



WHITE PAPER

NOW IS THE TIME: MOVE YOUR MAINFRAME TO THE CLOUD

How Candid helps
enterprises migrate mainframe
systems to Amazon Web Services

CANDID

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Advanced
Consulting
Partner

Public Sector Partner

Migration Competency

DevOps Competency

1 WHY NOW IS THE TIME TO MOVE YOUR MAINFRAME TO THE CLOUD

Why Migrate?

Many enterprises do not fully realize the savings and the flexibility that can be gained by migrating mainframe systems to cloud platforms. Some are simply hesitant to undertake a large-scale project that involves legacy systems.

But in fact, organizations that move applications from mainframes to the cloud have reduced their capital and operating costs by 70% to 90%. These savings are powered by today's hyperscaler cloud providers, who offer enormous cost reductions based on massive economies of scale, leading-edge technologies, and intense competitive pressure in their industry.

Enterprises also increase their flexibility and responsiveness to business needs by modernizing their software through cloud architectures and tools. They are able to enhance applications in less time, with fewer resources, and implement best practices in areas such as Agile software development and DevOps support models.



For those organizations under pressure to consolidate data centers and simplify operations, moving mainframe environments to the cloud enables IT groups to close or shrink data centers and manage operations with fewer, more modern, tools. The cloud providers take over most of the burden of managing and updating hardware and software.

The tools and practices for mainframe-to-cloud migrations have progressed to the point where such moves are very manageable. Drawing upon a pool of knowledge from projects in the recent past, organizations can now minimize the risk of these migrations.

Why Migrate Now?

The balance of risk has shifted. Today, it can be riskier not to move than to move. In many mainframe environments, IT organizations may no longer know how systems are used, exactly what applications do, or even where source code is stored. As key personnel retire, their expertise becomes unavailable at any price. Even small changes to the mainframe environment can result in problems that take days or weeks to troubleshoot and fix. Technical debt prevents enterprises from innovating, causing them to miss opportunities to increase revenues and reduce costs.

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In addition, cloud environments like Amazon Web Services (AWS) are now mature and fully capable of supporting large mission-critical applications with high performance, scalability, and reliability. AWS customers include many of the world's largest organizations in finance, technology, manufacturing, media, and government.¹

Finally, migrations have become easier and more reliable. New tools are capable of handling large-scale code migrations from mainframes to x86 environments on cloud platforms. These migration products are intelligent enough to automate transformations from small increments to millions of lines of code.

Candid Can Expedite the Migration

Specialist services organizations have emerged with methodologies to help plan and manage mainframe-to-cloud migrations, including seamless integration with AWS tools and technologies. These firms have the skills and experience to select and operate tools that can analyze and migrate millions of lines of mainframe code. They have the project management expertise to marshal the right resources and track the progress of large-scale migrations. They also have in-depth knowledge of how to design cloud architectures that match, and often exceed, the performance, reliability, and scalability of mainframe environments.

Selecting the right services partners can make migrations faster and less risky, and produce more cost-effective and flexible cloud environments in the end.

Whether you work with partners or go it alone, this white paper outlines strategies that will help you perform a successful mainframe-to-cloud migration, and some of the pitfalls you should avoid.

2 PREPARE FOR THE MIGRATION

Program Management and Project Structure

All large-scale migrations depend on strong project management. That includes establishing policies and procedures for project oversight and planning, defining leadership roles, developing change management and problem escalation procedures, and determining responsibilities for budgeting and license tracking.

Mainframe applications affect critical business processes across the enterprise. For that reason, it is particularly important that the core migration project team not be limited to IT operations professionals and application developers. It should include executives and business stakeholders who understand the business processes that the mainframe applications support, and architects and application support staff who have the “tribal knowledge” about how the current environment works.

Mainframe environments have often been compared to bowls of spaghetti with hundreds of intertwined strands. It is critical to delineate the roles and responsibilities of the teams that will be charged with untangling these strands, to set up processes that make dependencies between the teams visible, and to ensure that the teams will communicate frequently with each other.

Application Discovery and Analysis

Mainframe environments often contain batch processes and applications that are important but poorly understood, as well as code modules that are rarely or never used. To ensure that nothing important is left out of

the transition to the cloud, the migration team needs to discover source code for all applications in use. This involves:

- Combing through code repositories and other data stores to discover as much source code as possible
- Documenting all types of processes, including batch processes, transactional processes, and operational processes such as backups
- Mapping application dependencies
- Identifying all integration points with external services and applications
- Extracting usage information related to CPUs, storage, and networks that can be used to estimate requirements for cloud resources

This information is critical for designing the target environment on the cloud platform and planning the migration.

Migration Approach and Methodology

To prevent mistakes and wasted effort down the road, the organization should think through its migration approach before starting engineering work and code conversion.

A “replatform” approach involves recompiling COBOL and other mainframe code onto the cloud environment and running it there on an emulator. This approach minimizes risk and reduces costs. On the other hand, it does not take advantage of the maintainability or flexibility of the cloud platform. A replatform approach is an economical option if the enterprise wants the mainframe to “keep doing what it does” and doesn’t anticipate the need for many enhancements.

Successful projects invest considerable time and effort in evaluating the right tools.

Another option is to modernize the applications. With this approach, design focuses on converting raw data access into interfaces that allow applications to run using highly robust cloud-native services. Rearchitecting mainframe applications to take advantage of cloud-native services enables organizations to significantly improve their data platform, and provides opportunities to enhance applications with new capabilities that provide market differentiation. Modernization requires more time and work up front, but can be far more economical in the long run if the applications are going to be enhanced and scaled.

To avoid unnecessary work during the migration, the organization can rationalize its software mix. Applications that aren't providing much benefit can be retired, or replaced with packaged applications.

To generate some early wins for the project and to reduce risk, the migration team should also:

- Prioritize applications based on factors such as business value, application complexity, cost, and performance.
- Decide the sequence in which resources and applications will be migrated (for example starting with databases and files, proceeding to key batch processes, followed by important online applications, and ending with lower-priority applications).

3 PLAN THE MIGRATION

The Architecture

Before any engineering takes place, the migration team needs to define a foundational architecture for the target cloud platform. This involves matching platform features and available tools against the needs of the enterprise in areas like performance, scalability, high availability and networking. The team also needs to look at issues like process automation, security and compliance, user account management and access control, operations, archiving, and disaster recovery.

The Right Tools

Tools for translating source code and replicating parts of the mainframe environment on the cloud platform will have a critical impact on the success of the project. Successful projects invest considerable time and effort in evaluating and selecting the right tools.

Examples of Component Conversions

Mainframe	AWS
OS - Z/OS	REDHAT
BATCH	x86 EMULATOR
CICS - ONLINE	x86 EMULATOR
CA7 - SCHEDULER	AUTOSYS
DFSORT	SYNCSORT
IBM DB2	DB2 LUW
IBM COBOL	x86 COBOL
IBM JCL	x86 JCL
REXX	UNI-REXX
IDEAL	RAINCODE

Licensing

Surprisingly, licensing options need to be reviewed early in the planning process, not at the end, and certainly not after the engineering and code conversion work has begun. That is because some application and tool vendors have not adapted their licensing schemes to accommodate cloud platforms. For example, some vendors still price based on the number of core processors, making their products costly in cloud environments that feature large numbers of virtual CPUs.

Even without these anomalies, licenses can have a major impact on the cost savings provided by the migration. Organizations should negotiate with vendors before they start work and become locked into a particular tool. The impact of license costs may be so great that the team finds it necessary to select a different tool, or even to modify the planned architecture of the cloud environment.

Service Partners

Outside service providers can reduce the risk, time, and cost of migration projects, as well as producing better results. The enterprise's migration team should identify in-house gaps in skills, experience, and available hours that can be filled by qualified third parties. For migration partners such as consultants, they should determine selection criteria such as depth and breadth of knowledge of cloud technologies and the target cloud platform, experience with comparable migrations, willingness to customize the process to the needs of each client (versus taking a cookie-cutter approach), and willingness to put top people on the project rather than junior staff.

Change Management and Communication

Mainframes can be used by hundreds or thousands of people within an enterprise, many of whom are accustomed to applications

that have looked exactly the same for 10 years or more. That makes change management and communication critically important for gaining user acceptance of the migration.

Stakeholders who understand the dynamics of the migration will be more motivated to support the team.

The migration team should identify key influencers for each business unit, recruit them as champions for the migration, and empower them to help drive change. There are also advantages to embedding team members in the business units. This eases user concerns, because team members are available to get user input and respond quickly.

A communications strategy should be developed early in the planning process and updated as conditions change. It is critical to keep all stakeholders fully informed about the process, and comfortable that it is always under control. This can be done through formal status meetings, informal town halls, newsletters, social media, and other internal communication channels. The team should plan to create and disseminate metrics, to demonstrate continuing progress that might otherwise be invisible.

The migration team should also be prepared to communicate unexpected challenges and set-backs. Stakeholders and users who understand the dynamics of the migration will be more motivated to support the team and help it succeed.

Project Plan

Last, but not least, the migration team needs to develop a detailed project roadmap and implementation plan. These need to cover project phases, ongoing planning, task assignments, testing, and non-functional requirements.

An important project planning task is capturing all dependencies that the mainframe migration has across the organization. Knowing these dependencies can help prioritize other initiatives that are critical to the success of the mainframe migration and will help mitigate implementation risk. Dependency reviews with other stakeholders should be conducted on a regular basis as part of an overall program management cadence. These reviews should include a clear path of escalation so that issues can be quickly resolved to avoid project delays.

Non-functional requirements should also be captured as part of project planning effort, along with current state baselines. In many cases these requirements can be improved through hosting on AWS. Be sure to allow enough time for testing of these requirements prior to implementation, as this often gets overlooked or pushed to the end of the project, or worse not done until after the migration.

4 EXECUTE THE MIGRATION

All large-scale IT migrations involve similar steps. However, there are some special considerations in moving from a mainframe to a cloud environment.

Infrastructure on the Target Cloud Platform

At the start of the execution phase of the migration project, the team implements the foundational infrastructure on the target cloud platform. This involves designing networking and access controls, leveraging “code as infrastructure,” setting up tools to simplify the migration, and starting up internal processes to provide operational support for networking, security, logging, and other key functions.

Code Migration and Refactoring

Organizations should use automated tools to port code wherever possible. Tools native to the cloud platform can be used to configure batch processes, transaction processing, backup and recovery, high availability, and performance elasticity.

Testing

The migration team should perform detailed testing at multiple levels. Automating the testing of desired application outcomes will significantly accelerate all aspects of testing, and may be the best investment a migration team can make. Building test automation for components, data assets, data obfuscation, integrations, and application functionality will result in more accurate performance testing of expected and worse-case scenarios, as well as the processes for dealing with system and network failures, security issues, and other threats.

Examples of Non-Functional Requirements

Auditability and control	Fault tolerance
Availability	Performance and response times
Backup and disaster recovery	Scalability
Capacity – current and forecast	Security
Compliance with industry standards	Supportability
Configuration management	Testability
Documentation	User experience

Training

The migration team should make arrangements to train end users, application support personnel, and developers on new application usage patterns and how to take advantage of the capabilities of the cloud platform and tools.

Roll Out

The migrated applications can be rolled out using either a “big bang” or a staged approach. The big bang approach is potentially the lowest cost, since it allows the mainframe environment to be decommissioned soonest. However, it creates the risk that unanticipated issues could interfere with many of the migrated applications.

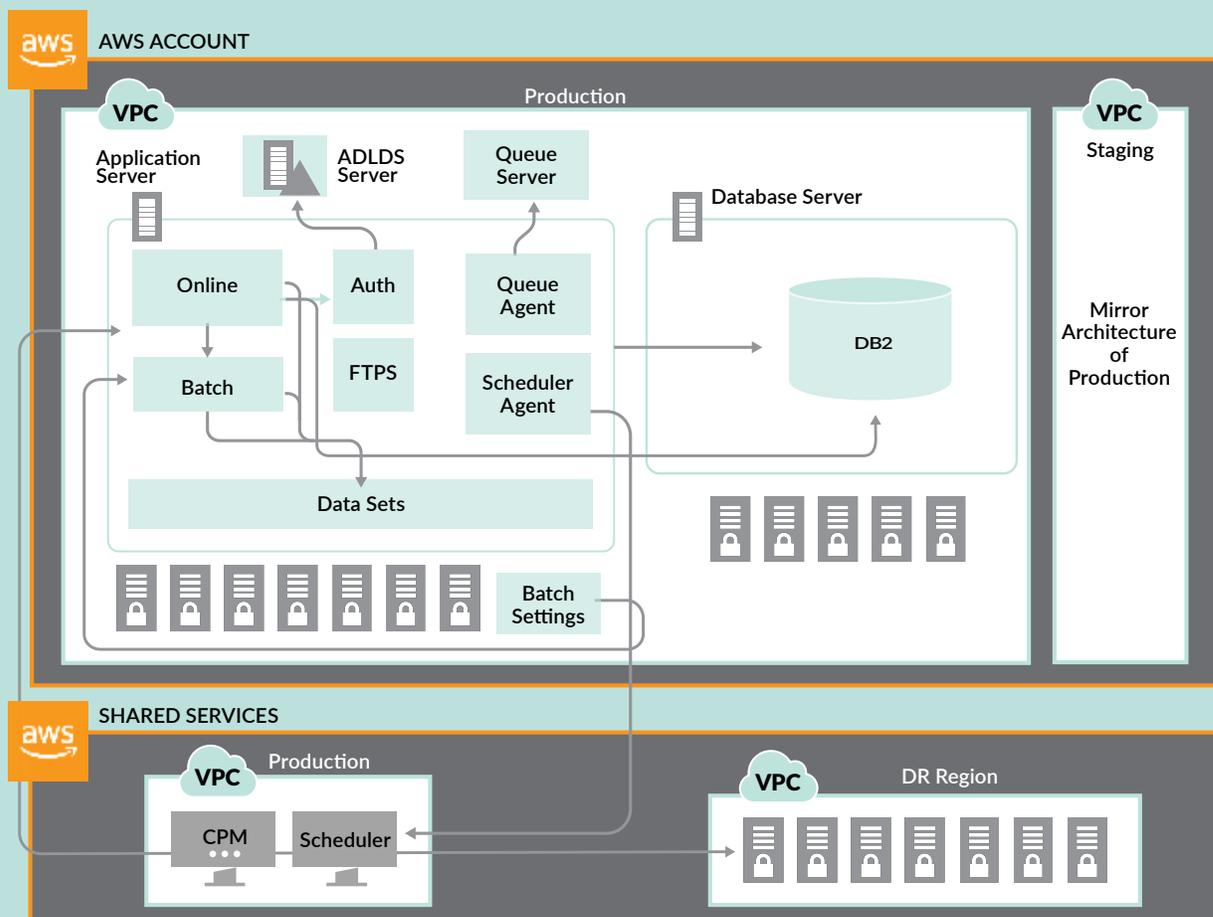
The staged approach requires running mainframe and cloud environments in parallel longer, but the first applications to go live can be used to uncover issues, validate the migration approach, and build confidence within the organization.

5 THE RESULTS

At the technical level, a successful migration creates an environment where the mainframe applications run on modern, virtualized commodity hardware, with the same or higher levels of performance, reliability, OLTP, and batch processing capabilities.

TYPICAL CLOUD-BASED ARCHITECTURE

The system architecture of one cloud-based environment is shown in this diagram.



At operational and business levels, the enterprise enjoys:

- Greatly reduced operating costs, often as low as 30% of the cost of licensing and supporting the mainframe hardware and software tools.²
- Software running on a modern, flexible infrastructure, with capacity that can be scaled up on demand.
- Opportunities to continually modernize technology, and to improve business agility with Agile software development, DevOps, and Continuous Integration.
- Reduced dependence on disappearing skills and unrecoverable tribal knowledge

Often the mainframe-to-cloud migration can be financed in a year or two by savings on operating expenses.

6 CANDID GIVES YOU A SAFE PATH FROM MAINFRAME TO CLOUD

Candid is an IT consulting firm that combines enterprise-class scale and process with born-in-the-cloud domain expertise. Its more than 100 management and technology consultants come from the world's top consulting firms.

To ensure the success of mainframe to cloud migrations, Candid brings to bear:

- Extensive knowledge of IBM-compatible mainframe environments.
- As an AWS Advanced Consulting Partner, a deep strategic relationship with Amazon; 80% of Candid's employees hold AWS accreditations or certifications.
- The Candid Cloud Factory, a holistic framework to facilitate the migration of applications, services and infrastructure from the data center to AWS environments.
- The Matter Cloud Automation Platform specifically designed to facilitate the migration of applications, services, and infrastructure from data centers to the AWS cloud.
- A proven track record with a range of data center to cloud migrations, including a major migration of an IBM data center environment that processed more than \$21 billion in financial transactions annually.

ENDNOTES:

1. <https://aws.amazon.com/solutions/case-studies>
2. [Mainframe Cloud Migration Saves a Global Enterprise \\$6 Million Annually](#)

Are you looking to make the move to cloud with confidence? Candid can help.

Contact us to set-up an initial Candid cloud blueprint consultation: info@candid.cloud





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We'll put advice into action for you.

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