

Cloud database migration essentials

A guide for database administrators, data architects, and other data professionals

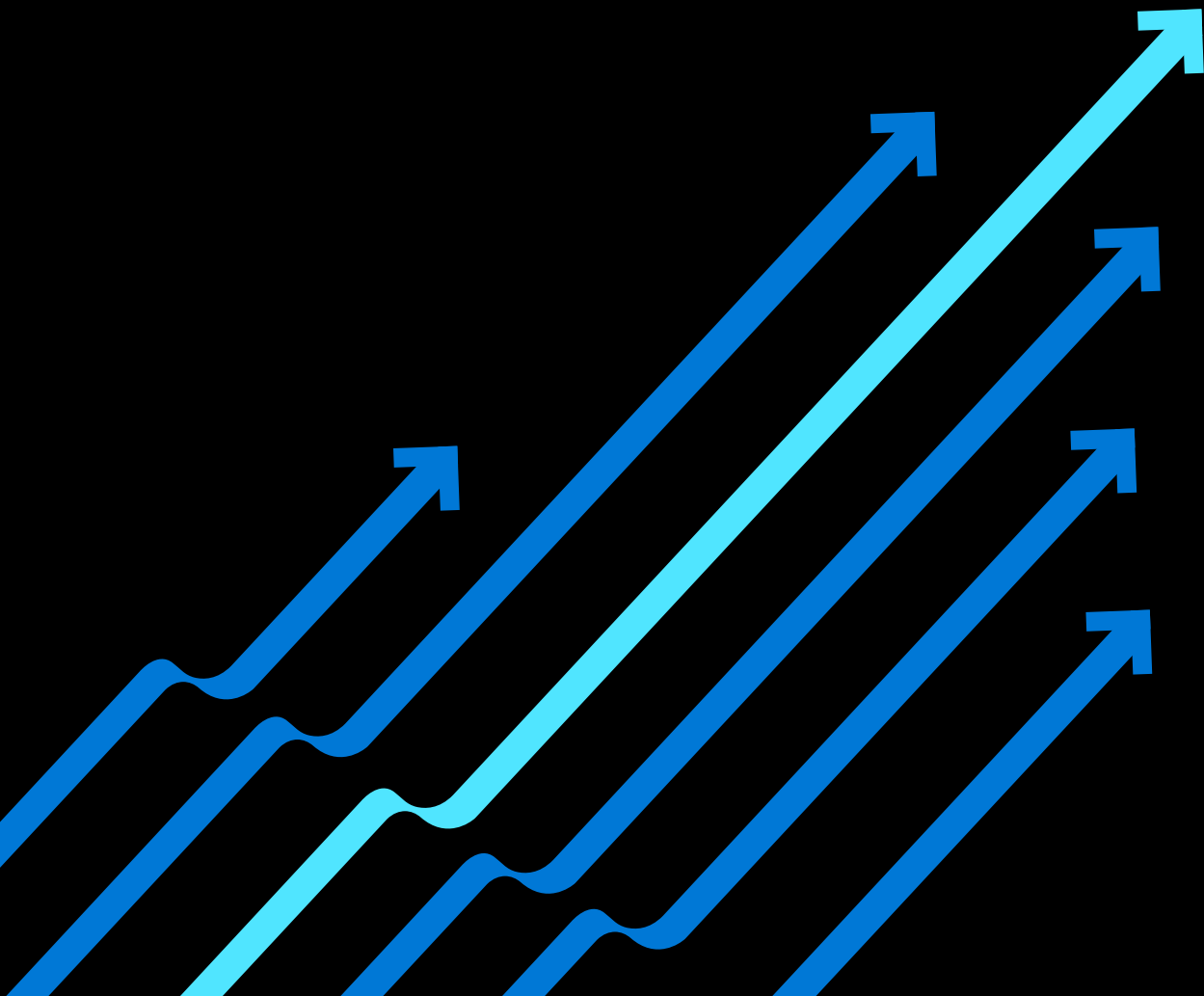


Table of contents

01

Introduction 3

02

Why migrate now? 5

03

How do you approach
migration? 6

04

Four steps to migration 6

Before you migrate 10

Readiness 10

Ready to migrate 10

05

Assess 10

Assessment plan 11

06

Migrate 12

07

Optimize 14

Performance optimization 14

Pricing optimization 14

Security optimization 15

08

Secure and manage 16

Secure cloud resources 16

Protect data 17

Monitor cloud health 18

09

Summary 21

10

Additional resources 23

Database migration 23

Get Pluralsight training 23

Compare cost 23

01. Introduction

In recent years, global business has witnessed significant cloud adoption, which provides considerable value over traditional datacenters—achieving greater scalability, cost efficiency, and improved performance.¹

Many organizations now want to quickly take advantage of cloud adoption by migrating their existing databases. However, cloud migration requires careful planning and strategy.

To enable successful migration, it's important to have a strong plan in place that covers the end-cloud environment, training and—most importantly—the readiness of your databases and systems.

This means you need to determine how to:



Create the initial technical plans and business justification.



Ensure your workloads will run as expected.



Perform the migration with limited impact to the business.

Then, once you've migrated your databases to the cloud, you need to make the most of your investment and keep it secure.

If you're a database administrator, data architect, or other data professional responsible for your organization's data needs, this guide can help you start your migration to the cloud.

In this guide, you'll discover:

- ✓ Preliminary steps to consider when looking at migration
- ✓ Some tools you can use to accelerate your migration project
- ✓ Tips for post-migration success

Migrating to the cloud doesn't have to be difficult. With the right tools and processes, your migration project can be fast and friction free. Methods such as lift and shift can rapidly move you to the cloud, reducing costs immediately and allowing you to focus on future cloud modernization. In addition, processes for assessment, optimization, security, and management can help throughout your continuing adoption of cloud services.



One of our big objectives was to eliminate \$3 million in capital costs over about three years, and to reduce our operating costs by approximately the same amount. At the same time, we wanted to improve our quality of service. **With Azure, we're confident that we'll meet those goals.**

Jim Slattery

Chief Financial Officer

Capstone Mining²

02.

Why migrate now?

At first glance, migration might seem like a technical decision, but its core is business related. Ultimately, it raises two fundamental questions: what's driving your business to migrate to the cloud, and why now?

The benefits of the cloud are universal—reduction in running costs, faster modernization capabilities, and increased security. But there's usually a specific catalyst for starting the migration discussion. These can include:

Operational efficiencies and reduced operating expenses. With reduced hardware support, increased manageability, and more efficient processes, you can save an average of 20 to 30 percent on virtual machine (VM) resource configuration alone.³

Increased focus on business requirements. By reducing management overhead and freeing up budget, you can focus more time and effort on meeting your organization's data requirements.

Support for cost-effective scalability requirements. When you plan for peak usage through on-premises systems, your servers are usually running at less than 20 percent utilization. The cloud releases you from this model, enabling a scale-when-you-need-it approach.

Renewal of datacenter or hardware leasing. If you're currently considering extending your budget to renew hardware leases or pay for datacenter locations, it's a good time to consider cloud migration. A cloud vendor can host these services for you, eliminating the need for costly leasing.

Renewal of licensing. Nearly all companies have an annual licensing agreement with their major IT providers. These agreements require ample budget to sufficiently cover licensing for your OS and virtualization platforms. The cloud can help here as well, providing a pay-as-you-go offering that reduces these costs.

Database development and modernization. Two common challenges for today's businesses are over-allocated IT resources and on-premises platforms that limit the adoption of modern services. The cloud tackles both with scalable services and continuously updated platforms that meet modern data requirements.

Software end of support. End of support for Windows Server 2008 and SQL Server 2008 means the end of regular security updates. This can be an opportunity to migrate your end-of-support databases to Azure, strengthening your organizational security posture and ensuring compliance across your hybrid environment.

Ultimately, by migrating your current databases to the cloud, you're putting yourself in a better position to accelerate your business success.

SQL Server end of support

Support for SQL Server 2008 ends on July 9, 2019. If you're using SQL Server 2008, save with three years of extended security updates, free when you move your SQL Server 2008 databases to Azure Virtual Machines.

Or, migrate your workloads to Azure SQL Database now and stop worrying about security updates or the next deadline for end of support. You'll strengthen your security posture, reduce infrastructure costs, and gain more time to focus on business innovation.



[!\[\]\(d5d7044e5caf6907399af2dced8d6ff8_img.jpg\) Learn more](#)

[!\[\]\(35dc653d59570f8f891c312eeece91a2_img.jpg\) See how AWS is five times more expensive than Azure for Windows Server and SQL Server](#)

03.

How do you approach migration?

Several options are available on Azure for migrating and modernizing on-premises databases. They range from lift and shift infrastructure-as-a-service (IaaS) approaches to various platform-as-a-service (PaaS) options, including support for fully managed data platforms.

Lift and shift is the most common (and fastest) first strategy, enabling you to move your databases quickly to the cloud by simply rehosting them with SQL Server in Azure Virtual Machines for an IaaS solution. You may also consider PaaS options, depending on your current database technology and appetite for reconfiguring your current databases.

If you are migrating an SQL database, you should consider Azure SQL Database with a single database or elastic pools, or even Azure SQL Database Managed Instance, which enables you to seamlessly lift and shift SQL Server databases to Azure without code changes, and provides full database-level compatibility with the productivity benefits of a fully managed Azure service. Azure also offers fully managed open source cloud offerings for MySQL and PostgreSQL, as well as Cosmos DB for NoSQL options (for example, MongoDB, MariaDB, Cassandra, and Gremlin).

04.

Four steps to migration

No matter which strategy you choose, you need a solution that makes cloud adoption as smooth and easy as possible—one that lets you migrate at your own pace.

This requires a cloud provider (and core partners) that can deliver a comprehensive set of tools and methods to help ease migration and reduce overall risk. Most of all, this solution should offer a simple process that's easy to follow. With these goals in mind, Microsoft recommends a four-step migration process for moving databases to the cloud.



Assess. Discover and assess your on premises resources, such as applications and workloads, to plan where your Azure migration should start.



Migrate. Move resources using powerful free tools while minimizing downtime.



Optimize. Streamline your cloud resources, improve performance and ROI, and stay compliant.



Secure and manage. Ensure security and fine-tune management of your cloud environment.

With this straightforward framework, you get a proven approach to migration. This process provides a clear picture of your entire database portfolio, the best way to configure that portfolio to achieve migration, convenient tools to ensure low-impact transfer, and ongoing performance and cost optimization.

But before migration begins, how do you ensure that your virtual datacenter in the cloud is ready to receive your databases? Since you plan to run your most critical databases there, you want to be confident that your cloud foundation is solid. If you already have workloads or DevTest running in the cloud, you might have an environment and connectivity ready to go. However, if you're new to the cloud or only have a basic setup, you'll need to perform a few steps before migration.

Before you migrate

Before migration, your system administrator will need to build a virtual datacenter in the cloud, including connectivity, networking, storage, and identity—elements comparable to your on-premises environment. By establishing this virtual datacenter, they can ensure that your databases will continue to support your business after migration, without surprises.

Building your virtual datacenter is a streamlined process because system administrators can use components available in the cloud for quick assembly and configuration. They can take advantage of

many excellent tools and guidance to help accelerate this step, which can be found in the [Cloud Migration Essentials guide](#).

Readiness

While many core database management skills are useful in the cloud, there are some key skill differences, so your team will need to get up to speed on some new tasks. However, training takes time away from performing core duties, can be costly, and often doesn't properly build on what people already know.

[Microsoft Learn](#) can help solve these challenges with unique learning paths focused on job roles. This readiness tool offers simple online training in bite-sized pieces, practical labs, and assessments to test knowledge. It's a fast way for your team to grow their skills, and, best of all, it's free.



Ready to migrate

Now it's time to begin your migration journey to the cloud!

05.

Assess

The first step toward migration is to understand your database footprint, discover on-premises database servers, and identify app and server dependencies. Then, you need to plan and analyze whether the targeted migration scenario is compatible with the database requirements of your application. It's important to understand your database performance needs and to determine how you would deliver that performance on Azure after migration. In the case of Azure SQL Database Managed Instance, this might require computing the number of vCores needed for each database. If you have specific security or regulatory requirements, you also need to consider them during the assessment process.

Two other key points to remember for the assessment phase are to:

- Involve stakeholders
- Calculate your total cost of ownership (TCO)

By reaching out to key people—including representation from both IT and business owners—you can foster engagement and

gain their support, which will lead to a smoother, faster cloud migration process. Calculating TCO will help you evaluate potential cost savings of migrating to Azure, and can also be part of your customized cloud assessment, which will help you create the business case to support your Azure migration. [Calculate your Azure TCO](#).

To achieve these goals, Microsoft has created many helpful resources and tools, including:

[Azure Database Migration Guide](#)

This one-stop guide for database migration provides step-by-step guidance from source to target. It also showcases recommended partners and customer case studies. View the [Database Migration Guide](#).

[Data Migration Assistant](#)

You can use Data Migration Assistant (DMA) to spot potential compatibility issues that can affect database functionality. DMA assesses the readiness of your database for migration to Azure SQL Database and enables performance and reliability improvements for your target environment.



We don't want to be in the datacenter business; we're in the thread. We plan to move 90 percent of our global datacenter infrastructure into Azure, and we're at about 75 percent now. The only things we'll leave on-site are a few domain controllers and file/print servers.

Richard Cammish

Chief Information Officer

Coats⁴

For more information about assessment tools, explore these resources:



Azure Migrate. Take advantage of discovery, assessment, guidance, insight, and mechanisms for cloud migration through this free integrated Azure service.



[Learn more](#)



Azure migration support. Accelerate your migration with experienced assessment partners, which provide many options for your unique environments.



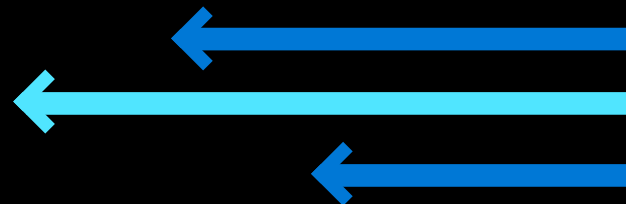
[Learn more](#)



Pay less with Azure. Achieve the lowest cost of ownership when you combine the Azure Hybrid Benefit, reservation pricing, and extended security updates. Amazon Web Services (AWS) is five times more expensive than Azure for Windows Server and SQL Server.



[Learn more](#)



06.

Migrate

After you assess your databases, you need to complete the schema, data, and object migration process. Azure offers migration tools and services that analyze data platform solutions, recommend the best options, and then enable seamless execution.

Azure Database Migration Service

A comprehensive, fully managed offering, Azure Database Migration Service (DMS) reduces the complexity of cloud migration by facilitating the movement of data, schema, and other objects from heterogeneous sources to Azure database platforms—all with minimal downtime. To start, DMS provides assessment reports that highlight the changes required before performing a migration. After conflicts

are resolved, DMS performs all the steps associated with the migration process. An Azure SQL Database instance can be created based on different regions, with a variety of vCore options available. By allocating more vCores, you can accelerate migration to meet a desired timeline, but with an additional cost.

Backup and restore

Azure SQL Database Managed Instance delivers a robust backup and restore functionality for migration. You can take a native SQL backup of on-premises SQL Server databases, put it on Azure Blob storage, and restore it directly to Azure SQL Database Managed Instance. Although it requires some downtime, this method enables quick and easy offline database migration.



To expand globally, we can simply clone the infrastructure that we have running in our U.S. Microsoft Azure datacenter to Azure datacenters in Asia and elsewhere.

Tom Grounds

Chief Information Officer


Dillon Gage

For more information about migration tools, explore these resources:



Azure Site Recovery. Migrate physical servers or VMs from on-premises to Azure. Azure Site Recovery supports custom replication timing, isolated testing, and final migration cutover.


You can replicate and migrate VMs to Azure using right-sizing recommendations based on the Assess step, and take advantage of Azure Hybrid Benefit when the initial replication occurs (as a configuration option). This tool saves time because you don't need to go back and complete this effort for each VM.

 [Learn more](#)



Azure Database Migration Service.

Migrate your existing application database running on SQL Server, Oracle, DB2, MySQL or PostgreSQL to Azure as a VM, Azure Managed Instance, or directly to Azure SQL Database.

 [Learn more](#)



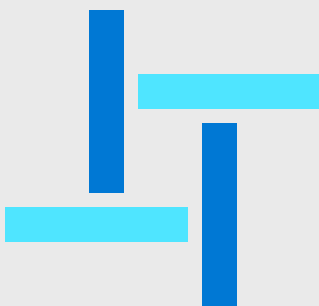
Azure migration support. Accelerate your migration to Azure by working with partners that offer technology solutions and expertise.

 [Learn more](#)

07. Optimize

After migration, you're ready to transform and optimize, making any changes required for your applications to run smoothly and efficiently.

You can use Azure tools and services to perform tests, address performance or security issues, and then retest to confirm improvements. You can also review new SQL features available on the Azure platform and implement them, as appropriate.



Performance optimization

You can run performance validation queries against both the source and Azure SQL Database Managed Instance databases, and then analyze and compare the results. For example, you might want to change the database compatibility level for query regressions. You can use Query Store as the optimal tool for getting information about workload performance before and after this change. You can also check for missing, duplicate, redundant, rarely used, and completely unused indexes, and then resolve them using the Database Engine Tuning Advisor and Dynamic Management Views (DMVs).

Pricing optimization

After migration, you can right-size your on-premises SQL workloads in Azure. Azure SQL Database Managed Instance introduces a pricing model based on vCores, which lets you select the right level of resources (storage and compute) for your workloads by comparing vCores to physical cores on-premises.

Security optimization

It's easy to optimize security in Azure through Azure Active Directory authentication at the database level. With the free Microsoft Azure Active Directory Connect tool, you can synchronize your on-premises Active Directory to Azure Active Directory and enable single sign-on with Windows user credentials. Azure SQL Database Managed Instance also adheres to compliance standards available in Azure SQL Server, so there isn't a lot of administrative overhead.

Plus, with auditing and threat detection features, you can monitor activities and use Row-Level Security and Dynamic Data Masking to control access to sensitive and privileged data. You can also use firewall rules at the database and server levels to specify a range of IPs that can access the instance. Likewise, you can manage virtual network rules using firewalls.

Tools for optimization

For more information about optimization tools, explore these resources:



Azure Cost Management. Get detailed visibility into the resource costs of running systems on Azure.



[Learn more](#)



Azure migration support. Accelerate your migration by working with experienced partners that provide many options for your unique environments.



[Learn more](#)

08.

Secure and manage

Once you've migrated, you'll want to keep your databases continuously secure, protect your data, and monitor your cloud health. All that's easy to do with Azure—once you have an understanding of the full suite of available controls and capabilities.



Secure cloud resources

Ensuring strong security for your cloud-based resources is a responsibility that's shared between your IT department and your cloud provider. Azure is built with a foundation of trust and security, compliance, privacy, and transparency. The Azure platform provides a solid foundation on which to host your infrastructure, with built-in security controls and capabilities to help further protect your data and applications.

Azure Security Center provides unified security management and advanced threat protection across hybrid cloud workloads. Azure Security Center enables your organization to take advantage of capabilities like these:

Centralized policy management.

Ensure compliance with company or regulatory security requirements by centrally managing security policies across all your hybrid cloud workloads.

Continuous security assessment.

Monitor the security of machines, networks, storage and data services, and applications to discover potential security issues.

Actionable recommendations. Remediate security vulnerabilities—before they can be exploited by attackers—with prioritized and actionable security recommendations.

Advanced cloud defenses. Reduce threats with just- in-time access to management ports and whitelisting to control applications running on your VMs.

Prioritized alerts and incidents. Focus on the most critical threats first by taking advantage of prioritized security alerts and incidents.

Integrated security solutions. Collect, search, and analyze security data from a variety of sources, including connected partner solutions.

**Protect data**

Azure helps ensure workloads and data are fully backed up and protected from disasters while providing encryption of stored data for internal and customer security. Azure can also automatically encrypt your stored data—while allowing full accessibility to all applications and users.

VM disk encryption. Azure Disk Encryption enables encryption of Windows and Linux Azure Virtual Machines disks. Azure Disk Encryption uses the industry-standard BitLocker feature of Windows and the dm-crypt feature of Linux to provide volume encryption for the OS and data disks. The solution is integrated with Azure Key Vault to help you control and manage the disk encryption keys and secrets in your key vault subscription while ensuring that all data in the VM disks is encrypted at rest in your Azure storage.

VM backup. Azure Backup is a scalable solution that protects your application data with zero capital investment and minimal operating costs. Application errors can corrupt your data, and human errors can introduce bugs into your applications. With Azure Backup, your VMs running Windows and Linux are protected.

Azure Site Recovery. An important part of your organization's business continuity and disaster recovery (BCDR) strategy is figuring out how to keep corporate workloads and apps up and running when planned and unplanned outages occur. Azure Site Recovery helps orchestrate the replication, failover, and recovery of workloads and apps so that they're available from a secondary location if your primary location goes down.



Monitor cloud health

As with any system, monitoring cloud health is important to drive both proactive and reactive analysis.

Azure provides many monitoring services targeted at applications, workloads, and core service health to ensure your organization has full visibility into current system status—and access to important data when you're working with a break-fix situation.

Azure Monitor. Azure Monitor enables your IT department to monitor Azure services by collecting metrics, activity logs, and diagnostic logs. For example, the activity log shows when new resources are created or modified. Metrics are available that provide performance statistics for various resources—and even for the OS inside a VM. IT administrators can view this data with one of the explorers in the Azure portal, send it to Azure Log Analytics for trending and detailed analysis, or create alert for critical issues proactively. Standard metrics are free and include select metrics originating from Azure resources, services, and first-party solutions. More advanced metrics—including insights into the availability, performance, and usage of your applications, along with health monitoring and alert rules—are also available. For more information, see [Azure Monitor pricing](#).

Service Map. Service Map provides insight into your IaaS environment by analyzing VMs and their dependencies on other computers and external processes. It integrates events, performance data, and management solutions in Log Analytics. This data can be viewed in the context of each computer and its relation to the rest of your environment.

Network Watcher. Network Watcher provides scenario-based monitoring and diagnostics for various network scenarios in Azure. It stores data in Azure metrics and diagnostics for further analysis.

Service Health. It's important to be aware of any issues with the Azure services on which your applications depend. Azure Service Health identifies issues with Azure services and helps with planning for scheduled maintenance.

Azure Advisor. Azure Advisor constantly monitors your resource configuration and usage telemetry. It then gives personalized recommendations based on best practices. Following these recommendations can help your IT department improve the performance, security, and availability of the resources that support your applications.



Many premium management solutions are packaged sets of logic that provide insights for an application or service.

They rely on log analytics to store and analyze the monitoring data that they collect. Azure Log Analytics enables deeper visibility into your hybrid IT environment and allows the diagnosis of performance issues from an advanced analytics portal with one click. With Azure Log Analytics, IT administrators can:

Analyze data. Use provided dashboards to run log searches by constructing queries to analyze collected data. These dashboards can be customized with graphical views of the most valuable searches. Once there is a defined collection of operational data from your Azure VMs and activity logs, powerful searches can be performed.

Visualize data. Log Analytics dashboards can visualize saved log searches, providing the ability to find, correlate, and share IT operational data.

Get data alerts. Alerts in Microsoft Azure inform IT administrators about important information in your repository. They are created by alert rules that automatically run log searches at regular intervals and match certain criteria. With Action groups,

advanced actions can be performed with alerts, such as creating an email notification, launching an automation runbook, or creating an incident record in your ITSM incident management system.

Tools for security and management

For more information about security and management tools, explore these resources:



Azure Security Center. Apply security policies across workloads, limit exposure to threats, and detect and respond to attacks.



[Learn more](#)



Azure Log Analytics. Centralize log data from multiple systems in a single data store.



[Learn more](#)



Azure Monitor. Get detailed, up-to-date performance and utilization data; access to an activity log that tracks every API call; and diagnostic logs that help you debug issues in your Azure resources.



[Learn more](#)

09.

Summary

The key to a successful cloud database migration is breaking the process into steps—regardless of why your organization wants to move or how complex your current environment is.

You can use the information outlined in this e-book to start with a few databases, and then continue to expand to more of your environment.

First, you need a clear plan that takes into careful consideration your servers, VMs, databases, and workloads—and what's required for these to function in the cloud. Along with this assessment, you need to

determine your true usage of resources and analyze any configuration dependencies. Then, as you move forward with database migration, you need to make sure that your databases in the cloud are in sync with any on-premises system in real time. Along with this, you'll want to test the health of your system so that your final cutover is smooth. Finally, you should continue your cloud journey by pursuing even greater cost efficiency through optimization and by keeping your workloads operating securely at peak performance.

The benefits of migration can be immediate in terms of time and budget. The cloud can help you be more agile and, in many cases, help you respond to business needs faster. The cloud can help you in reducing your TCO, freeing you to take that massive savings and invest it back into your business to drive faster modernization. Plus, you can explore PaaS and SaaS options, decreasing your TCO even more while expanding your IT capability.

Pay less with Azure

AWS is five times more expensive than Azure for Windows Server and SQL Server.

For more information, see [Azure vs. AWS Cost Comparison](#).

Whether you're in the early stages of assessment or planning your approach, keep in mind that database migration is easier with a trusted provider like Microsoft. Through integrated tools, a strong partner ecosystem, and rich guidance, you can tread a well-forged path to minimize risk and possible negative impact to your business.



To learn more about options that can meet your unique database migration needs, visit the [Azure migration center](#).

10.

Additional resources

Database migration

[Choosing your database migration path to Azure](#)

Get Pluralsight training

[Assessing and Planning Microsoft Azure Migration](#)

[Microsoft Azure Architecture—Getting Started Designing Migrations for Microsoft Azure](#)

Compare costs

[Estimate the cost savings you can realize by migrating your workloads to Azure. Check out the Total Cost of Ownership \(TCO\) Calculator.](#)

[Pay less with Azure.](#) Learn about how AWS is five times more expensive than Azure for Windows Server and SQL Server.

Sources

¹By migrating to the cloud, you can save more than 80 percent over the total cost of running a traditional solution on-premises. See [Migrating VMware to Microsoft Azure: Total cost of ownership guidance](#).

²[Read the customer story](#)

³VM sizing calculations from the [Microsoft Azure TCO calculator](#).

⁴[Read the customer story](#)

© 2019 Microsoft Corporation. All rights reserved. This document is provided "as is." Information and views expressed in this document, including URL and other Internet website references, may change without notice. You bear the risk of using it.

This document does not provide you with any legal rights to any intellectual property in any Microsoft product. You may copy and use this document for your internal, reference purposes.