

APPLICATION MODERNIZATION IN GOVERNMENT

Improving IT Agility and Application TCO

Table of Contents

Introduction	3
How Government Can Innovate in a Rapidly Changing World	3
The Cost of Indecision	6
Getting Started: Three Steps to Application Modernization	6
Ideal Times to Modernize	7
Establishing a Vision	7
Step 1: Retire Legacy Applications and Advance SaaS Adoption	8
Step 2: Extend Existing Applications to the Cloud	8
Step 3: Accelerate Agility and Innovate with Modern Approaches	9
Building a Culture for Application Modernization Success	11

Introduction

Facing increased pressure to contain costs while serving record numbers of people and with growing amounts of data to manage and protect, government IT teams are finding that the legacy applications that have formed the backbone of their enterprise operations are now stalling innovation. To improve mission agility, efficiency, and effectiveness, agencies must modernize and build applications that conform to today's digital society. Cloud-native and software-as-a-service (SaaS) apps, as well as modern development frameworks and agile methodologies are becoming the norm in the private sector. Agencies stand to achieve far-reaching benefits by adopting similar bimodal and iterative approaches to application development and delivery.

The demand for applications, and ways to easily surface and manage the data they accrue (such as from mobile devices), is putting increasing pressure on the underlying infrastructure. As massive scalability, data and analytics, and Internet of Things (IoT) become mainstream, these demands will only increase. Moreover, agencies will find that monolithic legacy applications are not compatible with the growing digital ecosystem of cloud technologies and services providers.

Forward-thinking government IT teams are not waiting until cost and complexity become unbearable. They are embracing agile approaches to application modernization now, and doing the necessary work on the backend (i.e., modernizing infrastructure) to support innovation on-premises and in the cloud.

This whitepaper examines the ways in which government organizations are approaching application modernization to accelerate time to benefit, increase operational efficiencies, deliver superior employee and citizen experiences, and better fulfill their missions. It describes the most popular application modernization strategies and how a robust digital foundation effectively evolves government organizations' IT capabilities, culture, and competencies to achieve greater agility and innovation.

How Government Can Innovate in a Rapidly Changing World

Government is changing quickly and on many levels. From adapting to flat or declining budgets and shifting constituent demographics to increasing the relevance of private sector, every aspect of government must consider cost-effective ways to keep pace with the demands of a digital society.

The mobile-cloud era has put pressure on agencies to modernize to deliver faster while controlling for operational efficiency. Without a modern application delivery strategy, government IT teams could end up hindering their organization's mission fulfillment.

As long as legacy applications power core government services—from eligibility systems and case management to licensing, permitting, and homeland security—they will also continue to add technical debt. Government IT teams recognize that maintaining infrastructure silos is costly. They know that purpose-built applications are cumbersome to modify, and that traditional software development lengthens the delivery cycle. For agency IT leaders, constant demands for improvements to citizen service delivery, user experience, and employee workflows necessitate change. The looming questions, however, are where and how to begin.

Government Teams Rely on Applications

Most government agencies interact with other organizations, whether it's a federal program delivering information to private sector contractors or a library accessing publicly licensed databases. Across the service continuum, applications usually fall into one of these three groups:

- **Core mission-critical apps** – These front-, middle-, and back-office applications, such as for intelligence collection, citizen services, and public information, support the core business processes that provide mission-critical operations. These applications and systems drive day-to-day interactions and serve as the underlying IT platform for new capabilities.
- **Line of business apps** – A wide variety of mobile and desktop apps, including self-service apps available directly to citizens such as for taxpayer IDs or Medicare enrollment, help government IT teams quickly deliver information where it's needed.
- **Supporting business apps** – Ranging from training, scheduling, and HR employee benefits to IT service requests, these utility applications help ensure government employees can work effectively.

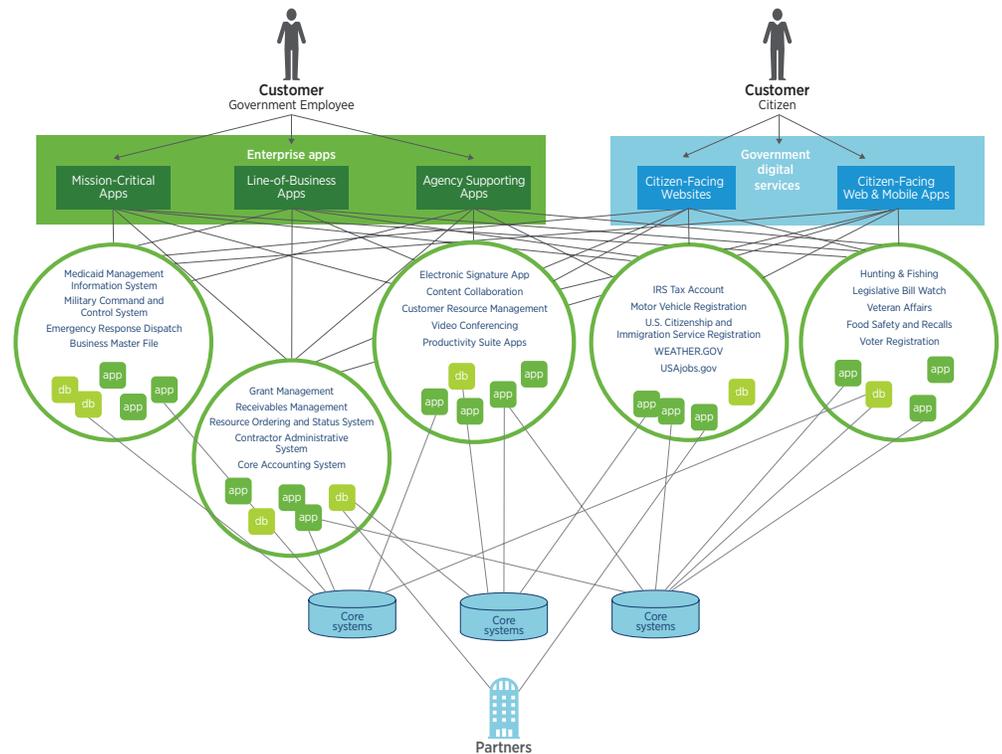


Figure 1. Government agencies consist of a variety of operations—each with specific apps designed to service each part of the organization.

Evolving Development Trends

Government organizations have chosen a variety of paths to acquire the applications running day-to-day operations and services. Many deploy commercial, off-the-shelf (COTS) applications that are now more expensive to maintain than SaaS and cloud-native alternatives.

A decade or more ago, in-house software development was more cost effective than today. Recently, as agencies have begun to rely more often on SaaS providers for software, the investment required to support legacy applications is making less and less sense; the opportunity cost for not having the entire development and operations teams focused on the most strategic new services is rising, and the skills required for the older applications are becoming less relevant. As baby boomers retire, a growing skills gap is challenging IT teams that still need to support legacy applications.

Moreover, every one of these applications must reach into a variety of data stores/data warehouses, creating major IT challenges around access, integration, and security.

Evaluating Workloads for a Modern Strategy

The absence of a single application platform, coupled with the considerable intricacies of core government systems, has historically driven IT leaders to devise their own application modernization strategies. That is no longer necessary. Today, government organizations worldwide are teaming with VMware to evaluate each application workload architecturally to address how it can be modernized securely and cost effectively and integrated into the new world of development and operations (DevOps) and continuous integration/continuous delivery (CI/CD) approaches.

Together, government entities and VMware establish an application-first approach to mission fulfillment, considering cost of delivery, risk, and speed to mission as they assess each workload:

- **Risk** – Is there potential downside to keeping or retiring the app?
- **Value** – Is this app worth the cost of optimizing the infrastructure it runs on, but not changing the app to get better economics (e.g., cloud speed and cloud scale dynamics)?
- **Opportunity** – Is it worth refactoring, replatforming, or rearchitecting this app to increase the speed of delivery or business agility?

The Cost of Indecision

Even indecision carries a price. Throughout the discovery process, government IT teams gain a better understanding of the costs associated with not modernizing their applications, which include:



• Financial Costs (Top- and Bottom-Line)

- Without efficient IT infrastructure, modern app development frameworks, and automated DevOps, IT staff is less productive.
- Retention and talent costs of developers to manage legacy applications is high (e.g., COBOL or Fortran programmers).
- Technical debt per employee or citizen rises when developers are not producing quality software at the fastest possible speed without creating security risks.



• Opportunity Costs

- Highly vulnerable legacy applications introduce a wider attack surface for breaches.
- Legacy applications with outdated user interfaces (UI) hamper application usability and adoption across a wide array of constituent and employee stakeholders.
- Antiquated technologies and processes make recruiting the best talent more difficult.
- The value of connecting the service experience across organizations, such as between courts, prisons, and social welfare organizations, is greatly limited by data silos and legacy applications.
- Citizen experience is compromised due to slower delivery of applications and incremental application features.
- Audits for compliance to local, state, and federal standards and data security are challenging when back-end systems are not seamlessly integrated.
- The inability to advance services with emerging technologies such as artificial intelligence (AI), machine learning, Internet of Things (IoT) sensors, and data analytics hinder innovation in the government sector.

Getting Started: Three Steps to Application Modernization

A primary goal for any application modernization strategy is to ensure that government organizations can run, manage, connect, and secure any app across clouds and devices in a common operating environment. A solid secondary goal is to support new app development while maintaining tie-ins to older applications.

Churning out new apps or adopting SaaS ones can eliminate bottlenecks initially, but the real transformation will come from auditing core business processes and lowering cost of delivery through a cloud-based approach that looks at all aspects of the application lifecycle, from development through deployment and retirement.

Cloud can be a good strategy to quickly accommodate speed-of-delivery requests, but teams will, at some point, have to solve foundational challenges related to interoperability between modern apps and back-end infrastructure.

APPLICATION MODERNIZATION APPROACHES:

- Retire legacy applications and advance SaaS adoption
- Extend existing applications with modern, front-end UI and back-end cloud delivery
- Application repackaging, replatforming, and refactoring
- Greenfield cloud-native app development

Ideal Times to Modernize

The best time to begin an application modernization effort will depend on the goals of the individual government agency. Plans to consolidate the enterprise application portfolio, refocus on mission-critical capabilities, or empower employees with the digital workspace are good opportunities to consider application modernization. These cycles are natural inflection points because they address most of the issues application modernization can fix, such as high TCO, data silos, slow delivery times, and impacted citizen experiences.

Case Study: California Natural Resources Agency

The California Natural Resources Agency (CNRA) faced a host of IT service delivery challenges created by operational silos and fragmented IT teams across 33 departments. Seeking improvement, CNRA began a journey to modernize infrastructure and unify IT operations. The agency leveraged the VMware Software-Defined Data Center (SDDC) to consolidate 24 data centers into one. Next, the agency deployed a private cloud to accelerate app delivery, using VMware NSX® to micro-segment mission-critical apps and VMware vRealize® Automation™ to automate network management. As a result, CNRA became a far more agile service provider, enabling the agency to reduce overall capital and operating costs by 30 percent, increase capacity by 300 percent, and shrink its physical footprint by more than 60 percent.

Establishing a Vision

As with any journey, government agencies partner with VMware to develop a vision and solutions architecture for success. With specific goals in place, IT can audit existing infrastructure and discover key capability gaps needed to achieve goals. For example, government IT teams can begin to catalog the following:

- Application classification and taxonomy
- Application mappings for existing applications and dependencies
- Descriptions of internal application architectures

Based on that information, agency IT organizations can begin to calculate the TCO of each application, which must take into account everything from the application development costs to the cost of the infrastructure required to deliver the application. Only then can IT make well-informed decisions about application portfolios, including how they can best be transformed (e.g., migrated, retired, etc.) and what additional capabilities and competencies (including people and processes) will need to be implemented to facilitate the desired change.

Step 1: Retire Legacy Applications and Advance SaaS Adoption

New citizen and employee demands require government IT teams to provide instant service delivery in a world of constant change. Yet even as IT teams are reimagining how each application could be more efficiently delivered and managed, they must not forget to evaluate the ultimate option: application retirement.

Some applications have simply outlived their usefulness and a relatively simple decision can be made to slowly phase them out until they no longer have users accessing them. Others must be retired because agency or resource constraints necessitate it (such as an application that must be maintained using a dated language, perhaps COBOL, Visual Basic, or one of the older C languages, that the current generation of developers no longer uses). A key benefit of SaaS apps is the speed of delivery of new services and ubiquitous availability across form factors and locations. For most government teams, the retirement of legacy applications coupled with migration to SaaS lowers application TCO.

Step 2: Extend Existing Applications to the Cloud

To put application modernization initiatives on “fast-forward,” modern government IT teams are extending on-premises data center capabilities to a cloud-based platform as a service (PaaS) like Amazon Web Services or Microsoft Azure to speed provisioning to application developers. This helps in-house developers assemble an application from ready-made software packages, including open source, to rapidly develop and deploy new apps without complex conversions or the need for re-architecting.

Even conservative departments are adopting cloud infrastructure and cloud service models to address demands of their constituents, both internal and external, for modern form factors, such as tablets. One of the key advantages in a cloud-based strategy is the ability to automate the deployment of new services, even microservices, against the policies IT puts in place for that app. Cloud also excels at lowering cost of infrastructure to ensure that capacity can expand and contract on demand. This increases the operational efficiency government organizations are continuously striving for because they never overprovision or overpay for capacity they don't use.

In some cases, public cloud hinders speed to delivery of new services because the application still needs to call back to internal, core legacy systems. This slows teams' ability to quickly adapt to new laws, administrations, or changes in the service continuum. Many government organizations find a hybrid cloud model enables the enterprise to modernize incrementally where it's most needed and at the lowest possible cost.

RUNNING MODERN APPS IS SIMPLER WITH VMWARE

- Deploy and consume container services with production-grade Kubernetes
- Boost developer productivity with open APIs
- Run containerized apps alongside existing workloads
- Quickly build and deploy apps

Additional examples where hybrid cloud empowers government IT to deliver more efficient service and drive down the costs of applications, include:

- **Developer dev and test environments** – Transitioning IT development and testing to hybrid cloud saves time and money because modern, secure environments can be quickly provisioned and de-provisioned from the cloud with agencies paying only when systems are in use.
- **Legacy data archival** – Government organizations can more easily and cost effectively maintain data with cloud-based storage and archival. Agencies can archive databases or complete applications using a hybrid cloud repository that links current information to data from legacy systems for increased scalability.
- **Backup and recovery** – Agency IT teams using hybrid clouds can avoid expensive second-site infrastructure investments for continuity of operations (COOP) planning and use existing staff skill sets to manage familiar on-premises and off-premises tools and infrastructure for COOP as well as the full application portfolio.

Step 3: Accelerate Agility and Innovate with Modern Approaches

When agencies embrace comprehensive application modernization, they are better positioned to address delivery demands. Container (e.g., Kubernetes, Docker, etc.) and microservices architectures built on agile principles speed software development and delivery. The former offers a simpler way to achieve deployment and execution consistency while helping to improve DevOps team handoffs, while the latter helps ensure a way to deliver scalable software faster as well as API management technologies and CI/CD platforms.

On top of a modern infrastructure foundation, government IT organizations can efficiently and cost effectively modernize their applications—choosing the right approach for each app—to accelerate agility and innovation.

Application Repackaging

When government IT teams choose to repackage applications (or app components) into containers, they can gain significant operational benefits. Through the use of containers, teams deploy services faster with less staff and eliminate many of the manual steps required by traditional application development methods. The results include simpler upgrades, increased portability through the production cycle, and better patch management. Compliance is also easier as teams can rebuild images in containers via clear traceability with immutable images, supporting improved CI/CD integration.

Agency IT teams using a container strategy to repackage applications improve operational efficiency without any of the usual roadblocks, as application blueprinting avoids the need to develop a new app framework. A derivative of application repackaging, ISV-delivered apps that come pre-packaged in containers also simplify app deployment. Application repackaging powered by software-defined infrastructure, integrated containers, and network micro-segmentation are a proven path to speed app delivery while improving an enterprise's security posture. Application repackaging based on a virtualization foundation saves time and money by leveraging the tools and skill sets of existing IT staff.

VMware helps IT teams interested in repackaging applications by providing a critical enterprise container infrastructure for IT Ops to run both traditional and containerized apps side-by-side on a common platform. [VMware vSphere® Integrated Containers](#), supporting containers in their virtualized environments, provides a number of benefits: IT teams get the security, isolation and management of virtual machines (VMs), while developers enjoy the speed and agility of containers—all within vSphere.

Application Replatforming

When agency IT teams choose to replatform applications, they take an existing application, containerize it and move it to a new container framework such as Kubernetes. Replatforming can provide consolidation benefits, helping teams to modernize traditional applications and run them on the same container framework as true cloud-native apps. With replatforming, container-based solutions ensure inheritance, not duplication, and also provide organizations with an opportunity to enhance security.

In partnership, VMware, Pivotal, and Google Cloud jointly developed [Pivotal Container Service \(PKS\)](#), a production-ready container solution augmenting the orchestration capabilities of Kubernetes with technology and support from Pivotal and VMware to provide essential day-1 and day-2 operational capabilities. PKS provides a simple way for developers to provision scalable, reliable containers without the overhead of configuring their own Kubernetes clusters or underlying infrastructure. It includes deep integration with VMware NSX for connectivity and security and the Harbor registry for container image management.

Application Refactoring

When government IT chooses to refactor applications, they typically re-architect all or part of a monolithic application using cloud-native principles to produce a distributed, microservices-based, stateless app. Refactoring, or recoding, large monoliths provides benefits such as better scalability and availability, yet is generally resource-intensive. As a result, many organizations choose to incrementally refactor monolithic applications by deploying microservices for new functionality and converting existing modules into microservices over time.

VMware supports agency refactoring journeys with solutions such as NSX that are compatible with [Pivotal Cloud Foundry \(PCF\)](#), a full-stack, cloud-native platform for deploying and operating cloud-native apps. Operating at a higher level of abstraction than a container orchestrator, PCF is ideal for enterprises interested in exchanging developer infrastructure awareness for speed and agility. PCF automates CI/CD deployment, containerization, networking, operating system images, and more, so developers avoid spending time on low-value tasks.

Case Study: SAIC

Science Applications International Corporation (SAIC) is a premier technology integrator, providing full lifecycle services, solutions, and support to Federal government customers. SAIC sought a secure cloud solution that supported infrastructure as a service, easy workload migration between private and public clouds, and integration with customers' existing infrastructures, helping to speed delivery of new apps and services. SAIC leveraged VMware's hybrid cloud architecture to migrate workloads across clouds and automate network administration with minimal IT effort—saving time and reducing errors. SAIC is now able to efficiently, securely, and cost-effectively deploy applications and services across data centers, clouds, and mobile devices on- and off-premises.

Greenfield Cloud-Native App Development

When government IT teams need to deliver new functionality fast, many are turning to cloud-native apps. These apps, architected and developed as cloud-native from the start, are designed for high availability and scalability. As in app refactoring, cloud-native apps are distributed, microservices-based, stateless, and highly orchestrated.

With [Developer-Ready Infrastructure](#) from VMware and Pivotal, agency IT can quickly build and deploy apps. The solution delivers a robust set of capabilities that accelerate next-gen software development and delivery to drive innovation. Together, PCF and VMware virtualization provide a layer of abstraction that boosts developer productivity, so they have more time for the high-value tasks that drive innovation.

Building a Culture for Application Modernization Success

Digital government requires a digital foundation. Successful government application modernization initiatives require support from the highest levels of an organization. The most successful initiatives also involve those on the front lines of service delivery—such as clerks, police, fire fighters, dispatch, customer service personnel, and even warfighters and citizens.

The accelerating pace of modern society, including rapid expansion of how and where people are accessing information, requires departments within government organizations to work together to optimize operations while reducing costs. Those serving government employees and citizens may want a greenfield approach for application modernization while IT needs a holding place for migrating legacy applications. Instead of application and infrastructure teams looking at multiple vendors and approaches to solve similar problems, the most successful organizations are choosing one, software-defined approach to compute, storage, and networking that support CI/CD models with security that is architected in rather than added later.

For many government IT teams, application modernization is a natural extension of business continuity and disaster recovery (BC/DR) planning. These capabilities, which must be refreshed regularly to comply with regulations and protect personal information, provide an opportunity for internal teams to take a leading role in understanding how applications can be modernized. With the help of [VMware Accelerate Advisory Services](#), government can achieve business and application modernization objectives.

Teaming with VMware accelerates application modernization using technologies designed to drive agility and innovation. VMware solutions for compute, cloud, mobility, networking and security software form a dynamic, consistent digital foundation to deliver the applications that power innovation. VMware streamlines the journey to digital government by unlocking value from technology investments made today and in the future.

Government organizations interested in establishing or progressing application modernization strategies can learn more at <http://www.vmware.com/go/government>.



VMware, Inc. 3401 Hillview Avenue Palo Alto CA 94304 USA Tel 877-486-9273 Fax 650-427-5001 www.vmware.com

Copyright © 2018 VMware, Inc. All rights reserved. This product is protected by U.S. and international copyright and intellectual property laws. VMware products are covered by one or more patents listed at <http://www.vmware.com/go/patents>. VMware is a registered trademark or trademark of VMware, Inc. and its subsidiaries in the United States and other jurisdictions. All other marks and names mentioned herein may be trademarks of their respective companies. Item No: VMW-WP-APP-MODERNIZATION-GOV-USLET-106