CLOUD AND TAXES, THAT'S CERTAIN:
GEORGIA DOR'S TAX SYSTEM MIGRATION PROJECT

NASCIO 2022 State IT Recognition Awards

DEPARTMENT *of* **REVENUE**

STATE: Georgia

AGENCY: Georgia Department of Revenue

AWARD CATEGORY: Enterprise IT Management Initiatives

PROJECT BEGINNING DATE: March 1, 2020

PROJECT END DATE: February 8, 2021

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The Georgia Department of Revenue (DOR) Integrated Tax Solution (ITS) is a mission-critical application in the truest sense. It's used to process tax returns and taxes, and to enforce tax regulations for the state of Georgia. And it processed $23.7 billion in fiscal year 2020 alone. So when DOR faced making necessary updates to ITS and the supporting infrastructure, one thing was certain – it had to be done right.

In 2020 DOR charted a bold course to move ITS to the Amazon Web Services (AWS) commercial cloud and away from on-premise server services. This change in altitude allowed DOR to meet industry challenges, and it provided the flexibility to easily scale up or down while avoiding long-term capital expenses. And importantly, it helped ensure DOR's constituents continue to have an informed, seamless tax experience.

Working with Amazon and the Georgia Technology Authority, DOR reviewed the infrastructure setup to test and remediate code, ensuring the application would perform with the new database. DOR also introduced new security measures using data encryption that adheres to the highest security standards. This was all built in a sustainable, agile, and easy-to-manage cloud environment, capable of meeting the evolving needs of constituents and the agency.

The new cloud environment provides substantial benefits related to support, disaster recovery, and flexible storage options. The overhaul reduced maintenance costs significantly –savings of more than 40% - with an even larger reduction likely with ongoing upgrades. There's now also greater ease of turning infrastructure environments on and off as needed, providing more flexibility in planning.

A cloud-based ITS is better able to support a complex and dynamic ecosystem of federal and state tax information for constituents. It readies DOR to provide accessible and high-quality tax resources for all Georgians. DOR has realized such compelling benefits with ITS, in fact, that the agency has moved all its other major applications to the cloud as well. The cloud transition supports the Georgia governor's initiative of making Georgia a technology leader. Cloud is not a brand-new notion, but efforts to capitalize on it are now accelerating in Georgia government. Other agencies are following DOR's lead, attracted by the speed, flexibility, and cost management control that cloud services offer. And the improvements bode well for Georgians.

5,421 Total Migration Effort Items

- 1,092 Code Analysis
- 375 Interfaces
- 675 Reference Configuration
- 1,379 Ad Hocs, Reports, and Cubes
- 298 Production Support Items
- 1,602 Warehouse and Discovery

ITS to AWS
Georgia Department of Revenue (GA DOR) GenTax (ITS) and eServices (GTC) implementation is live in the AWS Cloud and successfully transitioned from Oracle to SQL effective February 10th, 2021

IDEA

An ITS upgrade was due – that was clear. How best to do it was not. Extensive research by DOR enterprise architects pointed the team toward exploring server options outside the state's data center. DOR landed on migrating ITS to a more sustainable, agile, and easy-to-manage Amazon cloud environment. Benefits, including cost-efficiency, made an attractive case.

COST

- Negotiated database management software licenses from the COTS vendor's preferred database platform vendor for migrating from Oracle databases

- Achieved substantial cost savings through database conversion

- Completed project well under original budget

- Secured migration assistance from AWS for the first year, avoiding need to engage an additional vendor for migration services.

- Trimmed consumption costs for storage and compute

- Reduced storage backup costs by categorizing data and moving it to more cost-effective storage
  - SSD, HDD, Glacier

- Cut management and support costs by consolidating support with Amazon Managed Services (AMS)

- Eliminated redundant infrastructure for disaster recovery by utilizing AWS availability zones to address potential data center outage

- Avoided expensive additional support associated with on-premise environments

TIME

Creating and maintaining cloud infrastructure environments could be achieved on a more agile timeline than was feasible in an on-premise environment. What previously required months could now be accomplished in less than a single month.

PERFORMANCE

ITS, as the system processing all the state's revenues, has to be robust and provide high availability. The cloud solution meets those requirements. DOR is also able to maintain an Exadata (database) appliance at a remote data center hosted by a third party in another state.

COMPLIANCE

- Collaborated with AWS to meet compliance requirements in commercial cloud rather than in more costly government cloud

- Implemented procedures to make most compliance-related documents centrally managed and available

- Provided additional security using data encryption at rest and in transit

- Implemented enhanced security, with DOR security division's exclusive access to encryption keys
  - AWS cannot see DOR data

- Provided enhanced high availability and disaster recovery environments

BUSINESS AND TECHNOLOGY PROCESSES

- Exponentially improved the business processes to procure, design, build, configure, and maintain infrastructure environments by utilizing AWS cloud environment tools

- Added ability to quickly create and maintain infrastructure environments with Amazon Cloud Formation Template technology, which runs in minutes to spin up an environment or turn down one that is not in use

- Enhanced storage options, which can easily increase or decrease as needed

Migrating ITS to the AWS cloud allowed an innovative shift in how DOR creates and maintains infrastructure environments. The agency is now more agile in meeting the evolving needs of constituents. And with help from AMS teams, it can manage the new cloud infrastructure at reduced costs.

The migration also helped achieve one goal in DOR's five-year strategic plan -- maximize operational efficiencies. Its success hasn't gone unnoticed, in Georgia government and beyond. Multiple states have contacted DOR to learn from its cloud migration experiences.

IMPLEMENTATION

ITS was DOR's first swimmer in the pool, with the agency envisioning eventually moving all its other applications to the Amazon cloud as well. Project leaders set an ambitious goal of completing the migration of the ITS infrastructure environments, application, and data from the state's data center to the Amazon cloud within a year, before the 2021 tax season. The project management approach was an agile, multi-team effort, working the critical areas of infrastructure, data, and application in tandem.

INFRASTRUCTURE

At the outset, creating the AWS infrastructure environments with network connectivity from the state was critical. That work was completed in record time, making the first environment ready for the data and application teams. To meet an aggressive timeline, DOR secured assistance from an Amazon cloud architect and the Amazon Professional Services team who worked with the DOR IT division to create the infrastructure environments.

All infrastructure environments were designed to meet industry security standards and built using Amazon Cloud Formation Templates. Once the environments were spun up and evaluated, they were spun back down until needed by the data and application teams.

In addition, DOR coordinated with the Georgia Technology Authority (GTA) to make network connectivity, trust, and federation changes to facilitate a connection between the state's network and AWS. This too was accomplished on an accelerated schedule.

DATA MIGRATION

Migrating the Oracle data (i.e., the ITS database) to the cloud was one of the most time-consuming parts of the project. The team used the Amazon data migration service. Database administration teams put in incredible efforts to identify any issues in the data that needed resolving and to ensure that no data was left behind in the conversion.

To minimize business disruption, database teams converted all transactional data over a long cutover weekend. This required multiple mock-migrations throughout project implementation to ensure the migration process went smoothly.

APPLICATION

Application teams tested hundreds of processes to remediate code, ensuring the application would perform with the new database platform. This allowed seamless data conversion from Oracle to the COTS vendor's preferred platform. Application testing and quality management teams thoroughly tested the application once remediations were in place. The teams tested more than 1,000 regression test scenarios, completed year-end updates, and implemented a redesign of paper processing and two new tax types – all while maintaining production support.

Moving ITS to the cloud required intense coordination across teams. DOR IT project managers even worked with service provider project managers to ensure agreed timelines were met, risks were avoided, and issues resolved.
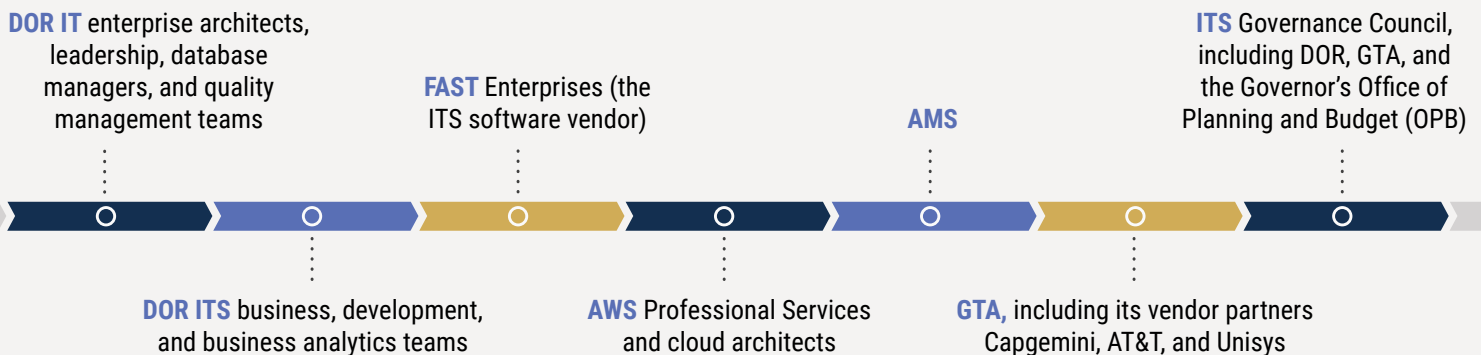
DOR enterprise architects researched requirements and costs for the cloud-based solution, and worked with GTA and business partners to determine which cloud platform provided the tools DOR needed. These tools needed to be scalable to efficiently manage DOR's infrastructure environments.

Initial approval and buy-in was achieved by providing agency and state leadership with information to compare cloud solutions with the existing Oracle/Exadata environment. DOR architects presented this information in Excel spreadsheets for side-by-side comparison. The benefits of a cloud solution in both cost and operational efficiency were so clearly apparent that all parties approved.

DOR teams were critical contributors to the project, working with Amazon Professional Services project managers to identify and implement project processes and, most importantly, to provide operational support after project completion. This established a sense of ownership for DOR teams, and added critical insight necessary to project success.

Obviously, an effort of this size required significant financial support. The team needed, and secured, resources to accomplish their tasks on a short timeline. DOR architects and leadership also worked with Amazon to get all the credits available for their services. And DOR used internal teams for all enterprise architectural work as well as data migration.

The project's timeline was incredibly tight, but thanks to the commitment and caliber of the professionals involved, all project milestones were met on time. Key contributors included:

DOR IT enterprise architects, leadership, database managers, and quality management teams

DOR ITS business, development, and business analytics teams

FAST Enterprises (the ITS software vendor)

AWS Professional Services and cloud architects

AMS

GTA, including its vendor partners Capgemini, AT&T, and Unisys

**ITS** Governance Council, including DOR, GTA, and the Governor's Office of Planning and Budget (OPB)

The project was deemed successful when it came in well under the original budget, before tax season, and over the planned cutover long weekend. Some 3,605 database tables, weighing in at 27 terabytes (that's 27,000 gigabytes), were converted from Oracle to the COTS vendor's preferred database platform with virtually no business disruption. Business then resumed as usual with minimal post-implementation issues.

The ITS cloud solution provided DOR with a flexible, scalable, and redundant platform in which infrastructure environments are created and maintained using leading industry practices. The DOR security team owns the data encryption keys, which provides a high level of security and privacy assurance for Georgia constituents.

IMPLEMENTATION *(continued)*

SOME TECHNICAL HIGHLIGHTS:

- Web, application, and database servers distributed across multiple physical data centers (availability zones) in an AWS region to provide high availability and disaster recovery.

- The COTS vendor's preferred database platform databases were configured as availability groups with multiple servers in each group to provide recovery from server failures in a matter of minutes.

- The architecture used AWS services such as CloudTrail, CloudWatch, and Guard Duty to monitor the environment and provide alerts to address any problems.

- Used the S3 object storage to automate backups across multiple regions.

- ITS data will have multiple copies of production data replicated across multiple data centers with an AWS region and one copy migrated to a different AWS US region.

- Used AWS security enhanced machine images to create the virtual servers.

- Implemented dedicated dual high-speed network connections between state networks and AWS.

- Established a one-way trust with on-premise active directory for user authentication to the IT systems.

- Leveraged the state's existing network and security capabilities to provide secure access to the public-facing website.

- Implemented encryption of all data storage using keys controlled solely by DOR IT security.
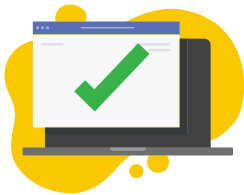
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Test Scenarios Completed
1,000 Regression Test Scenarios
400 E2E Test Scenarios
5, 421 Migration Effort Items Tested

Entirely Remote
All Testing and Development tasks were completed entirely remote

Project Team
28 Fasties
23 Business Users
7 BAs
15 Client Developers

Tax Type Implementation
The Team implemented two new tax types; a Vape License Tax and a Transportation Services Tax, during the ITS to AWS project

During the Project
The Team continued Production Support, implemented Year End changes and redesigned paper processing

Project Fun Facts
45+ Games of Trivia
224+ Questions of the Day
5+ Pets Adopted
1 Child Born

IMPACT

Migrating ITS to the AWS cloud provided DOR with a better, more cost-effective path for upgrading and maintaining the technical infrastructure of the state's mission-critical tax application, ITS, which was at the end of its support.

As support was ending, DOR could have opted to upgrade infrastructure at the state's data center. But instead, DOR chose a new, less-traveled path to provide the most flexible, cost-efficient environment for years to come.
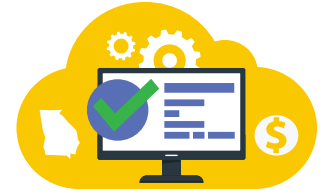
DOR planned and expected benefits from the move to the cloud, particularly in critical areas like cost, time, disaster recovery, compliance, and business and technical processes. Fifteen months after a successful migration, the benefits are apparent:

- Realizing projected cost savings of $1.7 million for the first year.
  - Anticipating $6.8 million over three years.
- Enjoying ease of turning infrastructure environments on or off as needed, which provides huge ongoing cost savings and flexibility in planning.
  - In an on-premise server environment, support charges could not be turned off and on.
- Benefitting from AWS discounts of 20% applied over three years for growth (no comparable option with an on-premise environment).
- ITS V12 upgrade is currently in progress.
  - The workload for this upgrade was reduced by not having to test and tune the ITS application (tuned for COTS vendor's preferred database platform) to perform accurately with Oracle.
- Realizing benefits for every infrastructure request since the team can now quickly add temporary resources needed for system upgrades and remove when no longer needed.
- Seeing much more manageable support needs and quicker provision of support for the AWS cloud environments compared to on-premise.
  - Requests that might've taken months can be fulfilled in just days.
- Implemented robust security layer controls.
  - Performed third-party security review.

With infrastructure in AWS, DOR can plan with confidence regarding timelines and costs. Business need (not how long it takes to get on-premise servers) becomes the true driver for technical change timelines.

Noteworthy improvements have also been made in providing compliance information to auditors. The DOR team can now provide the information directly via AWS console features, no longer needing input from providers of on-premise server services.

The ITS migration project has moved to the operational support phase, maintained by FAST Enterprises (the ITS software vendor) and DOR application teams, database administrators, and infrastructure and enterprise architects.

Georgia's return on investment for the now cloud-hosted ITS application is being realized today, and the positive impact will be felt by Georgians for years to come. DOR has set an example other state entities may learn from and model after as they too consider cloud computing options.