NASCIO State IT Recognition Awards Submission

2018

Cirrus project

Moving UI Online to Amazon Web Services

Category: Enterprise IT Management Initiatives

State: Massachusetts

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Project completion: November 2017

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Executive Summary

The Commonwealth's UI Online (UIO) system was designed in 2006 to replace a legacy Unisys Mainframe System that handled the State's Unemployment Program. The Revenue module was implemented in 2009 and the Claimant module in 2013.

Capital funding of $3.39 Million was allocated in July 2016 to upgrade the on premises infrastructure. An agreement was reached between DUA & EOTSS (formerly MassIT) to repurpose the funds towards Cloud migration.

Migrating to AWS instead of replacing in house servers reduced the capital expenditure to $1.99M ($1.4M under the allocated amount for an on premises hardware refresh) while providing a fully redundant system in a highly scalable and secure environment (Amazon Web Services). By adopting additional cloud services, the Executive Office of Labor and Workforce Development (EOLWD) is on target to reduce its database licensing costs by $300,000 annually and its infrastructure maintenance costs by $500,000 annually.

Why go to the cloud – Key business drivers

- Hardware and software on unsupported versions
- Long system outages due to on premises system instability
- Loss of institutional knowledge due to attrition
- No System Disaster Recovery
- Inconsistent environments for Development and Testing
- Lack of scalable technology stack and in other cases overprovisioned and under utilized
- Lack of proper security procedures

Cloud Security & Failover

- Infrastructure scans & patched server environments
- Sandbox to test Application compatibility
- High-Availability tested successfully
- 15 minutes to recover across 2 HA zones
- 2 minute DB recovery
- Pen testing in Cloud UAT & Production
- Consistent environments across Dev/UAT/Prod
- Managed Monitoring Services at Go-Live
- Internal connections to AWS with redundancy

Concept

What moved to the cloud?

- Online Unemployment system for claimants and tax (Web Tier, Application Tier & Database)
- Data Warehouse (OBIEE & ODI)
- Document Management
- Batch Processing

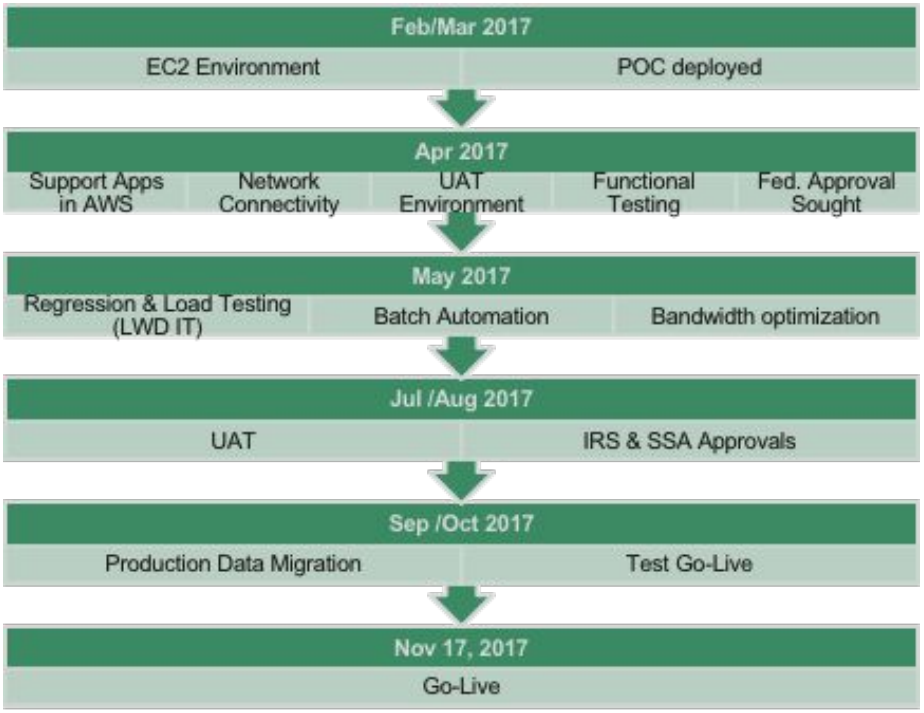
Application/Service	On Premises	AWS	Swampfox	AWS Service
UIO Application		X		EC2
Oracle DB		X		RDS/S3
FileNet		X		EC2
Data Warehouse		X		RDS/S3
DataCap		X		EC2
Batch Processing		X		EC2
IVRS			X	
Client LDAP		X	X	EC2
FTP Servers	X			

- OS Upgraded from Windows 2003 and 2008 to 2012 R2
- Oracle Upgraded from 11g (on Windows Servers) to 12c (on Linux)
- FileNet upgraded from 4.x to 5.x (LWD Resource)
- .NET Framework upgraded to 4.6.1
- Argent Software for batch scheduling updated to latest version and consolidated licenses for Application & Data Warehouse.
- Sophos for Security services & Monitoring
- New Relic for Application Monitoring

How long did it take?

Certification process: SSA requests 120 days and the IRS requires a 45-day notification for certification. Resubmissions automatically restart the clock with IRS.

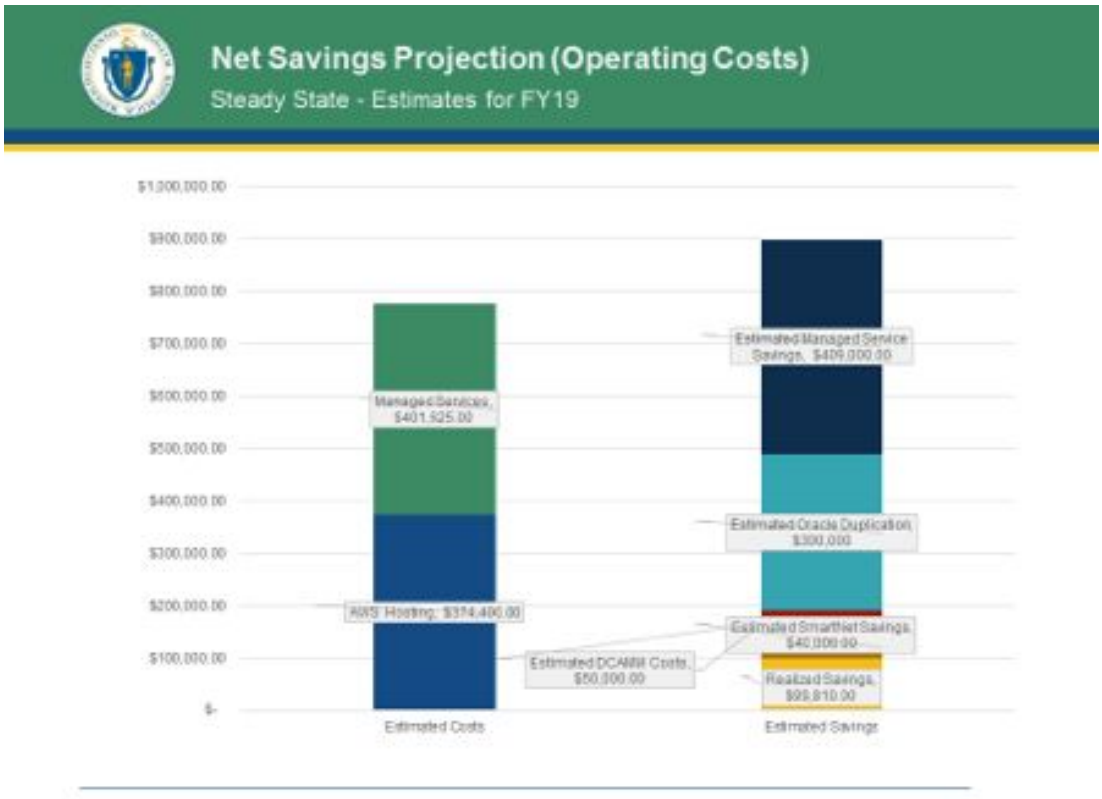
One notable difficulty we experienced during the process was that IRS required the physical location of Amazon which for security reasons Amazon does not supply. We have since resolved the issue and in doing so blazed the trail in this regard. Other agencies should be able to cite this migration to speed the process along for them.



Why did we choose AWS versus Azure/Google?

- Amazon is the leader in the Gartner quadrants with the greatest maturity, most diversified products, and solid tool sets.
- Azure ranks high in Microsoft tool sets, but is less beneficial for a heterogeneous environment like UI Online.
- Google was not selected as part of the contract award due to its inability to guarantee that data will remain within US Data Centers.
- In selecting AWS, we opted not to go with the Gov Cloud and decided Fed Ramp certification was more than sufficient to satisfy IRS, SSA and business needs. Costs are furthermore significantly lower in the Non-Gov Cloud environment.

Costs of Cloud Computing The cost range of migrating to the Cloud largely depends on what you use and the scale of your usage (24x7 for production and limited usage of lower environments). For UI Online, all costs involved direct vendor costs with AWS hosting and Managed Services. EOTSS acted as a pass through for all billing. For the size and scale of the Department of Unemployment Assistance (DUA), the operating costs were lower while benefiting from full disaster recovery & high availability.



Challenges

Lessons learned or things we would do differently

- **Get IT Security Involved Early** – The Cloud has its own "security architecture" and it is best to utilize it rather than force fit your likely outdated security model into the Cloud. (E.G. static IPs and firewall hole punching is probably not the way to go.)
- **Stop Counting Servers** – When you migrate to the Cloud the number of on premises servers for the legacy system is not important. Move the functions to the Cloud and build out the servers as necessary.
- **Networking Engineering is Very Important** – The Cloud vendors make it very easy to build out the infrastructure and to load your applications. Your internal networking team needs to embrace the Cloud early and work on adapting the existing policies to enable communication with the Cloud. A knowledgeable Cloud specific consultant can be very helpful here.
- **High availability is built in** – Follow the recommendations of the Cloud vendor regarding setting up Availability Zones and high availability will work "right out of the box" - no need to do a lot of design work.
- Move something to the Cloud early – Initial resistance will be that "We can't move anything until we have figured out everything". Use the Agile approach. Applications and data move to the cloud rather quickly and as they begin working – this builds confidence and reassures skeptics.
- **Data copy not data migration** – If you are moving a legacy application then you may need to move huge amounts of data. However, it is important to keep in mind that data is only moving, not transforming. So typical data migration issues do not arise. The issues we ran into are how to move these terabytes of data to the Cloud. We suggest either ensuring there is a high-speed path to the Cloud for this purpose or using a "snowball" such as disk and simply mail the data to the Cloud.
- **Snowball** – The idea of making a local secure copy and mailing it to the Cloud has a lot of benefits. However, connecting the disk to a system and pulling down the data without having the download can cause significant issues for production servers. This is a critical problem that needs to be resolved beforehand.
- **Environments** – Spinning up environments are easy in the Cloud. However, getting everyone to agree on the template for the Cloud configuration (i.e. what constitutes a new environment) can be time-consuming. Legacy design constraints are probably not applicable anymore, so a competent Cloud architect to work with is necessary. The Cloud provider will recommend "standard" templates – try to fit our business into the standard.
- **Replication** – We used the concept of replication to simplify the cutover to the Cloud and to develop confidence in the Cloud. The UIOL DB and associated files tend to be quite large and it takes a long time (tens of hours) to move the data from on premises to the Cloud. Replication lets you get the data there once and then incrementally keep it up to date. In addition, make copies of the replicated DB and make them available for testing again, thereby eliminating the need for long data copies to the cloud for updates.
- **Good time to restructure user access** - Like most systems, over time the rigidity of the security and access groups can begin to break down. Moving to the Cloud brings more and better tools to control access and limit use by roles, etc. This is a good time to re-examine the requirements and realign the access with the roles. The new tools also help keep track of who has access to what.

Challenges

Lessons learned or things we would do differently

- **More security can mean performance degradation** – Adding new and better real time virus scanning available in the Cloud makes the system more secure but large files take a long time to scan, so be sure to test with maximum file loads as needed to increase the horsepower of the scanning server or whitelist some files to and scan these files on a schedule.
- **CPU Credits.** For some types of cloud virtual servers, "buy processing power" by purchasing credits, e.g. x hours at 80% of the processor per day. If you run an off schedule large job that "eats up" all these credits, then processing reverts back to 205 of the server automatically until the next day. As you might imagine this can create some strange processing profiles that can take a while to debug.

Impact

- System response times are nearly 33% faster.
- IVRS response is noticeably faster.
- On a couple of occasions, the Database has failed over to another Available Zone with no impact to the end users.
- UI Online Fraud detection system used to take 36+ hours for data extraction and analysis previously. By decoupling the cloud and on premises work load, that time has now reduced to 6 hours.
- Better audit controls in place for system access and limiting privileged users.
- With improved application monitoring, the application support team is able to monitor the system health more efficiently.
- Decommissioning of 200+ on premises servers was completed in January 2018.
- With the AWS migration, we have also addressed nearly 80% of recent Federal audit findings.
- Cloud environment moved into an operational phase within 7 days of migration with regular help desk and application teams managing the work load.

Significance

- The Unemployment system impacts unemployed Bay Staters at one of their most vulnerable points in their lives. To have a reliable system goes a long way in providing a positive reinforcement to the Commonwealth's constituents.
- The Commonwealth was able to optimize the computing environment and move to a demand-based computing and saving valuable operating costs.
- The software environments were upgraded to the latest versions with the appropriate security patches. This has been critical in improving our system performance and support framework.
- By leveraging additional AWS services, the IT staff is now able to focus on the business process improvements rather than technology challenges, including consistent environments and more time for deployment of computing environments.