Government Business Council

FEDERAL MODERNIZATION

Cloud Native Apps Growing in Popularity

Government Business Council & REI Systems

INTRODUCTION

The federal government has been actively working to modernize for more than 30 years. Yet according to the Government Accountability Office (GAO), about 80 percent of the more than $100 billion spent on IT and cyber-related investments every year is for operations and maintenance of existing IT investments. Legacy IT maintenance costs account for about $29 billion of that total spending[1]. This spending represents an array of technology-related obstacles the government faces on the road to modernization.

Contributing to those obstacles are legislation and executive orders that are pushing agencies to modernize their technology, including:

- **Information Technology Management Reform Act of 1996**
- **Modernizing Government Technology (MGT) Act of 2017**
- **21st Century Integrated Digital Experience Act of 2018**
- **Executive Order on Improving the Nation's Cybersecurity" issued May 2021**
- **Executive Order on Improving Government Customer Experience and Service Delivery for the American People issued in December 2021**

Something needs to shift if the government is to modernize while meeting mandates. That shift is a move to the cloud. Gartner predicts that over half of agencies will migrate critical applications[2] to the cloud by 2025 to improve resilience and agility. A move to the cloud is critical but cloud-based applications that lift and shift to the cloud isn't enough.

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CLOUD BASED IS THE ROADBLOCK; CLOUD NATIVE IS THE PATH

A Forrester analyst predicted that 2022 would "see big organizations move decisively away from lift-and-shift approaches to the cloud, embracing cloud-native technologies instead."[3] Cloud native is a development approach that encompasses tools and techniques to build applications for the public cloud, as opposed to traditional architectures suited to an on-premises data center. An article in the *Economic Times* illustrated the differences between cloud-native and cloud-based[4]. In summary:

	Cloud-native applications	Cloud-based applications
Design	Specifically designed to operate in the Cloud. They use a microservices-based architecture and are built to handle different kinds of failure.	Built primarily for availability and not designed for the Cloud. They leverage the availability and flexibility of the cloud.
Time to deploy	Are quick and easy to deploy because modules and components can be built simultaneously without a need for additional hardware or software.	Require substantial hardware acquisition and software setup. They are vulnerable to potential configuration interruptions and roadblocks.
Ease of maintenance	Are easy to maintain because they are built using microservices. Interruptions are minimal because edits and changes can be made to individual modules without impacting the performance or availability of the entire app.	Are difficult to maintain while also being prone to interruptions because of the complexity of the underlying architecture and configurations.
Upgrade complexity	Because they are designed for the Cloud, they are flexible and scalable. Because they are designed for the Cloud, they are flexible and scalable. Any aspect of the app can easily be upgraded without disruption.	Are tightly integrated within their existing ecosystem, making upgrades difficult and susceptible to downtime.
Price	Cost effective because they are developed, managed, and run in the Cloud.	More investment needed because they require owning the whole stack and purchasing additional hardware before the application can be deployed.

CLOUD NATIVE APPS IMPROVE PROGRAM OUTCOMES

The government can benefit from more evergreen cloud-native applications because they more effectively support government missions with better, faster, cheaper, and (we can't forget) more secure operations.

For example, the Department of Treasury has been working on an enterprise cloud contract that will expand the number of cloud services available to agency programs[5]. Called TCloud, the contract envelopes various cloud solutions under a single business model. And the DoD's DEOS (Defense Enterprise Office Solution)[6] is an enterprise commercial cloud environment. It supports DoD's strategy to acquire and implement enterprise applications and services for joint use across the Department, standardize cloud adoption, and enable cross-department collaboration.

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Examples of Better:

Workforce Support. The combination of COVID and the rapidly growing economy has tightened the labor market, and the government is feeling the pain of labor shortages[7]. The trend doesn't seem to be reversing anytime soon as the scarcity for quality developers only gets worse. Cloud-native apps don't require large IT teams compared to traditional applications and on-premise servers because:

1. *Cloud native apps can be implemented quickly because cloud services providers offer managed services that reduce the time for infrastructure setup or ongoing management.*
2. *Many of the cloud service providers offer programs and products that can be implemented with limited developer resources while allowing for improved functionality.*

3. *Cloud native apps offer more opportunities for automation and orchestration. Cloud automation eliminates manual efforts used to provision and manage cloud computing workloads. Orchestration involves scheduling and integrating automated tasks between different systems.*

Scalability. Cloud native applications give agencies the ability to instantaneously and easily ramp up and down their computing power. For example, when disasters hit (natural or manmade) government resources tend to get severely strained. Cloud-native apps offer FEMA the ability to scale when major floods and/or hurricanes hit, and citizens need life-saving services[8]. When the demand for services decreases, the apps can scale back down to save costs.

Capabilities. Due to the nature of cloud native application architecture—microservices—agencies can quickly build new capabilities to address an immediate need. For example, if another pandemic hit and the US Department of Health and Human Services had to disperse billions in grants within weeks to help treat underserved communities, a cloud native app could rapidly add new capabilities to get that money into the hands of medical providers to treat those citizens.

An IBM study found that more than **70%** of development managers, IT executives, and developers believe cloud-native principles resulted in faster development and launch.

Customer Experience. The US Customs and Board Protection agency is using cloud native applications to pre-fill claims forms when traveling citizens are returning to the US[9]. Travelers are provided a code that customs officers can scan to review the travelers' claim data. The cloud native technology reduces custom processing time and eliminates cumbersome paper for a better citizen experience.

Insights. The Department of Veterans Affairs is using cloud services to apply artificial intelligence and machine learning for improved medical care and diagnostics[10].

Examples of Faster

The cloud native approach focuses on speed and how quickly a program gets from the design phase to production using agile, DevSecOps, and automation principles.

Agencies like DHS and HHS are continuously working on developing capabilities to keep citizens safe and healthy. As more threats emerge overseas from ongoing war and new health crises arise, agencies can rapidly respond with leading-edge technology.

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Not only can cloud-native applications bring value via new capabilities and innovations to citizens faster, but the actual apps run better and faster than traditional software because of the cloud's impressive processing speeds. Cloud native applications are backed by giant and powerful data centers with enormous computing power.

Examples of Cheaper

When talking about costs, it is important to understand the value of the investment. Cloud native applications provide an enormous value compared to other types of applications like cloud-based and traditional on-premise applications.

For example, cloud-based applications (applications made to work in the cloud) have similar benefits and functionality to cloud native

apps, but by far cloud native provides better overall performance. Cloud-native is designed to:

- *Withstand all kinds of disruption to service*
- *Deploy capabilities faster*
- *Make changes easily without impacting the entire app*
- *Produce upgrades without any downtime*
- *Be cheaper because cloud native apps are developed and managed in the cloud (hosting expenses tend to be lower because of licensing and storage expenses)*

> The transparency of cloud-native apps helps better **give insight** into the performance of the entire tech stack and costs.

Other cost-savings with cloud-native applications compared to traditional on-premise software include no upfront hardware or software licensing costs, you pay for what you use, and you aren't managing physical equipment that lowers your power, maintenance, and labor costs.

The transparency of cloud-native apps helps better give insight into the performance of the entire tech stack and costs. This analysis can be done with FinOps, an evolving cloud financial management discipline that enables organizations to get maximum business value

on data-driven cloud spending decisions. Agencies can always track and monitor their technology in the cloud, eliminating ghost servers living in a forgotten closet.

Examples of More Secure

In most cases, the cloud is more secure than on-premise data centers because cloud providers have made significant investments to ensure data protection. Many cloud services for organizations have security features available, including application role-based authentication. Cloud-native user authentication enables your agency to access information anytime, anywhere while retaining control and lowering risk. Other security features include multilayer encryption, regular security updates, zero downtime auto-patching, firewalls, redundancies (ultra-backups), and two-factor authentication.

The cloud offers a "shared responsibility model" where security at the infrastructure level is the responsibility of the cloud service provider, while the apps and data are the responsibility of the end-user organization. Agencies also save time and effort on compliance and documentation because in a shared security model agencies inherit the cloud service providers' security level.

Finally, FedRAMPed cloud services ensure federal data is tightly protected and follows the strictest security compliance in the cloud. Agencies have a cadre of cloud service providers to select from that offer FedRAMPed solutions like AWS GovCloud, Microsoft Azure Government, Appian Cloud, Google Cloud, and more.

CONCLUSION

Legacy systems represent the past. Cloud native applications represent the future. If agencies want to move into the future, they need to transition to the cloud and cloud-native apps. While cloud platforms force organizations to keep their technology more up-to-date, cloud native applications are built to be quickly and easily updated or modified. The combination is a powerful way to combat the downfalls of legacy systems.

Cloud native applications not only offer immunity from outdated technology, but the apps will help the government operate better. Although the initial transition might be overwhelming, the long-term benefits are well worth the investment. Adopting a cloud-native approach will usher in a next-generation of government where capabilities are modular, and the best ones are shared like a commodity that helps agencies meet ever-changing mission requirements now and far into the future.

Over the coming decades, the federal government will be faced with unprecedented challenges like climate change, resource depletion, sustainable energy, domestic and international terrorism, and new pandemics. Technology will help us manage some of these herculean problems. Going cloud native is a step in the right direction by getting more innovative solutions to market faster. Being able to address these challenges at some level will not only improve government mission outcomes, but trust in government.

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Cloud Native Apps Meet Sustainability Goals

When agencies put forth the investment to modernize, finding a sustainable path that will ensure longevity for the investment is critical. That's why many are looking at cloud-native applications.

Cloud-native apps offer the architecture, infrastructure, capabilities, and modern delivery approaches needed to keep applications future-ready and more evergreen. In terms of performance, they outpace other types of applications for the mere availability of cloud services and automation the applications can access. This means that cloud-native applications help reduce legacy technologies so the government can better meet its mission by being more adaptable, responding to citizens' feedback, and providing a platform to increase trust with the American people.

The enduring advantages of cloud-native features include:

Modern Software Delivery: The cloud easily enables modern software delivery approaches including Agile, DevSecOps, and Continuous Integration/Continuous Delivery (CI/CD). DevSecOps teams manage and automate infrastructure using cloud technologies, enabling Agile work processes. DevSecOps processes are very Agile when implemented correctly. The cloud centralizes the management of all DevSecOps stages, and most cloud providers offer CI/CD tools to automate DevSecOps processes.

Microservices Architecture: Cloud-native apps use a cloud-based modular approach to building, running, and updating software called microservices. Think of microservices like Legos®. Each Lego is a component and represents one business function, and Legos communicates with each other via web-based services. You can continue snapping together different Legos with different business functions until you build a complete application with multiple business functions. When one Lego needs to be fixed, you unsnap it from the others and fix it while the entire app is still available and running all the other business functions. This modular approach can help agencies manage the rate and amount of persistent change at practically an infinite scale.

Composable Applications: Composable applications is an innovative and futuristic concept grabbing hold of the software industry. According to Gartner, organizations of the future will have complete fluidity. Composable applications will repurpose individual components or processes that can

be separated from the entire application, so improved capabilities that offer faster, better, and cheaper innovation can be developed across an enterprise. The foundation of composability goes back to how applications are built from component parts (microservices)—individual Legos.

Serverless Computing & Containers: Both are scalable ways to deploy applications in the cloud. Serverless computing is where the maintenance of servers and underlying infrastructure is on-demand and offloaded to the cloud service provider. Development teams don't have to worry about capacity planning, configuration, or management. Also, serverless computing is completely scalable. The application will auto-scale post-deployment in response to traffic flow/usage. When an app is not in use, there are no computing resources allocated; therefore, also optimizing pricing.

A container is a virtualization architecture that contains both an application and all its dependencies so the app can run on any operating system. Container apps are portable, faster, lighter, and more efficient than running a virtual machine. Containers ensure an application can run once it's moved from one environment to another.

Multicloud & Distributed Cloud: To leverage best-of-breed needs with performance and regulatory compliance requirements, agencies are adopting multicloud and distributed cloud architecture models. This strategy helps agencies protect themselves against vendor lock-in, varying costs, and other risks. Each cloud brings its own set of strengths and capabilities that are rapidly changing and provide high levels of compliance with federal regulations.

Low-Code: Not all government processes are completely unique to the point where only custom applications will foot the bill. Case management systems are a prime example of where government processes are similar to other organizations. Low-code is perfect for case management-like processes. Low-code providers like Appian, Salesforce, and Mulesoft provide a pre-built platform in the cloud where developers can configure more than code to exponentially speed up software development. Low-code platforms also take advantage of cloud services, microservices, and containers. Low-code will also support the composable application model talked about above.

Emerging Technologies: The pioneering hype around cloud-native applications is the ability to leverage AI services. AWS, for example, offers services like:

- *Rekognition* for image analysis, which helps **law enforcement** in criminal investigations.
- *Polly* that turns text into speech so applications can talk to you, which the state of **West Virginia** used to help with their unemployment call center during COVID.
- *Lex* for building conversational interfaces for a highly engaging user experience, which the **City of Johns Creek** used with AWS Alexa so citizens could ask questions about local park hours or property taxes.
- *Amazon Elastic MapReduce (EMR)* is a flexible, customizable big data management and processing platform. It's built for any data science workload, not just AI so organizations can use their data to gain insights. Instead of focusing on infrastructure, Amazon EMR helps data scientists start working on the data on day one.

Cloud native development in combination with cloud services, platforms, frameworks, and infrastructures that greatly increase scalability, memory, and databases, means that government can address major challenges.
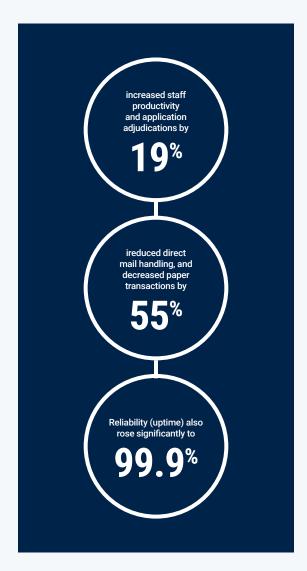
Department Of Homeland Security (DHS)

DHS administers a case management system that processes millions of requests and applications from immigration to visas to naturalization. DHS built a system to help manage the workload, however, the monolithic system was overwhelming the agency from mainframes and databases to unstructured data, all needing continuous updates. To keep up with the growing demand for timely and efficient application accessibility and processing the system had to continuously modernize, streamline, and revise its processes.

REI Systems (REI) partnered with DHS to honor its mission of safeguarding the American people and leveraged its **award-winning Mindful Modernization® approach** that combines leading-edge business acumen, modern technologies, and Agile and DevSecOps workflows to transform and migrate the system to the cloud.

With so many mission-critical processes on the line, DHS knew that moving to the cloud and leveraging capabilities they could only find in the AWS cloud was the best way to keep up with the continual demand. REI delivered value and flexibility through containerized and microservices-based architectures, breaking down a single application into loosely coupled and independently deployable smaller components or services. A continuous integration continuous delivery (CI/CD) software development pipeline using leading-edge technologies, tools, and knowledge was stood up to help DHS innovate faster. REI helped the agency's ability to see data assets across all enterprise services through a single system that provided stronger quality assurance and adjudication consistency. Doing so created a consistent data model for benefits processed and an enterprise schema for data consumption and reporting.

REI helped transition 14 legacy systems into a containerized and microservices-based architecture. The modern cloud native solutions REI helped implement reduced program workloads, increased staff productivity and application adjudications by 19%, reduced direct mail handling, and decreased paper transactions by 55%, letting DHS move work to locations where staff are available, optimizing workloads, and enabling specialization. Reliability (uptime) also rose significantly—to 99.9%.

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US Department of Health and Human Services (HHS)

HHS helps ensure the safety of consumer products with numerous field offices and laboratories around the country. HHS conducts thousands of product samples annually. The majority of the sample and regulatory analysis data are manually compiled into a cumbersome paper-based report.

HHS was ready to start on its journey to the cloud and incorporate automation for the collection, processing, sharing, and compliance of analysis data to modernize field office operations and information sharing across the agency. HHS looked to help the Microbiology Analyst Program first by piloting a program to create a cloud-native lab system first.

Many of HHS processes are unique, so REI Systems partnered with HHS to develop a completely new and custom cloud-native, web-based application on AWS GovCloud platform. REI System used its **Mindful Modernization approach** of analyzing the problem holistically and then combining business expertise, best-of-bread technologies, and hyper-efficient processes to develop the lab systems.

Before any code was written, REI's Customer Experience (CX) team conducted product research via multiple interviews with what would be the systems' end users and stakeholders to document the product user requirements. The team created user personas, user stories, and storyboards to help the UX designers create the specifications for an easy-to-use and intuitive application.

Once the CX roadmap was produced, REI applied its Agile Delivery Framework to incrementally build the business functionality of the application.

The lab system is a microservice-based application with a dedicated database. The microservices are deployed in docker containers to enable cloud-native capabilities like auto-scaling, managed storage, maintenance overhead, and Infrastructure as Code, with minimal code changes.

A scalable DevSecOps pipeline was stood up to leverage automation and CI/CD capabilities. In the CI/CD pipeline, the team used a blue-green deployment strategy, which reduced the application downtime while doing deployments.

The REI team implemented emerging AI technology via AWS X-Ray. AWS X-Ray collects data about requests that lab system serves and provides tools to view, filter, and gain insights into that data to identify issues and opportunities for optimization.

The lab system is the first full-stack application to be stood up in an AWS GovCloud using containers and other AWS cloud technologies within that particular program. The application helps HHS more rapidly identify risks, respond to public health emergencies, and safeguard consumer products. A system user said, "The ability to generate work packages in a click of a button is great. It took hours before to do this manually."

REI helped stand up a completely new lab application in under eight months. The application is helping HHS increase mission agility, productivity, flexibility, and reduce costs. Because it's been so successful, HHS is planning to build it into a one-stop shop for all sample-related programs.

ABOUT

Government Business Council

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REI Systems provides reliable, effective, and innovative technology solutions that advance federal, state, local, and nonprofit missions. Our technologists and consultants are passionate about solving complex challenges that impact millions of lives. We take a Mindful Modernization® approach in delivering our application modernization, grants management systems, government data analytics, and advisory services. Mindful Modernization is the REI Way of delivering mission impact by aligning our government customers' strategic objectives to measurable outcomes through people, processes, and technology.

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