
lzlabs
Microsoft
White Paper
The Benefits of Running Mainframe Applications on LzLabs Software Defined Mainframe® & Microsoft Azure

Contents

Overview

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A number of market conditions have coalesced in a way that is increasingly driving existing mainframe customers to consider running their application workloads on alternative platforms.

In 2020, the World Economic Forum noted that 42% of core skills required to perform existing jobs are expected to change by 2022, and that more than 1 billion workers need to be reskilled by 2030.

Mainframe modernization projects represent a key impetus to drive such an important global need.

The LzLabs Software Defined Mainframe® (LzSDM®) and the Microsoft Azure Cloud environment provide:

01 A platform that minimizes the number of changing parts, when migrating applications off the mainframe, thus overcoming IT leaders' main concern with such projects.

02 A strong, flexible platform for upskilling resources within an organization.

03 A powerful, scalable, reliable and secure platform to meet the variable demands of today's business models.

04 The strongest building blocks for an incremental and interoperable modernization of customer legacy applications – leveraging the strengths of the old, while evolving to the new at the "pace of business."

[1] https://www.weforum.org/agenda/2020/01/reskilling-revolution-jobs-future-skills

Cloud vs On-Premises

A decision about whether to fund IT infrastructure necessary to run business applications on premises, or take advantage of the opportunities enabled by modern cloud platforms should not be taken within the context of either/or.

At LzLabs, we believe in the freedom to choose the environment that is best for your organization.

It is not uncommon for an organization to move some of its workload to the cloud in an effort to determine the true impact and benefits to the business. A mixed cloud/on premise solution is the reality for many medium to large size companies.

Different applications represent different business processes and may be better served on premise. Others may be better positioned for modernization opportunities when placed in a cloud infrastructure.

The LzLabs Software Defined Mainframe and the Microsoft Azure cloud platform provide a strong environment for bringing the business processes instantiated in legacy mainframe applications to the innovation provided by the Azure ecosystem and the power of open systems.

Why the Microsoft Azure Cloud Platform?

The Microsoft Azure cloud platform provides a robust, secure and reliable environment for organizations across the globe. With large, sophisticated data centers located around the world, Microsoft can provide compute capacity to anyone.

For any modern web or mobile application, the cloud is a clear choice for those who need compute capacity for both small and large demands. The level of investment that Microsoft has made in these data centers to ensure they are efficient, reliable, scalable and secure is significant.

The Microsoft Azure cloud platform provides a robust environment for any organization, regardless of industry, to meet the growing demands of the modern, mobile and "connected" world. Instant connectivity from anywhere on the planet to these legacy business processes is the first step towards the modern IT future.

Not only is there an expectation of instant connectivity, but that also means the demand can be both variable and at the same time 24 hours a day. A flexible computing infrastructure that can meet these kinds of often conflicting demands is critical.

The Impact of Global Events on our Way of Working

Business leaders are rethinking working models, with significant ramifications for their IT infrastructure. Will workers return to the office? Indeed, many will, but will the concept of the remote workforce and a "connected" customer remain? Probably. Business systems need to reflect these global changes.

Variability and unpredictability are to be expected for many years. A flexible computing infrastructure that makes it easier for any business to respond to such changes is key but, equally, legacy systems that represent critical business rules must be brought along for the ride. They can't simply be thrown away, rewritten or reimplemented in a packaged software solution overnight.

The Software Defined Mainframe and the Azure Cloud platform provide a strong glide path towards the demands of the evolving worker and customer world.

LzLabs Software Defined Mainframe –Bridging the Gap

The challenge for many organizations is to understand how to move mainframe application workload to this environment.

» Mainframe and cloud architectures are different.
» The instruction sets are different.
» The data encoding mechanism is different.
» **The entire nature of the application development environment is dramatically different.**

So how does one move these traditional legacy mainframe applications to a modern cloud infrastructure?

Modernization of business applications is a continuum.

The single biggest roadblock to modernizing mainframe systems is the perception of risk and its potential to disrupt the business. Risk comes from changing things during migration, things which may disrupt the system as a whole during the lifetime of the project.

First, rehosting this workload, in a lower cost way, minimizing moving parts, to the cloud, is one of the strengths of LzLabs Software Defined Mainframe®. This approach does not require recompilation or changing the data in order to migrate that workload to Microsoft Azure.

Once applications are moved to modern environments, modernization can occur in phases as a way to reduce the risk of migration by preserving interoperability between the old and new, while continuing to leverage the business value of existing core business applications.

LzLabs Software Defined Mainframe – Bridging the Gap - cont'd.

The LzLabs Approach - Reducing Risk via Change Mitigation

The LzLabs approach reduces the amount of change necessary to migrate mainframe applications to the cloud, thus reducing the complexity and amount of testing required.

Many mainframe organizations would like to migrate some of their application workload to a lower cost and more easily scalable platform, such as the Microsoft Azure cloud. This frees up capacity for consumption by those applications that remain, reducing the need to constantly upgrade the mainframe infrastructure with the associated increase in software costs.

LzSDM® can run this workload, practically unchanged, thus significantly reducing the risk.

LzSDM® also provides the added benefit of being able to take advantage of the flexibility of the Microsoft cloud platform.

This approach is the key to reducing the cost of running an application in the cloud. You can scale up instances of LzSDM® as needed to support, for example, increased demand associated with nightly batch workloads, thus significantly reducing the compute requirements and cost.

Interoperable Modernization at the Speed of Business

Once applications and data have been migrated, they can be gradually modernized over time. Modernization of an application should not require you to recompile everything in order to modify a few key programs.

With LzSDM®, you can modify/enhance existing COBOL or PL/I programs, recompile them using the LzLabs LzWorkBench and compilers and have them interact with existing mainframe load modules that haven't been changed in perhaps decades!

Only enhance those parts of the application you need to, leaving the rest to continue to function as they have for decades. Some of these programs can later be converted to Java, for example, and can continue to interact with the migrated legacy load modules.

Accessibility of data to analytics and integrations

Finally, once the data has been freed it can be readily accessed by any modern data analytics or query tool and more easily integrated into other business applications within the platform of innovation.

The advantage to moving mainframe applications and data is not just for the immediate cost benefits and flexibility of the Microsoft Azure cloud environment, but to the new opportunities this provides now that this important business data is open and available to the innovation of the modern open-source world!

This approach enables organizations to turn their ideas into innovation while reducing the implications of more extensive modernization efforts, such as package migration or application re-writing. Microsoft Azure and Open Source provides a number of key products and services that can be used to greatly enhance these legacy applications without incurring the challenges of a complete migration to different technologies.

Azure Virtual Machines – The First Step to Migrating Mainframe Workload

As mentioned previously, the first step to migrating mainframe application workload is to move it to a modern Azure Virtual Machine (VM) environment. LzSDM® can run on Linux virtual machines in Azure.

LzSDM® is architected to run on either x86 or ARM-based servers in the Azure cloud. Microsoft offers a number of Linux VM deployment options from economical "burstable" VMs to memory-optimized ones that can be configured to meet a variety of mainframe application needs.

Organizations can optimize their Azure cloud infrastructure using the Azure Reserved Virtual Machines Instances, reducing their costs by up to 70% or more compared to pay-as-you-go prices.

Using LzSDM® on these Azure cloud virtual machines, organizations can easily create a hybrid infrastructure environment whereby migrated mainframe applications can continue to interoperate with remaining mainframe applications, much like they would in a multi-mainframe environment used by many companies.

"Scale Up" approach to Mainframe Architecture

The mainframe architecture is designed to use what's referred to as a "scale up" approach. Mainframe capacity can be increased by adding more MIPS to an existing mainframe platform.

The amount of available compute capacity on particular mainframe models has continued to increase over time. Additional mainframes could be clustered to support extremely large workloads or for backup/recovery reasons, but the scale up approach is the most direct.

Since mainframe applications run on a single large instance of compute power, they have been architected to presume this characteristic, affecting how applications interact.

Azure Virtual Machines – The First Step to Migrating Mainframe Workload - cont'd.

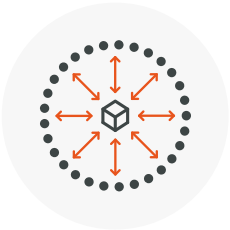
"Scale Out" approach of the Cloud Environment

Cloud environments are designed to "scale out". This approach is key to understanding how large volumes of mainframe workload can be moved to the Azure cloud environment.

Enterprise architects should not think about creating a single large instance of LzSDM® running on a multi-core Linux VM as the only way to migrate mainframe workload. LzSDM® can run large volumes of mainframe workload on a single multi-core VM instance in the Azure cloud, but the long-term future of growing workload on the Azure cloud is through the scaling out of multiple VM instances running full or partial instances of LzSDM® to provide increased processing power.

In Azure it's common to deploy multiple VMs running applications that interact with a separate set of VMs for the data tier. Additional instances are then added for development, etc. LzSDM® is designed to evolve mainframe workload from its scale up architecture to the scale out architecture of the cloud.

Migrating Transactional Workload to Microsoft Azure Using LzSDM®



Mainframe application workload has historically been split between on-line transactional workload and batch workload. Many organizations run transactional processors for the duration of their "business day" and then run significant batch workload overnight.

As the length of business days increases in a global economy it becomes increasingly difficult to maintain this approach.

When moving online transaction processing applications to Azure, LzOnline provides mainframe transaction processing (TP) capabilities run as Infrastructure as a Service (IaaS) using virtual machines on Azure.

LzSDM® can be used to support any transactional workload. LzSDM® has been shown to easily support up to 4,000 transactions per second on older x86 processors and on a single VM instance. Using LzSDM®, organizations can begin to partition transactional workload in such a way that multiple instances of the LzOnline component can be spread across multiple Linux VM instances to provide significant increases in transactional workload volume.

The screen handling and form functionality can also be provided by web servers. This approach can be combined with database APIs, such as ActiveX Data Objects (ADO), Open Database Connectivity (ODBC), and Java Database Connectivity (JDBC) for data access and transactions.

This is where the true elasticity of the Azure cloud environment begins to shine. Organizations should not think about how they can create a mainframe in the cloud. They should understand how they can run mainframe applications in a cloud environment and get the benefit of horizontal scalability that Azure can easily provide.

[2] https://info.lzlabs.com/zref-performance-benchmark

Migrating Batch Workload to Microsoft Azure Using LzSDM®

Historically, the mainframe application architecture has been designed around the structure of the underlying hardware. Also, business models of the past defined a "transactional approach during the day and a batch approach overnight".
This technical approach not only matched the business models of the times, but also allowed organizations to overcome some of the limits of running both workload types at the same time as well as to reduce the computing capacity needed during a 24-hour period to support the application workload.

Mainframe batch operations contain a combination of application styles, data access methods, job scheduler systems and I/O demands. Scheduling and coordinating large numbers of batch jobs during a 9-12 hour timeframe, ensuring they all ran successfully to conclusion, required sophisticated scheduler products usually supplied by mainframe independent software vendors (ISVs).

Key to batch processing is the notion of precedence. Certain batch jobs are highly dependent on preceding jobs running successfully to completion. Batch jobs are also heavily I/O-centric as they were designed to read large volumes of data and provide some update/modification of the data based on business rules or heavy reporting demands to provide end-of-day summaries of the application processing.

Many sophisticated approaches are available on the mainframe to prioritize workload based on type. Job classes were defined around workload characteristics and mainframe capacity was managed around these notions.

The LzBatch feature of LzSDM® provides an analogous prioritization structure for running mainframe batch workload on Microsoft Azure. THis approach makes it easier during an initial migration to minimize the amount of architecture or structural changes that need to occur. **This reduces the cost and complexity of the migration and ensures that the workload can be moved quickly**.

Multiple instances of LzBatch, running across any number of scalable Linux VM instances, can be used to horizontally scale batch workload. Once migrated, batch workload can evolve to take advantage of the elasticity of the cloud and the concurrency of data access/updates available via PostgreSQL. LzSDM® uses PostgreSQL, the most commonly used relational DBMS in the world, to enable access to mainframe DB2® data that has been migrated to the Azure cloud.

Preserving Scalability and Availability with LzSDM® & Microsoft Azure

When migrating mainframe application workloads to Azure, LzSDM® can be used in conjunction with a number of key Azure cloud features to create a highly reliable and recoverable environment.
Each instance of LzSDM® running on a Linux VM can be matched to an appropriate disaster recovery architecture. Production and database VMs might require hot or warm recovery, whereas development or testing instances of LzSDM® on Linux VMs would only need cold recovery requirements.

Azure Scale Sets

Azure VM scale sets let you create and manage a group of load-balanced VMs.
The number of VM instances can automatically increase or decrease in response to demand or a defined schedule.
Scale sets provide high availability to your applications, and allow you to centrally manage, configure and update a large number of VMs. With virtual machine scale sets, you can build large-scale services for areas such as compute, big data and container workloads.[3]

Scale up VM

After you create a virtual machine, you can scale the VM up or down by changing the VM size. In some cases, you must deallocate the VM first. This can happen if the new size is not available on the hardware cluster that is currently hosting the VM.
If your VM uses Premium Storage, make sure that you choose a version of the size to get Premium Storage support. For example, choose Standard_E4s_v3 instead of Standard_E4_v3.[4]

Azure Site Recovery

Azure Recovery Services contribute to your business continuity/ disaster recovery (BCDR) strategy as follows:

Site Recovery service: Site Recovery helps ensure business continuity by keeping business apps and workloads running during outages. Site Recovery replicates workloads running on physical and virtual machines from a primary site to a secondary location. When an outage occurs at a primary site, you fail over to a secondary location, and access the apps from there. After the primary location is running again, you can fail back to it.

Backup service: The Azure Backup service keeps your data safe and recoverable.

[3] https://docs.microsoft.com/en-us/azure/virtual-machine-scale-sets/overview

[4] https://docs.microsoft.com/en-us/azure/virtual-machines/windows/resize-vm

Ensuring Mainframe-Level Security on the Microsoft Azure Cloud

RACF® Resource Access Control in LDAP

The LzSDM® security solution, LzVault™, uses an LDAP schema as its permanent definition store. All LzSDM® security definitions – including, but not limited to, those of users, groups, resources, and permissions – are maintained in an LDAP directory implemented using the open-source solution, **OpenLDAP**. This provides support for:

Open Administration	LzSDM® security administration and reporting tools access this repository using the industry standard LDAP protocol, thereby ensuring that all administrative functions that are available to LzLabs tools are also available to customer applications as well as to general-purpose, open-source administrative tools.
Interoperability and Integration	LzSDM® can serve as an authentication server to applications supporting standard LDAP interfaces, and can easily be integrated with third-party Single Sign-On (SSO), Identity and Access Management (IAM) as well as Information Governance (IG) solutions.
Backup, Recovery and High Availability	Various replication and synchronization strategies and utilities are freely available to backup and restore the directory, maintaining a hot backup, or synchronizing with external repositories.

The LzLabs security definitions are stored largely within LDAP schema extensions, as is the convention for LDAP applications. However, LzLabs leveraged the existing security definitions to an LDAP schema definition and modified it to suit our specific runtime environment.

Since we recognize that some customer applications may expect to interact with a RACF database through LDAP, our LDAP service also recognizes and responds to a subset of the LDAP object identifiers (OIDs) presented by the existing mainframe-populated LDAP schema, now directed to the LzVault schema.

Conclusion

The benefit of running traditional mainframe batch and transactional workloads on a Microsoft Azure cloud platform using LzLabs Software Defined Mainframe is clear. Using LzSDM®, companies can migrate their existing business applications to a highly resilient and robust environment in the cloud, realizing the same benefits traditionally associated with the mainframe platform.

Extremely high Reliability, Availability and Scalability (RAS) qualities of service can be achieved on a cloud platform, albeit in different ways.

The LzSDM® provides the lowest risk solution to migrating legacy applications to the modern world of cloud computing. It provides the first step on a path to modernization. Applications can achieve the same level of performance and scalability on Microsoft Azure as they can on the mainframe, and are then better positioned for subsequent modernization efforts.

The key to moving legacy mainframe applications to the cloud is a robust infrastructure that can provide performance and scalability.

The Microsoft Azure cloud platform provides features that enable dynamic scaling of compute capacity, as well as strong backup and recovery capabilities to ensure constant availability. The road to modern business applications is a long one. Take your first steps using LzLabs Software Defined Mainframe and the Microsoft Azure cloud platform.

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