

Agency modernizes, reduces costs, after migrating IBM i (AS/400) workload to Azure Infinite i technical case study

June 2020

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Migrating an AS/400 system to Azure

One of the biggest decisions for an IT manager is how and where to run datacenter applications while keeping costs down and supporting business agility. When the applications run on decades-old technology, the decision takes on some urgency.

That was the case for a federal agency processing millions of records through a nineties-era IBM RPG-based application on its IBM i servers. The application is used daily by government agencies, federal employees, and citizens. Originally built for the AS/400 platform, it required an IBM DB2/400 Database.

The AS/400 is an enduring platform. Programs designed for the original 1988 system can still be run today with minimal or no changes. However, the agency was ready to replace its green screens and move to Azure. It wanted a more modern approach to its digital landscape, and it needed to get out from under the aging system's costly maintenance.

Like many organizations, whether private or public sector, the agency looked to cloud computing to improve application scalability and availability while easing the hardware management burden. Also on the wish list was a modern application interface and a more standard database for reporting and analysis.

The question was how to do it. This article discusses the agency's journey to Azure with help from cloud specialists at Infinite Corporation, a Microsoft Preferred Partner.

The Infinite i solution

AS/400 systems have a place in running specialized, high-throughput transactions, but many applications—and the people who design and maintain them—benefit from a more agile cloud-based environment. Scalability on demand, seemingly endless storage, and a pay-as-you-go model make Azure an attractive choice.

Infinite Corporation specializes in AS/400 migrations and has developed the Infinite i toolset, which includes compilers for RPG, COBOL, CL, and DDS. It also provides a runtime environment that handles the commands of the AS/400 system and includes a complete replication of the DB2/400 database. Applications can continue to run as expected in the new cloud-based environment—without programmers having to rewrite a single line of proprietary code.

Infinite i provides a development and production environment that's very similar to the AS/400, from the menus to the command line. Its utilities, compilers, and services allow RPG and COBOL applications to run and perform in Azure as if they were in the AS/400.

For AS/400 rehosting, this solution has several advantages, in that it:

- Reduces hardware and software infrastructure costs.
- Modernizes application source code and databases.

- Improves the maintenance and deployment of the migrated application.
- Smooths the transition from the AS/400 to Azure.

The Infinite i toolset includes development utilities for writing screens (display files), creating physical and logical files, writing source code (RPG, COBOL, CL, and DDS), and executing and debugging programs.

Architecture on Azure

To run an application written in RPG, COBOL, or CL on Azure, the source code must be recompiled. Infinite i converts the business rules to C and the user interface to Java. You can freely modify the C and Java source code, enabling you to optimize and modernize your applications as desired—without touching the legacy source code.

In the agency's case, the application was migrated to virtual machines running the Infinite i environment on Azure. Moving to Azure enabled the agency to improve its disaster recovery configuration. In case of an outage, an automated failover process runs the workload from a secondary Azure region. The Azure environment also includes platform as a service (PaaS) options that perform load balancing, automate backup, and monitor performance.

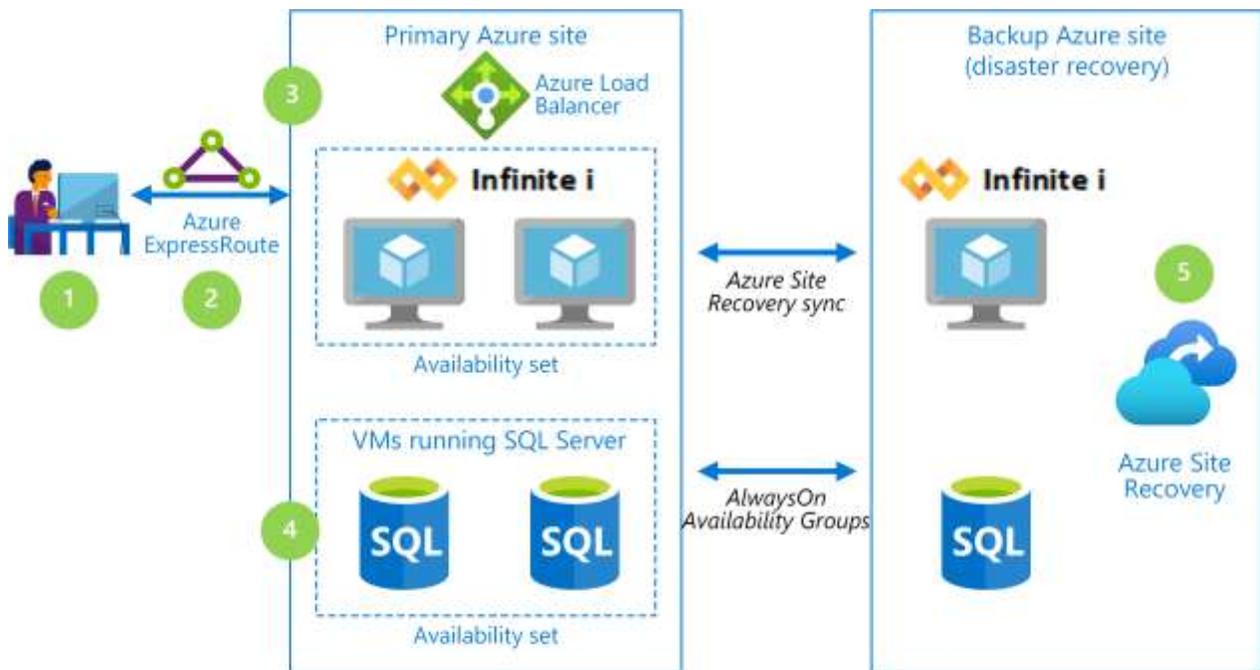


Figure 1. Infinite i creates an emulation environment on Azure for running AS/400 applications.

Dataflow	
1	Users gain access through a terminal using TN5250 terminal emulation software or with a web browser.
2	For fast connectivity, traffic flows across an Azure ExpressRoute circuit and a virtual private network.
3	Azure Load Balancer distributes traffic to the application layer. For high availability, virtual machines are grouped in availability sets. Azure Managed Disks provide storage based on Premium solid-state drives (SSD) designed for performance-sensitive workloads.
4	For high availability at the database layer, SQL Server is configured in an availability set with managed disks.
5	Azure Site Recovery provides backup and disaster recovery services when planned and unplanned outages occur. For high availability, the AlwaysOn Availability Groups feature makes sure that the group of databases fail over together to support the replicated environment.

The agency's DB2 legacy data was replicated in Azure and converted to Microsoft SQL Server running on Windows virtual machines. To move the data, the migration team used the Infinite i Database Migration Tool for DB2/400, which can migrate DB2/400 and legacy flat file data architectures to SQL Server or another database.

The Infinite i Database Migration Tool for DB2/400 automatically creates schema in SQL Server and then copies the data. It can also be used to move archival data to cold storage on Azure. Infinite i reads the DB2/400 physical files and creates corresponding tables and views on Azure. After that, the AS/400 can be decommissioned if desired.

New platform and new look—for less

After the application was migrated to Azure, the agency immediately saw a significant cost savings. The move to Azure enabled the agency to:

- **Cut costs in half** compared to the agency's previous datacenter costs for IBM hardware and licenses. The agency pays only for what it uses on Azure, and the cost of maintaining the application is much less.
- **Double the efficiency** because Azure can scale the application automatically to meet spikes in demand. No longer must the agency provision for peak load, leaving their servers underused nearly half the time.
- **Get better, faster reporting**, thanks to the highly flexible web-based reporting tools. Agency workers and citizens get the ease of a modern graphical interface and a standard SQL format for their reports.

- **Boost data quality** based on an industry standard database and data structure.
- **Improve availability** by moving to Hyper-V, the virtualization infrastructure that's part of the Windows operating system. The agency benefits from the familiar Windows interface plus a low-cost, easy-to-maintain virtualization platform that automates load balancing and provides high availability, without the need for extra hardware or expensive software.

Planning a migration to Azure

Any migration to Azure starts with an assessment of the legacy code, which often reflects years of undocumented patches and updates. With a clear sense of what you have, you can assess the next steps. What will it take just to migrate? What will it take to modernize the application?

In this case, the agency scheduled a few months for the planning and assessment phase. It started with a preliminary assessment to identify the main tasks. Teams from Infinite and Microsoft worked closely with the agency to create a roadmap and timeline based on the agency's models, processes, and existing IT architecture—all of which needed to be modernized to some degree.

In the planning phase, a best practice is to define clear roles and goals. In this case, Infinite brought its project management experience to the table and offered guidance on:

- Clearly defining all the project streams within a master plan.
- Roles and responsibilities, including how to coordinate among stakeholders.
- Setting main interventions and goals.
- How deadlines will be managed.

Microsoft and partners offer many resources for organizations that need help with a cloud migration project. To find the right migration partners and tools, see [Azure migration partners](#).

Government cloud computing

For the unique needs of US government agencies and their partners, Microsoft Azure Government is a physically separated instance of cloud services based on the global Azure platform. Azure Government is packaged for federal, state, and local government systems. The result is hyperscale compute and storage in a highly availability environment capable of supporting traditional mainframe workloads. Azure Government adds the value and agility of a modern, cloud-based platform without the costs associated with a mainframe environment.

Azure Government provides world-class security, protection, and compliance services specifically for US government agencies and their partners. Azure Government services handle data that is subject to certain government regulations and requirements, such as the Federal Risk and Authorization Management Program (FedRAMP), National Institute of Standards and Technology (NIST) 800-171 (DIB), International Traffic in Arms Regulations (ITAR), Internal Revenue Service (IRS) 1075, U.S. Department of Defense (DoD) L4, and Criminal Justice Information Services (CJIS).

In addition, Azure Government earned a Provisional Authority to Operate (P-ATO) for FedRAMP High Impact for systems that need this type of environment. Microsoft continues to add features to Azure Government that meet the requirements for FedRAMP High Impact. For more information, see the [Microsoft Trust Center: FedRAMP](#) website.

Next steps

Moving to a cloud platform completely changed the cost and use model for the federal agency at the center of this use case. If your organization is considering a move to Azure, the easiest way to get started is to lift your mainframe applications and shift them to the cloud, using mainframe emulation software.

The Infinite i toolset is specifically designed for AS/400 applications written in RPG, COBOL, CL, and DDS. A growing number of vendors provide similar solutions that emulate Unix, Solaris, and mainframe environments on Azure.

For more information, check out the following resources:

- [Mainframe application migration](#)
- [Azure migration partners](#)