Revitalizing Government: Legacy Application and System Modernization

Empowering critical and citizen-centric services through modernization

Introduction

Government agencies around the world are facing mounting pressure to modernize their IT infrastructure. Legacy systems such as mainframes have long been the backbone of many government agencies, but with aging technology, increased citizen-centric services demand, and rising costs, the time for change is now.

In this guide, we will discuss the main advantages and challenges of modernizing legacy systems such as mainframes in government ecosystems. We'll explore different approaches to modernization and provide expert tips on modernizing legacy systems.

The State of Public Sector IT

IT leaders often grapple with [uncertainties and challenges](#) that can cause sleepless nights, particularly when it comes to complying with ever-changing compliance and legislative standards. To effectively address these concerns and remain competitive, IT leaders must prioritize modernization efforts. However, legacy modernization entails more than just technological updates; it encompasses a comprehensive transformation involving infrastructure, design, operations, personnel, processes, and governance. By identifying the motivations and goals that drive the need for modernization, IT leaders can focus their efforts on and align technical objectives with broader business goals.

As citizen expectations for exceptional digital experiences continue to rise, the limitations of existing legacy applications, which were not originally designed for digital-first interactions, become more apparent. With significant technology debt, government agencies recognize the need to modernize many of their business critical applications to support broader public service objectives.

[The priorities for state government leadership](#) in 2023 encompass strengthening cybersecurity measures, adopting government off-the-shelf (GOTS) solutions, cultivating a modern IT and security workforce and undertaking the transformation of digital services to empower and serve citizens more effectively.

> **39% of government IT leaders** cite understanding organizational impact as a key challenge for successful modernization.
> [Mainframe Modernization Report, 2022](#)

The Six Common Modernization Catalysts in Government

Mainframes have been the backbone of countless government agencies' IT infrastructures for decades, but with the efficiencies and speed of innovation enabled by advancements in cloud technology, a shrinking legacy-capable workforce, and rising operational costs and technical debt, it is crucial for governments to prioritize modernization.

> Government IT leaders say that they would on average reinvest **30-40%** of their budgets if modernizing one legacy system.
> [Mainframe Modernization Report, 2022](#)

1. Reduced Costs

While cost-savings is not the only benefit of mainframe modernization, it is undoubtedly an essential factor. Government agencies that modernize their mainframes stand to reap significant cost savings. New technology tends to be less expensive to maintain overall, boasts a large and capable market of talent, and tends to be more energy efficient. Modern cloud infrastructure and virtualization technology is capable of handling high-performance workloads, reducing the need for additional hardware, thus reducing related expenses.

> **$35m** is the average spend on mainframes by government (with consumption costs rated as the highest).
> [Mainframe Modernization Report, 2022](#)

2. Improved Efficiency

Modernizing legacy systems such as mainframes increases the efficiency of government agencies by enabling technology-powered and streamlined processes in operational areas previously deemed inaccessible by innovation. In many instances, the power of innovative abstractions in the cloud such as horizontal elasticity, infrastructure as code (IaC), and containerization can turbocharge DevOps effectiveness post-modernization. Agencies can achieve further efficiencies by consolidating technologies and removing technical debt from legacy systems and infrastructure as well.

"A wide range of efficiencies have emerged from this work, contributing to ongoing technology development, the improvement of business practices, a more streamlined government, and a more informed public."

Bill Kehoe, Chief Information Officer, King County Washington

3. Greater Usability

Legacy systems bring a heritage of operational context which is often paired with outdated user experiences that can be highly constrained and difficult to adopt for digital natives. While many whose early careers were marked with the advent of the computer in the workplace and the adoption of green screens find these user interfaces to be intuitive, the majority of the modern workforce lacks the technical history to easily navigate the UIs of yesteryear.

4. Increased Security

Legacy systems are particularly susceptible to security risks. These risks vary widely depending on environment, with end-of-life or end-of-support systems running unpatchable software on one end of the spectrum, and mainframes which present an unsustainable burden of security maintenance in the form of growing attack surfaces or a lack of capable resources on the other. As the sophistication of cybersecurity grows, government agencies must do everything possible to protect sensitive information. While modern mainframe technology provides improved and supported security features like advanced encryption technologies, real-time monitoring, and threat detection, many related legacy systems do not have the foundation of support necessary to remain secure. Although modernization techniques and security postures can vary widely, it is important to assess risks and plan accordingly based on your goals and circumstances.

> **Security and high software license costs** are the primary drivers for governments to modernize. Mainframe Modernization Report, 2022

5. Integration with Cloud Technology

Modernization in the form of integration enablement between cloud technologies and mainframes has been game changing. The combination of the two allows for more efficient data processing. Governments can leverage cloud technology to safely store backups of sensitive data from the mainframe or provide flexibility for remote workers and infrastructure that was simply not possible to accommodate a short time ago. Cloud technology enables the automation of tasks, allowing teams to focus on more challenging projects that drive innovation, and it can live in harmony with mainframes in modern IT environments.

> **34% of government IT leaders** say the most attractive cloud features are scalability and managed cloud solutions.
> Mainframe Modernization Report, 2022

6. Improved Customer Service

Mainframe modernization holds the potential to significantly improve government customer service by enhancing efficiency, responsiveness, and user experience. Through modernization efforts, legacy mainframes can be transformed into more agile, user-friendly platforms that align with the expectations of today's tech-savvy citizens.

Integration with modern technologies and platforms enables the implementation of self-service portals, mobile applications, and online transaction capabilities, empowering citizens to conveniently interact with government services anytime, anywhere.

"Mainframe modernization has undoubtedly enhanced the customer experience. Also, it made it possible to offer additional digital services and support by making it easier to access operational data. Modernization will ease administrative burdens while promoting improved compliance."

Enterprise Architect, U.S. Federal Government

Six Common Modernization Challenges Governments Face

Modernization of government agency mainframes is a complex process, and it's important to understand the challenges and potential risks involved. By employing that assistance of experienced modernization experts to aid in addressing and monitoring these challenges, government agencies can implement modernization initiatives that are more efficient, cost-effective, and ultimately, provide better services to the public.

1. Lack of funding

Insufficient funding presents a major challenge for stakeholders in government agencies seeking legacy modernization endeavors. Transforming critical systems requires adequate financial resources and a well-defined path to realize a return on investment (ROI) in an acceptable timeframe. While it can be difficult to allocate these funds due to budget limitations and competing priorities, charting a clear path to ROI should be prioritized in the fundraising endeavor to ensure key stakeholders understand the risk vs. reward of the initiative. Fortunately, new legislation, such as the American Rescue Plan Act and the Infrastructure Investment and Jobs Act has increased funding opportunities for leaders in municipalities everywhere to invest in modernizing their IT infrastructure.

2. Legacy systems complexity

One of the challenges associated with modernization is the legacy system's complexity. In many instances, government agencies' mainframes have been in operation for decades and have become highly customized to the agencies' business processes. Over time, these systems become entangled and intertwined with various subsystems, making it challenging to migrate to modern platforms. The system's age also makes it difficult for the agencies to find programmers with relevant experience in the legacy domain. It is important to prioritize a comprehensive assessment with an experienced modernization team using proven tools to ensure a complete picture of complexity prior to engaging in a modernization endeavor.

3. Integration of new and legacy systems

Ancillary systems integration during mainframe modernization is a crucial consideration in the process. Data must be extracted from legacy systems and delivered to new platforms either through middleware or direct connections, while downstream systems which rely on the mainframe require remediation planning to ensure they can operate seamlessly as modernization phases unfold. These can be highly complex undertakings, and agencies need experts skilled in migration techniques to reduce risk and ensure success.

4. Skilled resource scarcity

Modernizing a legacy system requires skilled resources with expertise in the existing applications and languages specific to ensure a smooth migration. The demand for these limited resources can result in a high cost of recruiting or delay in the modernization effort.

> "In my opinion, finding the correct people in this mainframe modernization process will be the biggest challenge that I can clearly see. Finding the ideal employee with both mainframe and cloudification expertise is quite difficult."
>
> **Enterprise Architect, U.S. Federal Government**

5. Resistance to change

It's not always easy to convince stakeholders to take the plunge to modernize legacy systems. Despite its importance, mainframe modernization can be met with resistance for a variety of reasons, from lack of resources to fear of change.

> **53%** of government IT leaders say a lack of understanding of why moving to the cloud is better is the key reason for failing to get funding for modernization projects.
> Mainframe Modernization Report, 2022

6. Vendor dependency

Mainframe modernization can be complicated by vendor lock-in and dependency, from hardware to licensing and everything in between. Government agencies should leverage the insight of experienced modernization experts when assessing vendor dependencies and their effect on potential routes to transformation.

The Modernization Process

Legacy modernization is a complex undertaking that involves far more than dropping code into conversion tools and compiling it. It is important to understand the source environment, determine potential challenges and how to overcome them prior to transformation, iteratively test the results, and tune the tooling to adjust for any challenges that may arise during the modernization process. Harnessing a powerful combination of proprietary software and an iterative transformation methodology, our solutions follow this proven process to ensure success:

Step 1: Discovery

We begin every modernization initiative with a discovery, free of charge. Our modernization experts work with you to understand and document your business and technical goals and objectives. Together, we gather information about the mainframe estate. Everything from infrastructure to language and database types and quantities is accounted for. The discovery concludes with a workshop where we recommend optimal modernization approaches based on information gathered, as well as rough order of magnitude (ROM) pricing, and estimated project durations and resource requirements.

Step 2: Assess and Design

The assess and design phase is performed using our [automated tools](#) to fully catalog and develop a complete understanding of the components of a mainframe environment. It exposes mainframe artifacts that government agencies did not know they had, relationships they did not realize existed, and assets that are no longer in use. Assess and design activities provide stakeholders with valuable insight to inform application modernization decisions such as disposition strategies and target environment architectures, as well as mitigating cost and risk by highlighting potential challenges and suggesting ways to overcome them. At the conclusion of the assess and design phase, all in-scope artifacts are accounted for, a detailed project plan is established, and the transformation process begins.

> Our customers save an average of **50-70%** in annual costs post modernization.

Step 3: Transform

The transform phase depends on the disposition strategy (or strategies) you've chosen. In a [refactoring](#) project, it includes the database and data modernization as well as build-out of the target operating environment. During transform, we refactor pre-defined work packets, perform functional tests, and deliver them into the DevOps pipeline. While customer teams build, test, and deploy these work packets in the target environment, we refactor the next work packet, iterating until the entire mainframe estate has been transformed. In a rehosting endeavour, emulation software is deployed, the data and databases are transformed, and we perform any necessary refactoring (such as application consolidation activities) in pre-defined work packets. We also perform functional tests and deliver the work packets into the DevOps pipeline.

Step 4: Test & Deploy

The test and deploy phase start with the receipt of work packets through the DevOps toolchain as they are delivered from iterative refactoring activities in the transform phase. If issues arise, the work packet is passed back to us where we review the code, adjust our tooling, reprocess the work packet, and send it back into the DevOps pipeline to resume testing and deployment. This process repeats until the entire modernized estate has been deployed. Our Automated Testing solution speeds this process significantly.
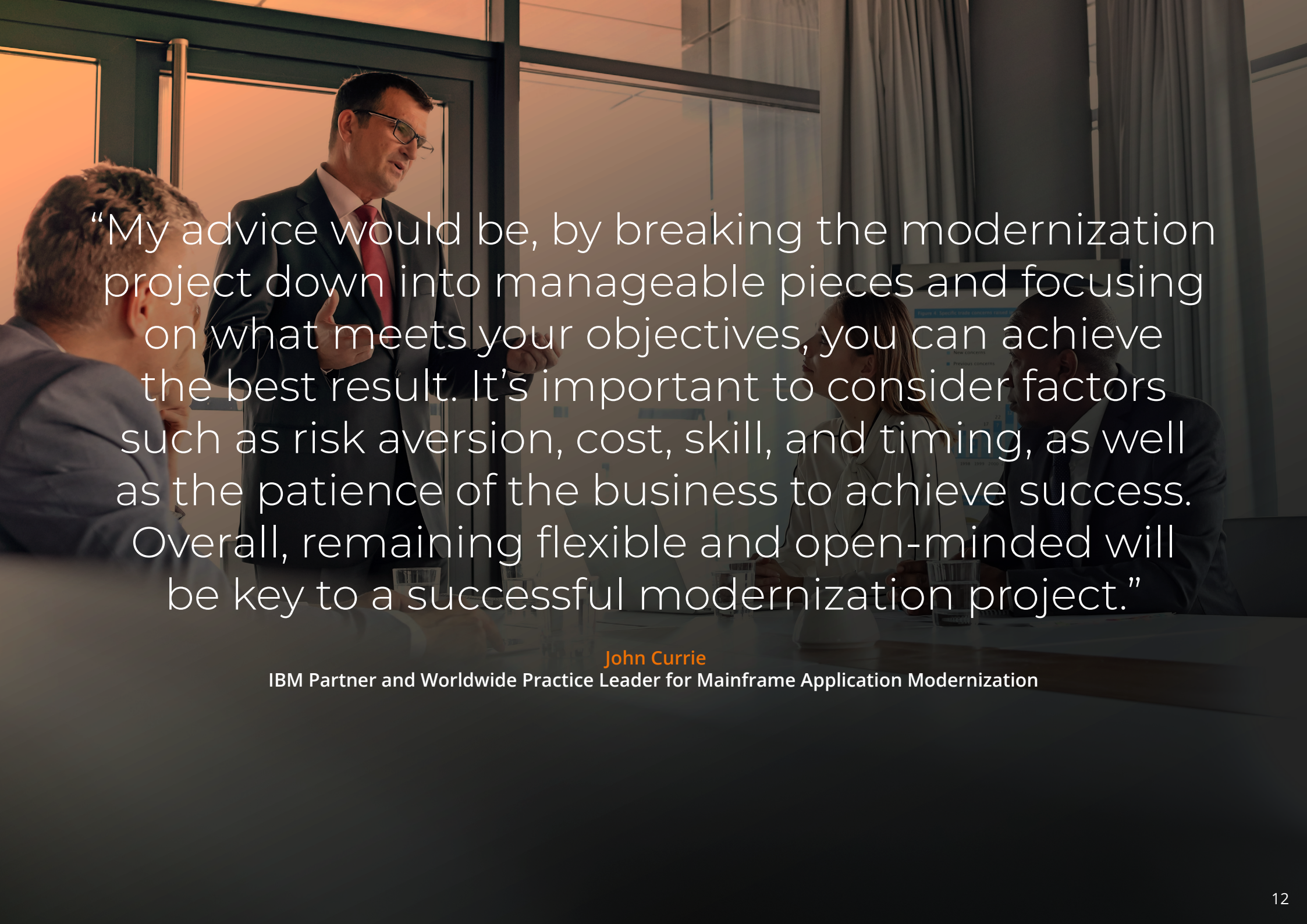
Prior to go-live, we refresh the target ecosystem by transforming a final snapshot of the mainframe environment to account for changes that have taken place throughout the modernization project as part of normal business operations. Fortunately, since all adjustments and optimizations have been made to the automated tools and not the modernized code, this final refresh can be delivered into production over a weekend, eliminating code freezes.

Step 5: Support

We work closely with your team to ensure a smooth transition into production. Part of this transition includes the cooperative construction and testing of a go-live production cutover plan to reduce the potential risks associated with application deployments. We also provide on-demand assistance during the warranty period following production deployment, as well as appropriate rehosting platform support, and post-transformation support of the modernized applications.

> **TIP:** When comparing partners make sure you're assessing like for like. For example, Advanced includes data migration in our project scope and pricing - offering a turnkey solution from start to finish whereas many others do not, leaving the customer to migrate their data, then deploy and fix any target state problems themselves.

"My advice would be, by breaking the modernization project down into manageable pieces and focusing on what meets your objectives, you can achieve the best result. It's important to consider factors such as risk aversion, cost, skill, and timing, as well as the patience of the business to achieve success. Overall, remaining flexible and open-minded will be key to a successful modernization project."

John Currie
IBM Partner and Worldwide Practice Leader for Mainframe Application Modernization

Common Approaches to Legacy Modernization

There are a multitude of modernization disposition strategies (i.e. approaches, or patterns) to choose from when seeking to transform legacy workloads. For governments looking to modernize, the ideal approach (or combination of approaches) will depend on a variety of factors, such as target technology stack, budget, timeframe, available skills and resources, and the future direction of the agency.

Our 2022 Mainframe Modernization Report reveals that government agencies express a preference for the **Rehost** or **Refactor** approach. Let's delve into these strategies in more detail.

> "We are using rehosting as this approach offers little or no modification to the existing applications. This approach has delivered a quick and convenient cloud migration solution based on our needs. Rehosting has reduced our cost of migration program, and the cost of running the programs is also comparatively low."
>
> **Senior Project Manager, U.S. State Government**

Rehost

Rehosting, sometimes referred to as replatforming, is ideal for governments that want to retain their legacy application code as-is while moving away from legacy infrastructure.

In a rehosting project, the application code is shifted into an emulation environment (a proprietary piece of software) where it can run on modern infrastructure in private data centers or the cloud without change. Once rehosted, the application code interacts with the database through emulation software.

Although this approach eliminates the mainframe, rehosting projects often take as long as alternative modernization initiatives such as refactoring, and after completion agencies remain constrained by their original legacy application code (or a version of it) running in a vendor-specific emulation environment, which can carry licensing costs that should be considered.

Refactor

Refactoring, a key aspect of mainframe modernization, involves restructuring the existing codebase without altering its external behavior to make it more maintainable, scalable, and compatible with contemporary platforms. This process culminates in the automated transformation of legacy code bases into modern languages such as Java and C#.

It also includes the automated transformation and migration of legacy databases to the target environment. The goal of refactoring is to achieve 100 percent like-for-like functionality as compared to the legacy system. The refactored applications and databases are deployed to the Cloud or in open systems on premises, allowing you to retire the mainframe.

Breadth of service (turnkey solutions vs. do-it yourself tooling) is an important consideration when looking at this disposition strategy.

"Advanced worked closely with our teams from the inception of the project through the sizing and planning to the delivery. The project has been completed within timescale and budget and this enables us to move onto the next stage of our IT strategy."

David Loughenbury, CIO, Police Mutual Assurance Society, UK

Expert insights:
Key tips for modernizing legacy systems

When embarking on the modernization of mainframe systems and applications, here are some tips to guide governments:

Successful application modernization requires a strategic approach and careful planning to avoid potential pitfalls.

Understanding the current state of the organization, including the application portfolio and workforce, is essential for successful modernization.

Seeking the support of experienced modernization partners can alleviate fears and increase the chances of successful application modernization.

Agencies should prioritize enhancing both the network infrastructure and user experience simultaneously. It is crucial to embrace the concept of a hybrid environment, acknowledging that a complete transition to the cloud may not be immediately feasible.

To support modernization initiatives, agencies must allocate resources towards training and development programs, ensuring that their workforce possesses the essential skill sets required.

Successful modernization initiatives should strike a balance between preserving current systems, enhancing their capabilities, transitioning them to contemporary platforms or architectures, and potentially replacing them with innovative alternatives.

Application modernization should be executed in overlapping phases to add value without interrupting operations, and security should be a priority throughout the process.

By centralizing data access, leveraging automation, and deploying richer digital offerings, state agencies can reduce non-value-added work and enable employees to focus on decision-making and high-level duties.

Successful Legacy Modernization Projects in Government

U.S. Department of Energy eliminated mainframe processing in five months

The Savannah River Operations Office in South Carolina, a part of the U.S. Department of Energy, manages nuclear weapons material disposal and environmental management. One crucial aspect of their security protocols is the visitor tracking system. However, when the mainframe maintenance contract for hosting the system was not renewed by the Federal government, the security and IT departments were left with the task of finding an alternative solution to maintain facility security.

U.S. Virgin Islands Department of Justice achieved significant cost reductions by eliminating software licensing fees

Charlotte Amalie, St. Thomas, is home to the Paternity and Child Support Division (PCSD) of the Virgin Islands Department of Justice. PCSD's Child Support Territorial Reporting System (CSTARS), an application written in Software AG's Natural and supported by an Adabas database faced high licensing and operational costs, and a shrinking talent pool of resources capable of maintaining Natural and Adabas. As a result, they sought to modernize CSTARS.

U.K. Department of Work and Pensions modernized its legacy systems to safeguard and improve services

The UK's Department for Work and Pensions, the largest government department, undertook a major modernization initiative. They migrated their application estate, including systems for key benefits, from the outdated VME mainframe platform to a modern, open systems platform. This automated refactoring and rehosting approach aimed to enhance and secure the systems handling welfare payments.

Conclusion

Modernizing legacy systems such as mainframes is critical for government agencies to provide quality services to their citizens, reduce and minimize costs, and embrace innovation. The benefits are numerous, ranging from improved efficiency and greater usability to increased security and reduced costs. By choosing to modernize, government agencies can ensure that they remain up to date with the latest technologies, stay ahead of the curve, and continue to deliver the best possible services to the public.

> "The modernized system provides the Department for Work and Pensions and its citizens with a faster and more responsive service with improved resilience and scalability."
>
> **Mark Bell, VME-R Deputy Director,**
> **The Department for Work and Pensions**

About Advanced

Advanced is a leading international provider of application modernization services, with unique expertise in the legacy modernization market.

With more than 600 modernization projects completed worldwide, and 3 billion lines of code processed through our solutions, we have been driving IT efficiency, agility, and competitive advantage for customers through core application and database transformations for over 40 years.

Over that time, we have helped organizations across all sectors including the UK's Department for Work and Pensions, FedEx, and The New York Times.

Aadvanced

Ready to take the next step?

No matter what kind of modernization plans you're considering, Advanced can help you meet your objectives and drastically reduce project risk by harnessing the power of unmatched modernization expertise and powerful proprietary tools. Read our most frequently asked questions.