projects were to be completed at a rapid pace. The first MiCloud project delivered the MiCloud Process Orchestration (PO) service and the MiCloud Data Storage (DS) service. The project was started in February of 2010. The two services went to production at the successful conclusion of the project on October 1st, 2010.

Together, these two initial services deliver a true on-demand, pay-as-you-go data storage service that is managed by users through an on-line wizard. Requests are fulfilled by an automated process in 10 minutes, more than 99% faster than the non-cloud process. Billed at $0.01167/GB/day for actual daily usage, MiCloud data storage is 85% less expensive than the next cheapest SOM data storage alternative. There are no up-front costs to the agency and no in-out charges, making the service price competitive with commercial cloud storage services. A redundant copy of the data may be maintained at a separate physical datacenter, at the discretion of the agency, for an additional $0.01167/GB/day.

The internally hosted data storage service performs at intranet speeds (10 times faster than SOM data transmissions traversing the internet). The data is not exposed to internet-based threats. For speed and data security, the MiCloud DS service value far exceeds commercial cloud storage service offerings for SOM users.

The second MiCloud project delivered the MiCloud Automated Hosting (AH) service. The project was started in October of 2010. The project followed the standard SOM Project Management Methodology and Solutions Engineering Methodology to include the SOM Enterprise Security Risk Mitigation and Enterprise Architecture Solution Assessment processes. These methodologies and oversight processes were to ensure best practices were incorporated into all phases of the project, from defining the problem to production service turnover. The service went to production at the successful conclusion of the project on May 1st, 2011.

The AH service was required to enable rapid business process transformation by dramatically lowering the agency investment risk, both in time and money, of pursuing new business approaches. The project proposed to transform the existing manually-intensive DTMB hosting service by creating a second, fully automated service channel. The resulting solution must lower several key IT measures simultaneously.

A thorough cost/capability survey of available commercial cloud hosting options was created during the first MiCloud project. None of these emerging services met all of the AH requirements, and the timeframe excluded issuing an RFP to contract with an external provider. All commercially available, internal cloud / hypervisor solutions were examined, but none met the requirements. The AH solution design approved by the

MiCloud steering committee called for the in-house development of simple MS PowerShell / VMware PowerCLI scripts to automate our existing virtual host provisioning and management processes.

The AH service was built on top of the PO and DS services. AH incorporated the SOM's existing VMware virtual server infrastructure and interfaced directly to the SOM's automated billing system for the first time.

The AH solution, like all MiCloud solutions, has the following architecture:

- A browser-based *service interface* and process orchestration layer (PO) that is shared by all MiCloud services
- A provider-specific automated *provisioning* layer
- A *metrics and billing* interface layer (PO) that is shared by all MiCloud services.

Service Interface: Agency IT support staff request server provisioning, restarts, rebuilds, activation, deactivation and deletion, as well as manage agency-specific server templates, through the service interface. By consuming all cloud services through a single interface, we create a single touch-point to govern and a single touch-point to secure. This eases integration and allows us to swap providers when it makes business sense, transparent to the users.

The service interface is loosely coupled to the provisioning layer using web services in a Services Oriented Architecture (SOA) arrangement. SOA connections make the cost of swapping providers very low, so that the decision can be based solely on the relative merits of the provider offerings themselves, without needing to factor in potentially enormous integration costs.

Provisioning: Each service can have multiple providers. In a hybrid model, this would include an internal provider (DTMB) and an external, vendor provider. Currently, AH does not use an external provider, but DTMB could enter into a contract with hypothetical cloud hosting Vendor A. Using simple provisioning scripts, Vendor A's offering would be integrated with the SOA connections from the service interface and to the metrics and billing interface. (The DTMB internal provider is integrated in the identical manner.) The user requesting a server would receive an internally provisioned server or a server provisioned by Vendor A in less than 30 minutes, based on the server attributes that they specify in their request. If SOM later contracts on better terms with Vendor B, we can migrate the Vendor A hosted servers and perhaps some internally hosted servers to Vendor B. This would occur transparently to the users, because they interact with the AH service interface, never with Vendor A's web interface.

Metrics / Billing: The metrics and billing interface is loosely coupled to the provisioning layer using web services in a Services Oriented Architecture (SOA) arrangement. SOA connections make the cost of swapping providers very low. It would enable DTMB to swap out our current billing system, without disrupting our cloud provisioning. While MiCloud services are provisioned internally today, the solution is designed to gather metrics and perform automated billing for multi-sourced services, as needed.

The AH solution is normally available. By SLA, the virtual infrastructure is supported 8-5, M-F. AH servers do not normally participate in the enterprise monitoring or the enterprise backup services. These services may be requested a la carte. However, no users requested these service during the 8-week pilot. AH users create known-good agency server templates ($1/day/template) in lieu of backups and view a AH dashboard to observe the status of their AH servers.

Like commercial cloud hosting services, O/S support is not provided for AH servers by default. O/S support services may be requested by the agency IT services team from the infrastructure services team at $90/hour. However, during the 8 week pilot, only one request for 2 hours of O/S support was made across dozens of virtual server deployments. AH users can request automated server restarts and server rebuilds from known-good agency server templates at no cost to the agency.

The AH service satisfies the same use cases as our existing hosting service. In fact, a AH server is no different from any other virtual server in our environment. This was a key requirement for our solution. Development and test/QA servers must be as similar to production servers as possible, to ensure that unit, integration and QA testing will accurately predict an application's operation and user experience in production. If we had purchased a separate cloud hosting product, our cloud-based development and test/QA environments would have been different from our production servers in subtle (and not-so-subtle) ways. These differences would have reduced the value of testing activities by making them less predictive of the application's behavior on production servers. Surprise issues could occur in production that were not seen in test/QA. Equally bad, our development teams may have wasted time fixing issues detected on development and test/QA servers that would not have occurred in production.

The AH service is designed to deliver an automated hosting service as defined by NIST. The AH service is managed by agency IT service delivery users through an on-line wizard. Requests are fulfilled by an automated process in 17 minutes, more than 99% faster than the non-cloud process. Billed at $8/day for active daily usage, MiCloud servers are 85% less expensive than the next cheapest SOM server hosting alternative. There are no up-front costs to the agency and no in-out charges, making the service price competitive with commercial cloud hosting services. The capability to maintain an inactive server image for $1/day is still not available in many commercial offerings.

The internally hosted AH service leverages the MiCloud DS service detailed above. Neither the data nor the AH processing is exposed to internet-based threats. For speed and data security, the AH service value far exceeds commercial cloud hosting service offerings for SOM applications.

Production support for the AH service was turned over to the DTMB Virtual Center of Excellence (VCOE) on May 1st, 2001. The VCOE conducted a series of roadshow presentations to educate agency IT service delivery teams in May. Their next step will be a series of roadshow presentations to educate agency business owners in June.

While MiCloud services are provisioned internally today, the innovative solution is designed to enable multi-sourcing and rapid, low-cost re-sourcing. SOM server images are readily converted to the Open Virtualization Format (OVF) that enables transferability between hosting service technologies and providers. This approach contributes to the overall design for avoiding vendor lock-in.

The dynamic solution design anticipates continuous disruptive innovations and market repositioning for the foreseeable future. The design's flexibility accounts for this market dynamism, coupled with changing requirements, shifting usage patterns and evolving compliance regulations that may prompt an agency solution to migrate between providers multiple times throughout the system's lifecycle.

MiCloud projects start with a unique and fundamental precept: "Cloud computing is not something that you *buy*. Cloud computing is something that you *do*." To demonstrate this paradigm-breaking principle, MiCloud projects *do not require capital*

expenditures. MiCloud projects leverage Michigan's prior investment in IT virtualization and staff hours only. No new infrastructure, software or contracted services were used.

The AH service satisfies two new, paradigm-breaking use cases to reduce risk to agency projects.

Use Case 1: An agency business owner needs to understand the benefits and risks of approving the use of low-cost alternative components (such as open-source components) in their enabling systems. Their alternatives analysis resources are very limited. Their margin for error is razor thin, as all resources are extremely scarce. Typical alternatives to explore would include, for example:

- How will key Oracle queries perform using PostgreSQL instead?
- How will physical server applications run, using virtual servers instead?
- How will legacy Windows 2003 Server applications operate using Windows 2008 server?

Paradigm-breaker: There is no form of IT analysis that is more powerful than simply giving it a try. Alternatives analysis predicts a result with varying degrees of accuracy. Actually performing a limited trial demonstrates the result with perfect precision. Using AH, a four server environment can be spun up in 30 minutes. If the IT team uses the four servers for a ten business day trial and then deletes them, the incremental cost to the agency is only $320.00. The increased value of the decision support information far exceeds the incremental cost.

Paradigm-breaker: This capability enables accelerated server consolidation and infrastructure optimization, as AH servers can be built initially with only 1 vCPU and 2GB of vRAM. Then, after an initial trial, the server can be rebuilt with more vCPUs and more GB of vRAM in minutes, using the self-service interface. Before AH, servers were created based on very conservative assumptions to avoid delays that would result from having to reorder or reconfigure servers manually. Thus, the majority of physical servers in the SOM inventory utilize 10% or less of their full computing capacity. The virtual server infrastructure can compensate somewhat for over-allocated vCPUs and vRAM. However, AH allows for full optimization, including the ability for agency IT service teams to make automated adjustments to compute resources for expected seasonal peaks or lulls.

Use case 2: A application development team is 6 weeks into a 12 week development project in support of an agency business process transformation. They are enhancing version 2 of the software on the development servers, while the latest release of version 2 is being reviewed on the test/QA servers. Version 1 of the software is running on the production servers. Then, the application support team detects a problem with version 1 that will cause a critical failure within two weeks.

Before AH, work on version 2 of the software would be halted, so that the application support team could use the development and test/QA servers to correct the problem. The agency business transformation would be delayed until the problem was verified fixed in production. In a complex project, this delay could have cascading negative impacts.

Paradigm-breaker: AH eliminates this risk. In the above example, work on version 2 of the software would continue without interruption. The application support team would use AH to create a second set of development and test/QA servers in order to correct the problem. The agency business transformation would not be delayed and would not risk cascading negative impacts. The agency would only be billed for the days that the extra set of servers were needed. Even if two complete sets of AH development

and test/QA servers were active for the entire project, the cost to the agency would still be 50% less than using one set of non-MiCloud virtual servers.

The ultimate beneficiaries of the MiCloud AH project are the citizens of Michigan. Through MiCloud AH, agency business owners have been empowered to rapidly transform the delivery of services to citizens in the most innovative and efficient manner that agency business owners can devise.

Large local units of government (LUGs), other states and federal agencies that currently provide internally or externally hosted virtual servers can benefit immediately from adopting this model. Michigan plans to open-source the entire solution by the end of 2011.

Interaction with smaller LUGs at the end of the first MiCloud project (October/November 2010) made it clear that LUGs were not interested in consuming a cloud service offering provided that was limited to data storage. However, it was also clear that there is a strong interest among LUG decision-makers in a combined, automated hosting and data storage cloud service offering provided by the SOM.

Discussions are in progress with LUGs regarding providing this service in the next by December 2011. The MiCloud service design for LUGs calls for a separate instance of the MiCloud PO, DS and AH services to be hosted by SOM or a large LUG. If hosted by the SOM, the rates and service model will be very similar to the SOM-internal service. Synergies are achieved through the support of like solutions, without introducing the compliance complexities surrounding comingled state / LUG data and processing.