Microsoft Azure

Cloud Migration:

Tips and tricks for
migrating Windows and
SQL Server Workloads

Contents

Introduction

In recent years, there's been a rapid acceleration in the adoption of infrastructure as a service (IaaS) and, consequently, a shift in the type of on-premises activities being migrated to the cloud.[1]

Many organizations now want to take advantage of cost efficiency, scalability, security, and other benefits the cloud offers. Datacenters are expensive, with the costs of real estate, power, servers, storage, and networks, plus operations staff tugging at a company's bottom line. It's no wonder that organizations see the cloud as a way to reduce—or even eliminate—some or all of these expenses.

This is especially relevant for organizations that are running on-premises versions of Windows Server operating systems (OS) and SQL Server database systems as they can be held back by the capacity and limitations of their physical datacenter.

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[1] The Total Economic Impact™ of Microsoft Azure IaaS. A Forrester Total Economic Impact™ Study Commissioned by Microsoft, August 2019.

Migrating to the cloud can provide operational and cost efficiencies. Further, it facilitates more flexibility and scalability—or the ability to command growing or diminishing resources to meet business demands—without the worry of infrastructure management. The public cloud also offers advanced security technologies to protect organizations against an ever-changing threat landscape.

While the benefits are worthy, the migration journey can be complex. When you are in a position to move to the cloud, it is essential to have sound guidance—from strategy definition and planning, to governance and management—and every step in between.

To perform migration, you need to determine how to:

Define business justification and create the initial cloud migration plan.

Assess your on-premises environment to understand what workloads and applications you want to migrate.

Perform the migration with limited impact to the business.

Govern and manage cloud resources after migration, making the most of your investment and keeping it secure.

This cloud migration guide is designed for IT professionals running on-premises applications, databases, and server, including Windows Server and SQL Server. It's intended to assist them on their cloud migration journey from on-premises to the cloud.

In this guide, you'll discover:

✔ Comprehensive guidance with best practices and recommended tools and services.

✔ Preliminary steps to consider in preparing on-premises and cloud environments when looking at migration.

✔ Migration strategies, including rehosting, refactoring, rearchitecting, rebuilding, and replacing your workloads in the cloud.

✔ How to accelerate your migration to drive desired migration outcomes.

✔ Tips for governing and managing migrated workloads after migration.

Migrating to the cloud doesn't have to be difficult. With the right tools and best practice guidance, your migration project can be fast and friction-free. An optimal migration approach can reduce costs immediately and allow you to focus on future cloud modernization. Customers using Windows Server and SQL Server on-premises value the hybrid capabilities of Azure as they move to the cloud—they provide maximum flexibility while keeping workloads secure and resilient no matter where they reside. In addition, processes for assessment, optimization, security, and management can help throughout your continuing adoption of cloud resources.

Our goal with this guide is to provide you with strategies and steps for planning and executing your cloud migration. As we do so, we'll introduce concepts from the Microsoft Cloud Adoption Framework for Azure, a proven methodology that has helped many customers in their cloud adoption journey. If you're still in the process of choosing a cloud vendor or may have an intentional multi-cloud strategy, this framework provides cloud-agnostic guidance for strategic decisions whenever possible.

Using this e-book, you can get started with aligning people, business strategies, and technology in your organization, driving desired business outcomes, and delivering fast results with control and stability.

"By migrating workloads to Azure, we've already closed or moved three of our datacenters, one of which was in Singapore. It's much easier for us to manage systems in Azure than hardware in a datacenter half a world away."

Peter Tomlinson, Director of IS, Technology Operations, Allscripts

Read the customer story >

Why migrate now?

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

There are many benefits of the cloud, including reduced running costs, faster modernization capabilities, and increased security. But there's usually a specific catalyst for starting the migration discussion. These can include:

Datacenter lease renewal or hardware refresh. If you're currently extending your budget on renewing hardware or paying 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.

Licensing renewal. Nearly all companies have an annual licensing agreement with their major IT providers. These require ample budget to ensure the OS and virtualization are sufficiently covered. The cloud can help here as well, providing a pay-as-you-go offering to reduce this cost.

Software end of support. Organizations sometimes find that the software they are using is reaching an end-of-support date. For example, Windows Server 2008 and SQL Server 2008 both have reached end-of-support life cycles, which means the end of regular security updates. This can be an opportunity to migrate your end-of-support workloads to Microsoft Azure and get extended-support security updates for up to three years after the product's end-of-support date. Migrating your workloads can help you to strengthen your organizational security posture and ensure compliance across your hybrid environment.

Increased 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.[2]

Decreased time to market. By reducing management overhead and freeing up budget, you can focus more time and effort on rapid software and solution development. Faster deployment of IaaS and platform as a service (PaaS) allows your business to release faster and more often.

Support for urgent capacity needs. When you plan for peak usage through on-premises systems, your servers are typically under-utilized, as you need more capacity to accommodate spikes when they occur. The cloud releases you from this model, enabling a scale-when-you-need-it approach.

Application innovation. 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 provides an integrated platform for modern development that can increase efficiency of developers and rate of team efficiency by 50 percent.[3]

Ultimately, by migrating your current environment to the cloud, you're putting yourself in a better position to accelerate your business. By reducing costs and making management more efficient, a cloud platform can immediately influence your IT group's ability to invest back into core strategic projects, increasing security and reliability while advancing development.

When business drivers and timing align, it is time for cloud migration—and Azure can help save money and improve efficiency. In the next section, we touch upon migrating with the Microsoft Cloud Adoption Framework.

[2]   VM sizing calculations are based on the Microsoft Azure TCO Calculator, which is available at: https://www.tco.microsoft.com/

[3]   The Total Economic Impact™ of Microsoft Azure Serverless Platform. A Forrester Total Economic Impact™ Study Commissioned by Microsoft, July 2019.

Why Azure

Migrate efficiently on your own terms

Optimize costs and migrate with confidence
Save money with the most cost-effective offers for Windows Server and SQL Server. Confidently migrate your workloads to Azure with best practices, expert guidance, and cost optimization tools.

Stay secure and resilient across hybrid environments
Protect workloads across your hybrid environments with intelligent security services backed by 3,500 cybersecurity professionals. Use built-in resiliency to avoid costly business interruptions.

Scale your workloads and applications on demand
Increase agility with best-in-class Azure infrastructure that scales to your business needs. Reduce operational burden with fully managed application and database services in Azure.

Realize significant savings with Azure Hybrid Benefit
Make the most of your existing on-premise licensing investments for Windows Server and SQL Server with Hybrid Benefit.

Cloud migration triggers

Cash flow challenges

Cybersecurity threats

Business continuity

Rapidly scale web apps and infraestructure

Datacenter contracts expiry

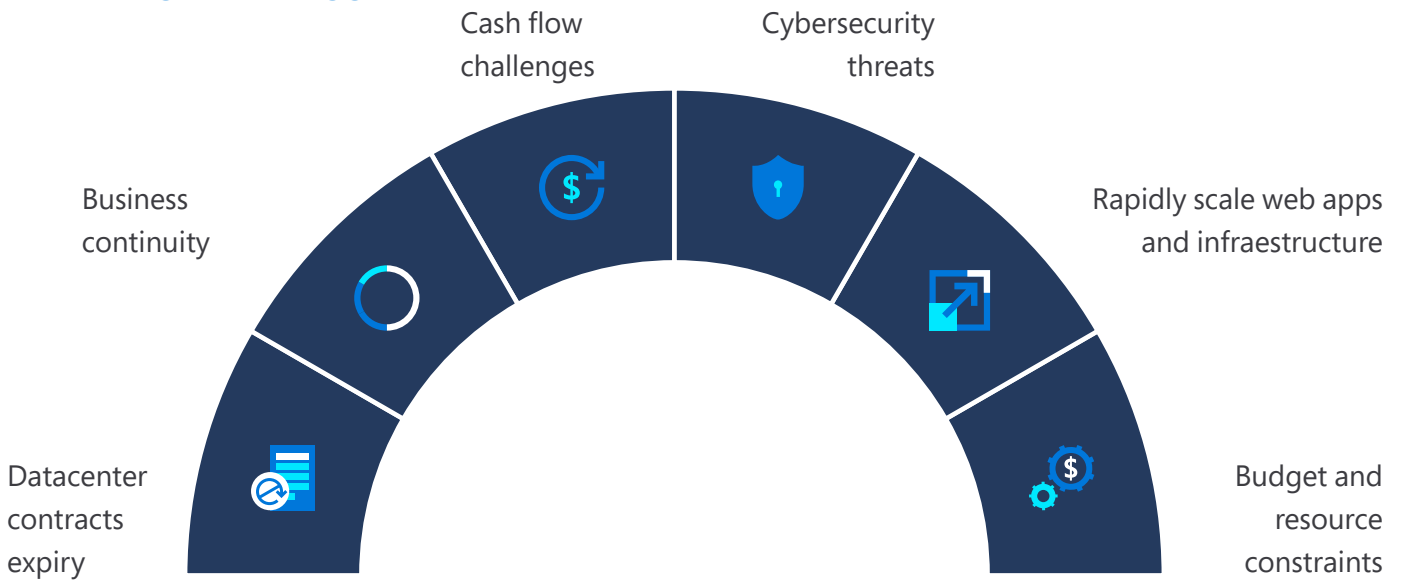Budget and resource constraints

Figure 1. Common migration triggers

In addition to the factors that trigger your move to the cloud, you should consider the range of workloads and applications that can be migrated. As an example, below are just a few of the common workloads that customers migrate to Azure.

Cloud migration projects

Windows Server

SQL Server

Linux and open source database

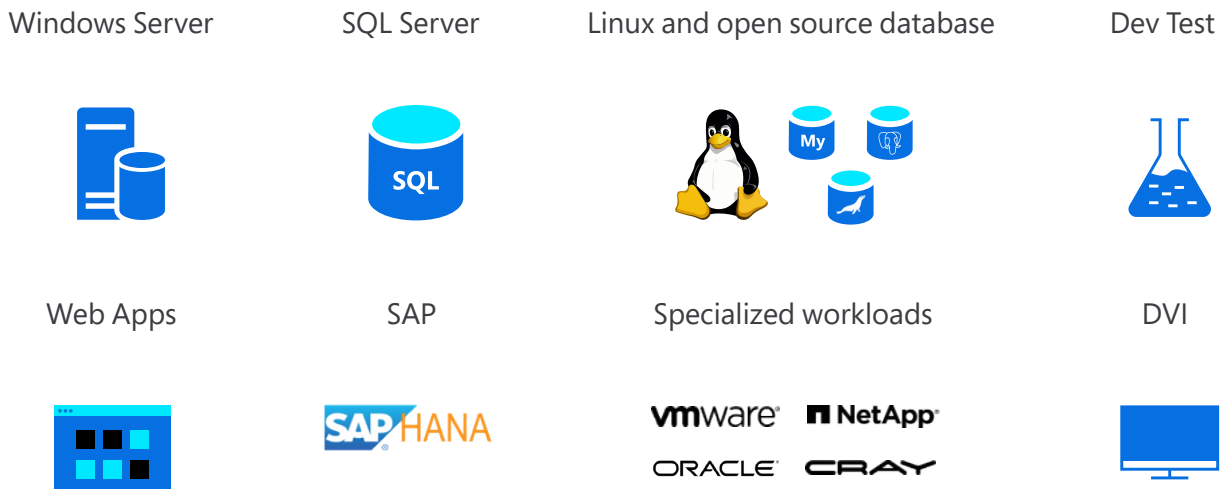Dev Test

Web Apps

SAP

Specialized workloads

DVI

Figure 2. Common migration projects

When business drivers and timing align, it is time for cloud migration—and Azure can help save money and improve efficiency. In the next section, we touch upon migrating with the Microsoft Cloud Adoption Framework.

Migrating with the Microsoft Cloud Adoption Framework

Every organization has its own reasons for migration. Whatever your reasons are, you can achieve your goals successfully by following a well-structured approach that addresses your various business, technical, and organizational needs.

This requires a cloud provider (and core partners) that can deliver a comprehensive set of tools and methods to help simplify and accelerate migration and reduce overall risk.

Most of all, you need a simple process that's easy to follow. You can simplify your cloud adoption journey by breaking it into phases. The steps you take should allow you to get a clear picture of your overall migration readiness and your entire application and workload portfolio—and the best way to configure that portfolio to achieve migration.

The Microsoft Cloud Adoption Framework provides proven guidance, best practices, tools, and templates to support your adoption journey through the different phases. The guidance covers strategy and planning, as well as the ongoing governance, optimization, and management of the migrated workloads. With this proven approach, you can execute your migration project with confidence.

In the following chapters, we'll discuss migration phases that have helped others move to the cloud and provide you with considerations for each phase.

Migration planning and execution

Define strategy

Executive sponsorship
Stakeholder alignment
Partner engaged

Plan

Discovery and
assessment
TCO/Business case
Migration plan

Ready

Technical skilling
Landing zones

Adopt

Migration
execution

Migration waves
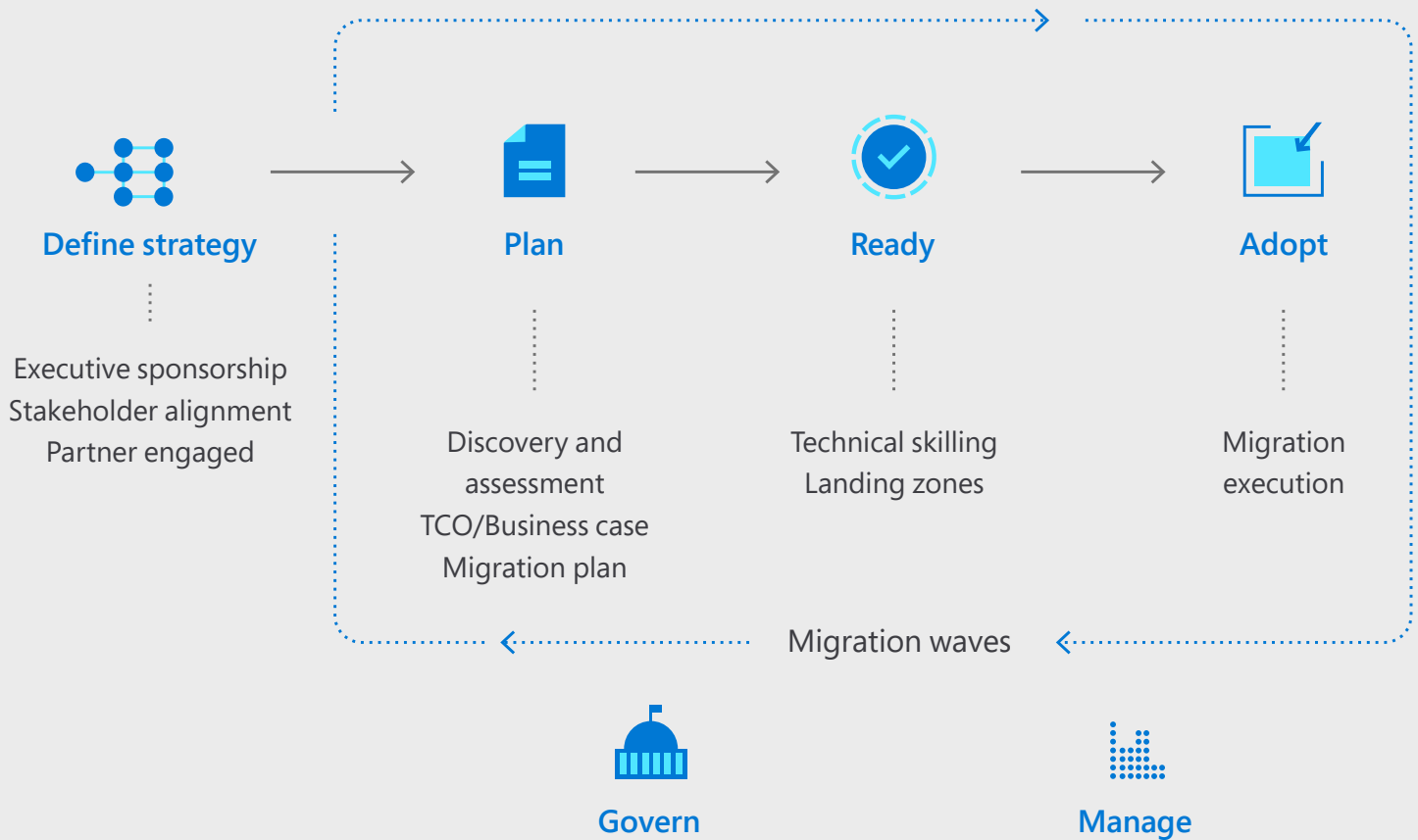
Govern

Manage

Figure 3. Common migration journey

Define strategy

The cloud delivers fundamental technology benefits that can help your enterprise execute on multiple goals.

To take advantage of this potential, you need to document your strategy in a way that's both understandable to cloud technicians and palatable to your stakeholders, illustrating the reasons your organization should migrate to the cloud.

Defining your strategy starts with initial exploration of the concept of cloud adoption and culminates in a more specific business case and commitment from leadership.

Executive sponsorship

To get commitment from leadership to pursue migration, you need to spell out your migration drivers. Establish the root business case for migration, along with the urgency and timelines associated with it. Within this business case, it's important to distinguish between business drivers, technical drivers, and timeline drivers, as your approach to the migration can shift.

In getting buy-in from executive leadership, you should set a strategy to ensure success, consisting of the following:

• Guidance on why the organization is migrating

• Assigning people and teams

• Allocating budget (with expectation to refine later)

Stakeholder alignment

Since migration involves coordination between multiple functions, it's important to achieve alignment. Being able to speak in terms of business outcomes supports transparency and cross-functional partnerships. To succeed, you need to count on the right level of support from IT, security, and other areas of the business—most importantly, the application owners who will be affected.

To maintain application owners' support throughout the migration effort and to avoid any surprises, include them in early planning exercises and reinforce the benefits of their application being hosted in Azure. IT infrastructure groups (for example, networking, security, identity, etc.) should also be part of design and planning discussions.

Engage your partner

Another part of your strategy is determining when to enlist external support for your migration.

Your cloud adoption team performs the actual migration of workloads to the cloud. To define the digital estate or build the core cloud infrastructure, the team executes a repetitive series of collaborative and problem-solving tasks.

With the Microsoft partner system as a resource, you are empowered to identify what tasks to perform with your in-house IT teams, and what tasks may require expert assistance. Work with your existing Microsoft partner if you have one, or find a Microsoft partner to leverage their deep expertise in the planning and execution of migration projects. They can help your cloud adoption team overcome any execution anomalies, so migration proceeds quickly and without missteps.

We recommend working with Azure Expert Managed Services Providers or other specialized partners, as they have deep cloud technical know-how, consistently deliver customer success, and are validated each year by an independent auditor.

Plan

When beginning a migration, you first need to know what you're dealing with. That means getting a better understanding of what your applications are, how many servers and/or VMs you have, and how you'll move these components to the cloud.

Once you understand those aspects, you also need to know how much it will cost.

Many workloads can run immediately on Azure without modification; other workloads, which have operational and application dependencies in an on-premises environment, require further analysis and planning. If your applications are composed of multiple servers or VMs, you should invest in consolidated planning to identify and shift them to the cloud. This isn't a manual process, and you need intelligent planning tools to do it.

Similarly, getting accurate cost comparisons can be challenging when you're estimating the load and Azure VM instances. Without automated analysis to map on- premises capacity to the VM instance, your estimations might fall short—causing performance issues. Or your estimations could be too high, stretching your budget.

Discover and assess digital estate

Before migrating a workload to the cloud, it's important to assess the workload and each related asset.

In an ideal migration, every asset (infrastructure, app, or database) would be compatible with a cloud platform and ready for migration. In reality, not everything should be migrated to the cloud, and not every asset is compatible with cloud platforms.

Ultimately, the goal of assessment is to collect information about servers, VMs, applications, and databases, including type, configuration, usage, and applications that might be running.

With cloud migration tools, you can not only assess your on-premises infrastructure, apps, and data readiness, but also analyze assessment data to map on-premises capacity to Azure VM instances and estimate cloud cost.

Azure Migrate provides a hub of tools and services to discover, assess, and migrate servers, databases, and virtual desktop infrastructure. It also seamlessly integrates with partner independent software vendor (ISV) offerings to provide additional capabilities.

Tool for understanding migration readiness

Start your migration journey by understanding your level of readiness for scale migration with the Strategic Migration Assessment & Readiness Tool (SMART).

This tool addresses your readiness across all dimensions of migration, from initial strategy to ongoing management. By answering a few questions, you'll get a customized report that will help you plan and close gaps.

Tools for assessment

To assess servers and VMs, [Azure Migrate](): [Server Assessment]() helps you discover and assess on-premises VMware VMs, Hyper-V VMs, and physical servers to determine whether they're ready for migration to Azure. Azure Migrate also allows you to export or download reports with discovery data for further decision-making.

For SQL database assessment, [Data Migration Assistant]() can help you in detecting compatibility issues that can affect database functionality in your new version of SQL Server or Azure SQL Database. It also recommends performance and reliability improvements for your target environment.

Discover on-premises infrastructure, apps, and databases

It's likely that your organization runs hundreds— if not thousands—of servers and VMs. While your current management tools might have a good representation of these, to kick-start any migration, you need an assessment mechanism that can feed data into subsequent steps.

Discovery is when you inventory your apps and the roles/features running on your on-premises machines. Discovering servers and VMs is usually a straightforward process. It relies on interaction directly with the endpoint (using an agent) or managing hypervisor (such as VMware vSphere or Microsoft Hyper-V).

Identify application and server dependencies

Once discovery is complete, you need to map any dependencies or communication between your servers (and applications).

Dependency analysis within Azure Migrate helps you to understand dependencies across machines that you want to assess and migrate. You typically use dependency mapping when you want to assess machines with higher levels of confidence and ensure all the components of an app are moved together. This is critical because when migrating an application, you need to know all the servers and processes the app is using.

Many tools provide server dependency mapping but don't provide application dependencies. To ensure a full picture of all communication among workloads, you need a tool that performs both. This allows you to create visual maps of all your applications and workloads, which enables their interaction as a single entity for costing, configuration analysis, and eventually migration.
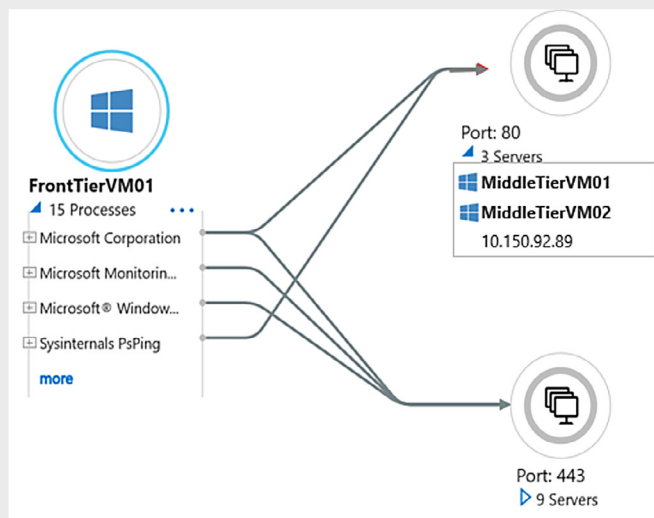
Analyze configuration

Assessment enables you to ensure that each workload will function on your cloud platform. Through the collection and analysis of data, assessment tools can give you metrics on the readiness of the workload in the cloud. For example, is the OS that the workload runs on supported? Or are there specific hardware dependencies that might not be replicated in a cloud environment (such as running a UEFI boot on a disk that's larger than 4 terabytes)?

Configuration analysis should show you workloads that will migrate with no modifications, those that might require basic modifications, and those that are not compatible in their current formation, as well as provide guidelines to remediate potential issues or recommend configuration changes.

Figure 4. Visualize dependencies

Figure 5. Export dependency data

Plan costs

The final stage of this assessment is collecting resource usage reporting (such as CPU, memory, and storage). This is important because on-premises VMs are often over-provisioned, but underutilized. If you were to take the physical configuration of your on-premises server and map this to an Azure VM series type, you'd likely find that you're paying for more performance and scale than you need.

Because the cloud is costed as a usage model, you should ensure your choice meets both performance and economic targets. The goal in any cloud model is to drive your VM's efficient levels of utilization, while making sure you meet performance and reliability goals. Through historic resource analysis, intelligent cost analysis tools can determine the actual usage of your workload and suggest the best cloud Azure VM series to use.

If your workload is running on Windows or using SQL Server as a database, migrating to Azure can maximize the benefits. The assessment solution can identify where programs such as Azure Hybrid Benefit, reservations for cloud resources, and extended security updates best fit into your migration to improve your budgeting and forecasting.

Tool for cost planning

The Azure TCO calculator helps you build a customized cloud assessment business case to support an Azure migration. Be sure to include all your hardware, software, facilities, and the cost of the team that currently supports your on-premises environment. You have the option to modify any assumptions so that the model accurately reflects your business. The result is a detailed report that shows how much money you can save by moving to Azure.

The Azure Hybrid Benefit enables you to save big on Azure by leveraging your existing on-premises licensing investment.

For more planning resources and calculators, try these Azure cost planning tools.

To evaluate the potential cost savings of migrating to Azure, calculate and compare your total cost of ownership (TCO) for Azure with that of a comparable on-premises deployment. Additionally, create an estimate of costs for the migration project, including professional services, development, and training for your team.

The TCO estimate and business case should be essential to the assumptions for migration planning. You can always refine these later as the team works through migration.

Migration plan

Using your application inventory, prioritize your applications into a migration plan based on dimensions such as business priority and complexity. Then define the core team who will execute migration and define the right approach for your business case.

Align migration team

An important aspect of any cloud migration plan is aligning the people who will make the plan a reality. To create a balance between speed and control during cloud migration, you should have people accountable for cloud adoption and cloud governance. This might be a team of people sharing responsibilities for each area or capability. Or you might assign individual people to be responsible for the outcomes and the work.

Once you're done with the team structure alignment for your cloud migration plan, the next step is to map specific people to the necessary capabilities. To do so, answer the following questions:

- What person (or group of people) will be responsible for completing technical tasks in the cloud migration plan?

- Who will be accountable for the team's ability to deliver technical changes?

- What person (or group of people) will be responsible for implementing protective governance mechanisms?

- Who will be accountable for the defining those governance controls?

- Are there other capabilities or people that will have accountability or responsibility within the cloud migration plan?

Define migration approach

Your cloud migration strategy depends on many factors:

- What are your most pressing needs?

- What are the skills on your team?

- Where are your apps in the development life cycle?

Once you've decided on your migration goals and gathered all the requirements and constraints from your assessment, you're able to define your migration strategy. Choose the best method of migration that meets your business and IT requirements, such as workloads that don't require code

and app changes, workloads that require minimal changes before shifting to the cloud, or workloads that require modified and extended code and app functionality to take advantage of cloud technologies.

Your migration could require you to run parallel and iterative migration processes as you progressively move your apps and workloads to the cloud. Whether your migration is simple or complex, it's helpful to think of the basic elements of the process.

Migration strategies can be boiled down to four main categories: Rehosting, refactoring, rearchitecting and rebuilding. In addition, some organizations find it helpful to replace some applications with SaaS (software as a service) applications, rather than migrating older ones.
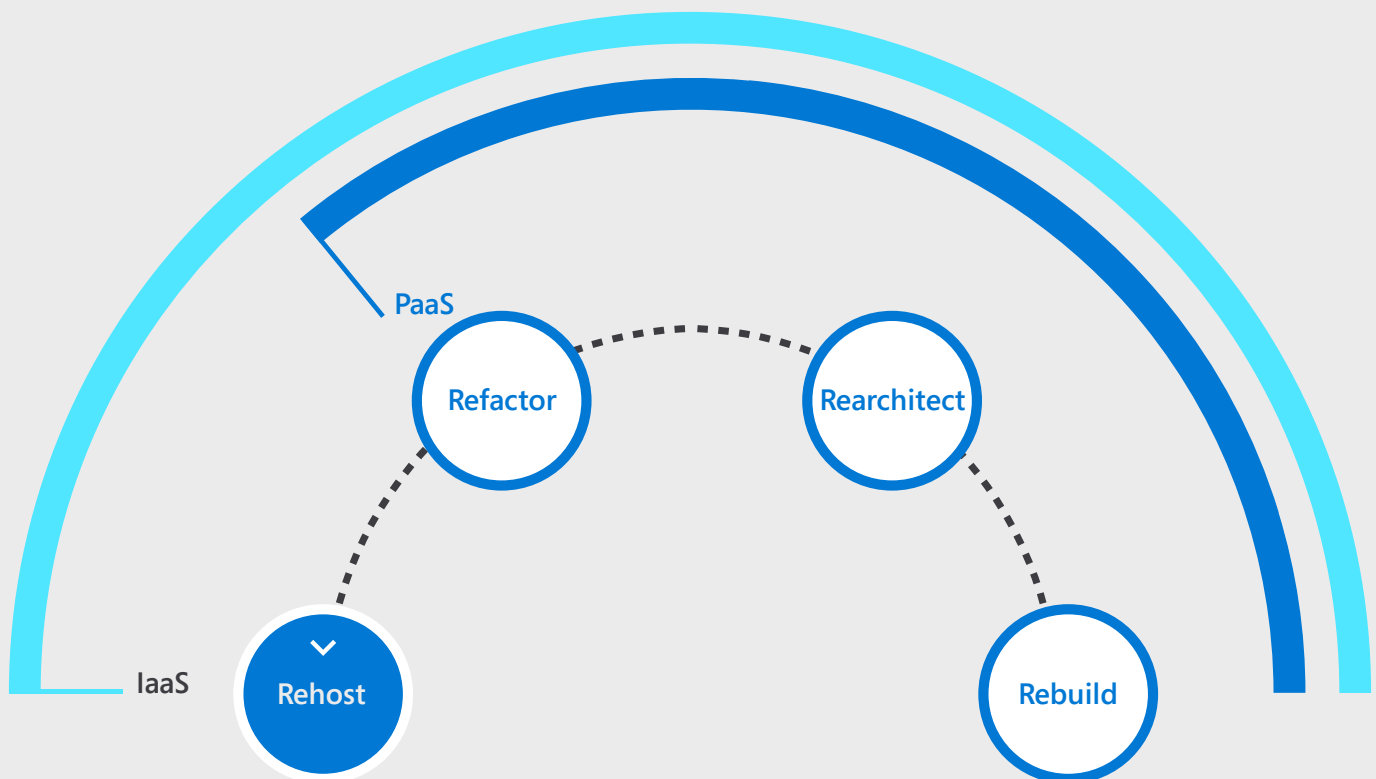

Figure 6. Migration strategies

Rehost apps and databases

Also referred to as "lift and shift," this strategy entails migrating your physical servers and VMs to the cloud just as they are, without any changes to the code.

By simply shifting your current server environment straight to IaaS, you reap the benefits of cost savings, security, and increased reliability. The advantages of this strategy include: moving quickly with no code changes, the ability to have a cloud provider manage hardware and operating systems, and realizing lower TCO quickly.

Rearchitect apps

The rearchitect strategy is also known as "redesigning" an application to modernize it—that is, to transform it with a modular architecture. Rearchitecting modifies or extends an existing application's code base to optimize it for a cloud platform and for better scalability. Cloud provider services can be used directly as back-end services of modern apps, which are highly scalable and reliable. The advantages include: improving agility by applying innovative DevOps practices, bringing new Azure capabilities to existing apps, and cost-effectively meeting scalability requirements.

Refactor apps and databases

Also known as "repackage," refactoring involves using additional cloud provider services to optimize the cost, reliability, and performance by refactoring your applications. Your application can take advantage of IaaS and PaaS products such as Azure App Service, Azure SQL Database Managed Instance, and containers. The advantages of employing modernized services in this scenario include: lower cost and management, using your current application as-is or with some minor code or configuration changes, and connecting to new infrastructure services.

Rebuild apps

The rebuild strategy revises the existing application by aggressively adopting PaaS or even SaaS architecture. The advantages of this strategy include: building new applications using cloud-native technologies, faster development if your existing application is slowing you down, innovation opportunities that take advantage of advancements in technology like AI, blockchain, and IoT.

Migration decision tree

Adopt a simple migration decision tree to drive decisions based on the company's priorities and requirements.

For example, if you are not planning on future development of your business application, you can select the rehost strategy and move the application quickly to IaaS. Or, if you want to realize the full benefits of the cloud over time and include future development with PaaS offerings, you can choose among refactor, rearchitect, and rebuild strategies.

Define migration timelines

Any cloud migration project should have a well-defined timeline for migration execution. Establishing timelines for estimating migration efforts requires project management capabilities, such as work breakdown structures (WBS), commonly used as a sequential project management tool. The WBS represents how dependent tasks will be completed over time.

For more flexibility, your team can employ agile and other iterative methodologies built on the concepts of iterations and releases. With an iterative approach, you can align efforts to the timeline and adjust the scope as the project requires. Iteration duration commonly depends on the type of technical effort, the administrative overhead, and the team's preference.
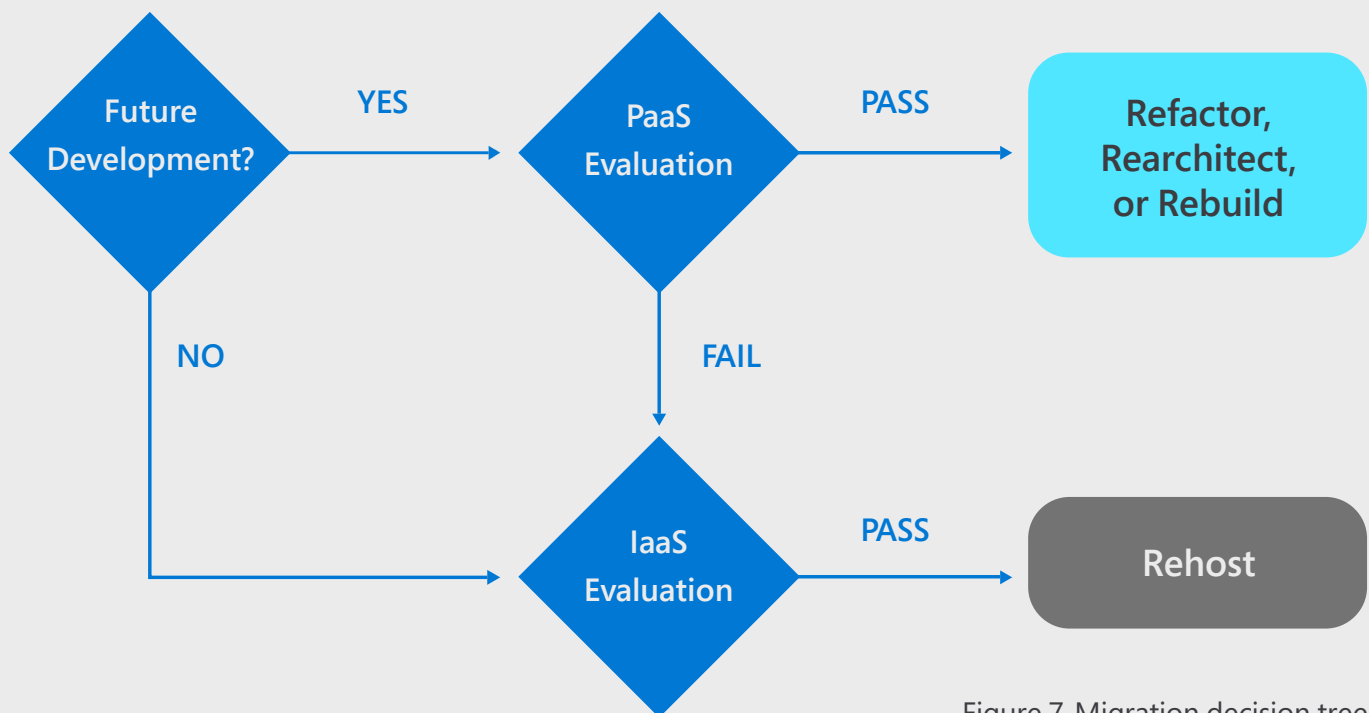
Figure 7. Migration decision tree

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Ready

In order to start building and deploying solutions using Azure services, you need to prepare your environment for the cloud adoption plan.

This can be accomplished by first organizing resources, controlling costs, and securing and managing your organization—and then keeping teams on track with a platform foundation and landing zones, which are explained later in this section.

Prepare your environment

Organize resources: Setting up a management hierarchy allows you to consistently apply access control, policy, and compliance to groups of resources and use tagging to track related resources.

Management groups

Subscriptions

Resource groups

Resources

Figure 8. Levels of management scope

Manage access: Use role-based access control to make sure that users have only the permissions they really need.Managing who can access your Azure resources and subscriptions is an important part of your Azure governance strategy, and assigning group-based access rights and privileges is a good practice.

Role

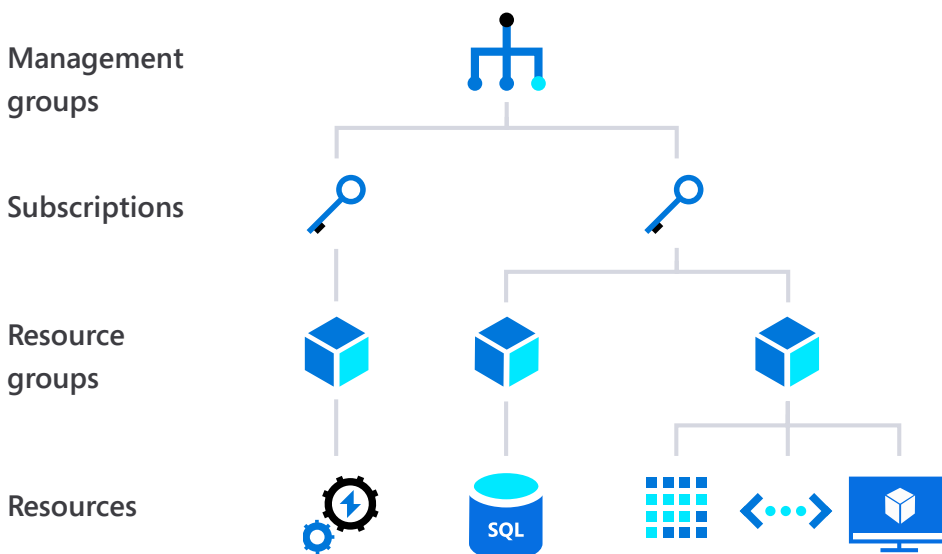|	Reader	Resource-specific or custom role	Contributor	Owner
Subscription	Observers	Users managing resources		Admins
Resource group				
Resource	Automated processes			

Scope
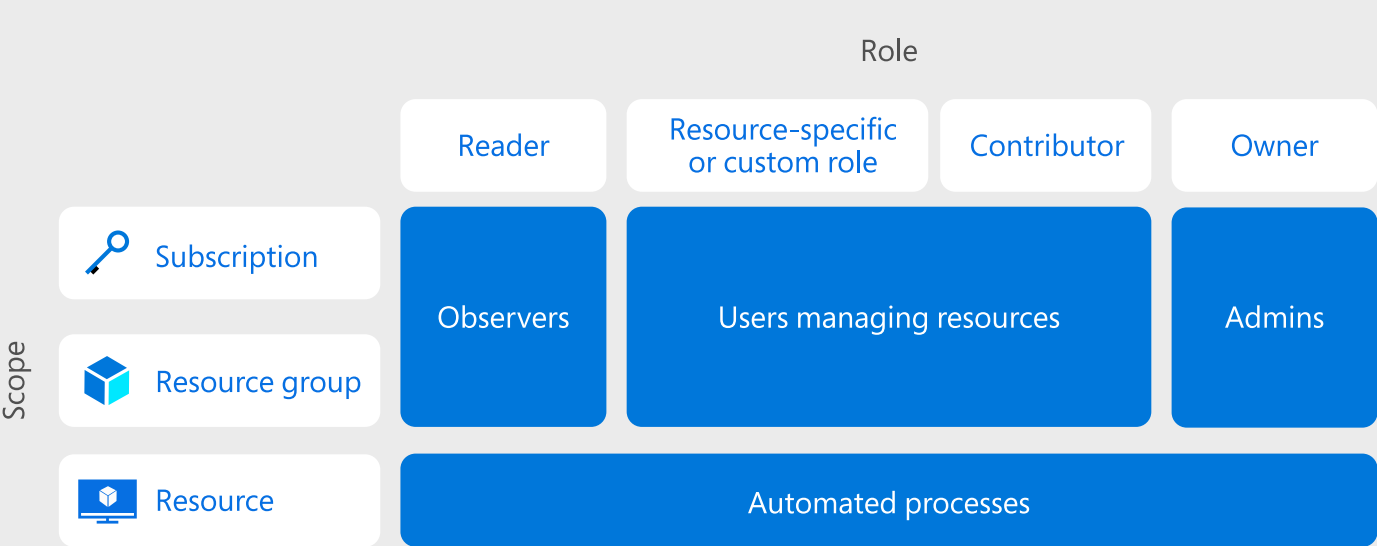
Figure 9. Pattern for assigning Azure role-based access control (RBAC)

Manage costs and billing: Identify your subscription type, understand how billing works, and learn how to control costs.

Azure Cost Management can help you plan with cost in mind. It can also help you analyze costs effectively and optimize cloud spending.

Plan for governance, security, and compliance: Enforce and automate policies and security settings that help you follow applicable legal requirements.

As you establish corporate policy and plan your governance strategies, you can use tools and services like Azure Policy, Azure Blueprints, and Azure Security Center to enforce and automate your organization's governance decisions.

Before you start your governance planning, use the Governance Benchmark tool to identify potential gaps in your organization's cloud governance approach.

Azure resources

Azure offers many services that together provide a comprehensive solution for collecting, analyzing, and acting on telemetry from your applications and the Azure resources that support them.

Azure Monitor provides a single unified hub for all monitoring and diagnostics data in Azure.

Azure Service Health provides a personalized view of the health of the Azure services and regions you use.

Azure Advisor is a free, personalized cloud consultant that helps you follow and implement best practices for Azure deployments.

Azure Security Center can help you monitor the security of your machines, networks, storage, data services, and applications.

Establish monitoring and reporting: Get visibility across resources to find and fix problems, optimize performance, and gain insight into customer behavior.

Landing zones: a primer

Infrastructure as code is a common requirement for most cloud adoption efforts. The shift to code-first environment creation can add a learning curve for team members, and impact operations, security, governance, and compliance. Deploying discrete, purpose-built landing zones helps to address those challenges and keeps the team on track with adoption plans.

Start with a platform foundation: A shared platform foundation supports all workloads in a specific cloud platform. It provides centralized controls for identity, security, operations, compliance, and governance to the landing zones—governing all workloads, and establishing a consistent baseline across the shared-architectural pillars of security, reliability, performance, cost, and cloud operations. It is critical to establish the platform foundation before deploying landing zones, because its centralized controls are shared across landing zones.

Build landing zones in your environment: A landing zone is the basic building block of any cloud adoption environment. The term refers to a logical construct that enables workloads to coexist on top of a platform foundation.

A landing zone is a segment of a cloud environment that has been pre-provisioned through code, and is dedicated to the support of one or more workloads. Landing zones provide access to foundational tools and controls, and establish a compliant place to innovate and build new workloads in the cloud, or to migrate existing workloads to the cloud. Landing zones use defined sets of cloud services and best practices to set you up for success.

The benefits of using the platform foundation and landing zones together include consistency across security, reliability, performance, cost and cloud operations. The combination also reduces the overhead that comes with maintenance, governance and compliance. Together, the platform foundation and landing zones capture everything that must be in place and ready to enable cloud adoption across the IT portfolio.

Additional landing zone resources

The Azure setup guide allows you to become familiar with the tools and approaches needed to create a landing zone. This provides guidance in choosing the most appropriate landing zone option, and establishing a code-based starting point for your first landing zone environment.

The Microsoft Azure Well-Architected Framework is a helpful reference for developers and architects who are deploying solutions within a landing zone, and wish to incorporate and build on the shared-architectural pillars when designing, building, or supporting workloads that run within a landing zone.

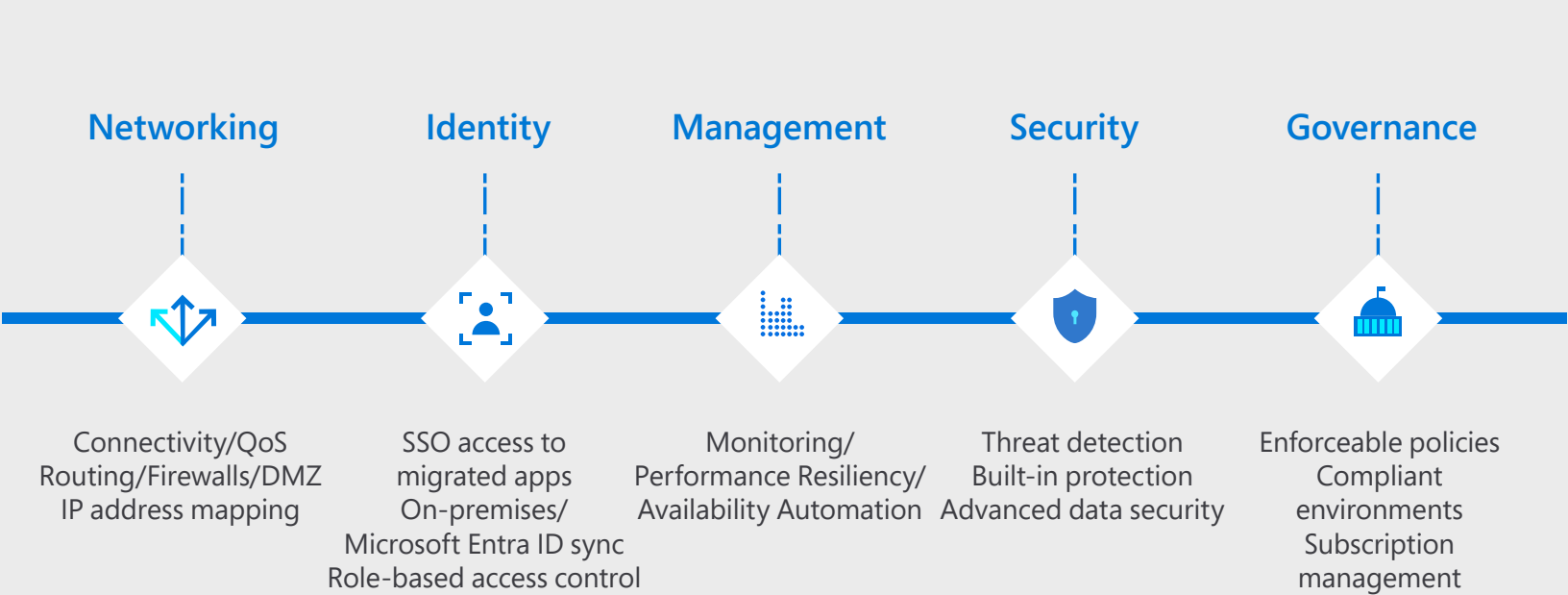| Networking	Identity	Management	Security	Governance
Connectivity/QoS Routing/Firewalls/DMZ IP address mapping	SSO access to migrated apps On-premises/ Microsoft Entra ID sync Role-based access control	Monitoring/ Performance Resiliency/ Availability Automation	Threat detection Built-in protection Advanced data security	Enforceable policies Compliant environments Subscription management

Figure 10. Landing zone blueprints

Migrate

While many core 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.

It's also essential to put a well-designed landing zone in place at the onset of a migration project, consisting of setting up networking, identity, management, security, and governance.

As with the earlier phases of the framework, you can tackle readiness by breaking it into parts:

- Develop skills for your cloud migration teams.

- Create a landing zone to host the workloads that you plan to build in the cloud or migrate to the cloud.

Technical skills

Prepare your teams with the cloud skills necessary to migrate workloads and operate them once in Azure. Microsoft Learn has free, self-paced learning so your teams can get the necessary skills for executing migrations. For those new to Azure, we recommend starting with Azure fundamentals. These migration resources will further help your teams prepare for migration and post-migration duties.

Microsoft offers a range of Azure training courses, certifications, and exams with different levels and specializations. Aligning with the roles that will make up your migration team, these programs can help you build skills in your team as well as identify suitable candidates when hiring.

Grow your skills with Microsoft Learn

Microsoft Learn further helps with skills readiness challenges by providing unique learning paths focused on job roles. Microsoft Learn 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. Best of all, it's free.

Explore the following learning pathways:

Explore Microsoft Azure Cloud Concepts

Plan and implement data platform resources

Migrate application workloads and data to Azure

Deploy and configure Windows Server IaaS Virtual Machine

Migrate your relational data stored in SQL Server to Azure SQL Database

Implement Windows Server hybrid cloud management, monitoring, and security

Now it's time to begin your migration to the cloud. Earlier in the guide we described the strategies that you can use for migration—progressing from rehosting your apps to refactoring and rearchitecting, and finally to modernization.
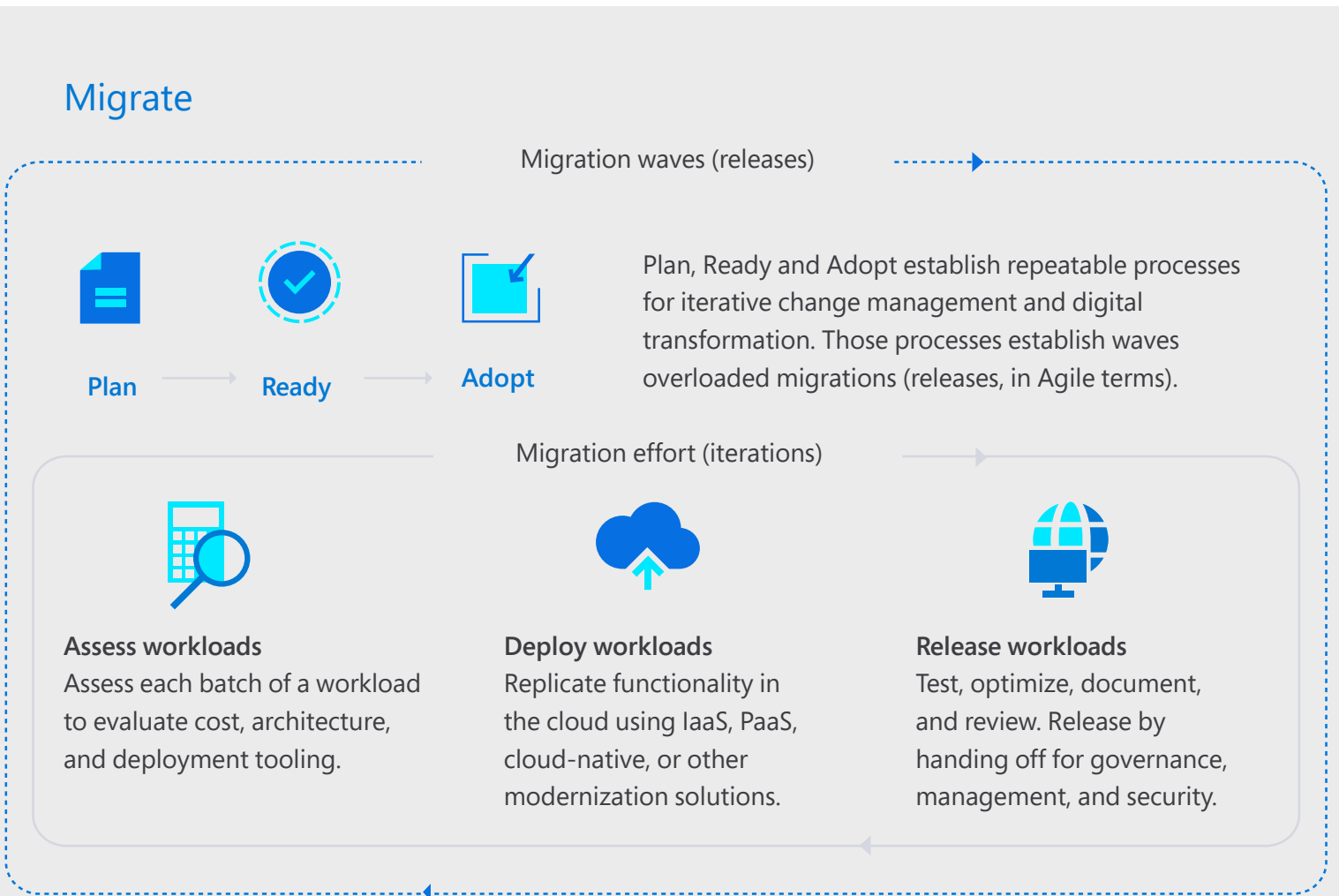
Determine the strategy that best meets your requirements—this is usually addressed on a per-application basis. A per-workload basis is equally important. It is lower risk, allows for learnings, and lets you choose the appropriate migration method for each workload. Learning about migration scenarios is a vital step in the process.

In many cases, organizations will start with lift and shift to drive rapid migration and early cost savings. Let's focus on the rehost strategy—moving applications running on traditional servers and VMs to Azure IaaS. Rehost requires no change in an app, workload framework, or architecture; it simply means hardware and OS are managed by the cloud provider.

Begin the migration waves with your first workload to Azure. You should become familiar with the tools and approaches needed to scale adoption efforts. As you get familiar with cloud migration, you can increase levels of complexity to simplify and automate the migration process—such as DevOps, infrastructure as code, and so on. Using a gradual migration approach allows your organization to become more comfortable with migration as you progress through the project. In completing the project later, you can migrate the more complex applications.

Azure Migrate is a central hub to discover, assess, and migrate workloads to Azure. Let's detail the steps required for using it to rehost your application workloads.

Migrate

Migration waves (releases)

Plan → **Ready** → **Adopt**

Plan, Ready and Adopt establish repeatable processes for iterative change management and digital transformation. Those processes establish waves overloaded migrations (releases, in Agile terms).

Migration effort (iterations)

Assess workloads
Assess each batch of a workload to evaluate cost, architecture, and deployment tooling.

Deploy workloads
Replicate functionality in the cloud using IaaS, PaaS, cloud-native, or other modernization solutions.

Release workloads
Test, optimize, document, and review. Release by handing off for governance, management, and security.

Figure 11. Migration waves

Replicate workloads to Azure

Replication is the first step of the Migrate phase, where you migrate on-premises VMs by copying them across to Azure. Asynchronous or synchronous replication ensures that live systems can be copied to Azure with no downtime. Most of all, systems must be kept in lockstep with on-premises counterparts. This means that while you're building and executing your migration plans, any data or server updates are synced between the copies.
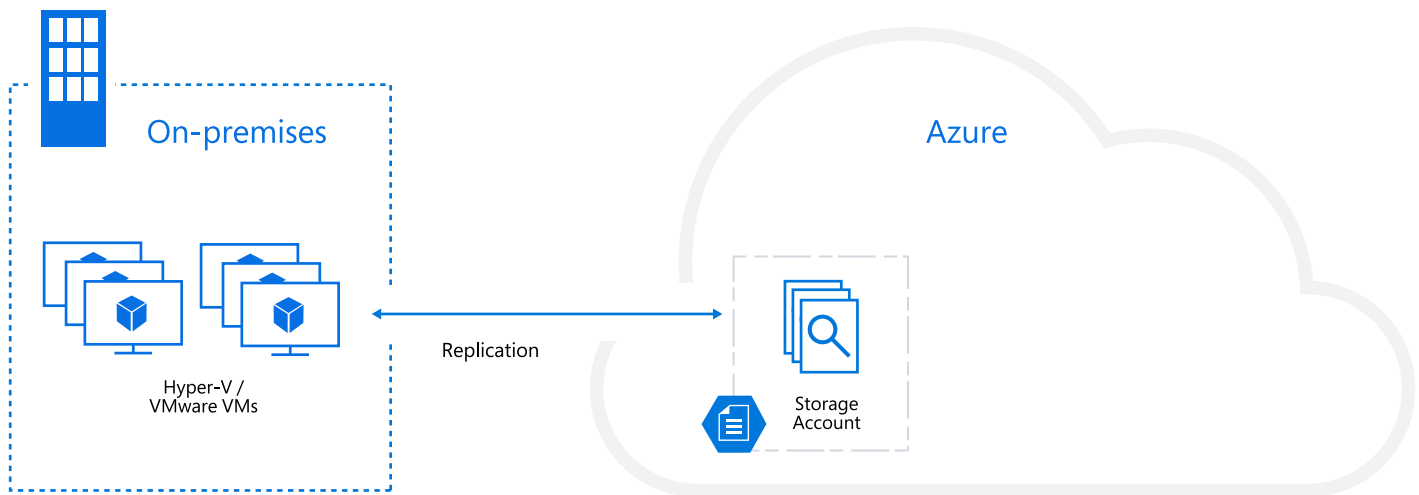

Figure 12. Replication with Azure Migrate

This model is also useful for connecting groups of VMs, such as a multi-tiered application or workload, during migration. This is important for testing and the final migration cutover. Once you review the details, you're ready to start replicating the servers. The replication will keep the servers fully synchronized with the on-premises versions until you're ready to migrate and retire the on-premises versions.

Pulling in data and insights from the assessment, Azure Migrate can configure each VM to replicate to the correct VM instance in

Azure. This is also when you should define the storage and network connections that you set up when initially creating the environment.

Application-aware replication helps you easily migrate business applications with Azure Migrate, understanding the actual context of an application. You can automatically use this feature for commonly used Microsoft enterprise applications such as SharePoint, Dynamics, SQL Server, and Active Directory, plus apps from other vendors like Oracle, SAP, IBM, and Red Hat.

Tools for migration

To migrate servers and VMs, use the server migration tool in Azure Migrate. It helps you migrate on-premises VMware VMs, Hyper-V VMs, physical servers, other virtualized machines, and public cloud VMs to Azure.

Migrate your existing application databases with the Azure Database Migration Service, whether they are running on SQL Server, Oracle, DB2, MySQL, or PostgreSQL. It allows you to migrate databases to Azure as a VM, Azure Managed Instance, or directly to Azure SQL Database.

Test migration before final cutover

The next step of the Adopt phase is testing, which ensures system health before final cutover and that migration will work as expected. Test migration simulates the migration by creating an Azure VM using replicated data. Testing doesn't affect the on-premises machines, which remain operational and continue replicating. You can use the replicated test Azure VM to validate the migration, perform app testing, and address any issues before full migration.

To establish that workloads function as expected, you might want to test migrated resources in isolated partitions in Azure. With Azure Migrate, you can fully test a set of VMs in an isolated environment without affecting the on-premises or cloud production versions. After you've completed VM replication, and as you perform delta replication for the real-time replication, you can run a test migration for the VMs before running a full migration to Azure. We highly recommend that you do this at least once for each machine before you migrate it.
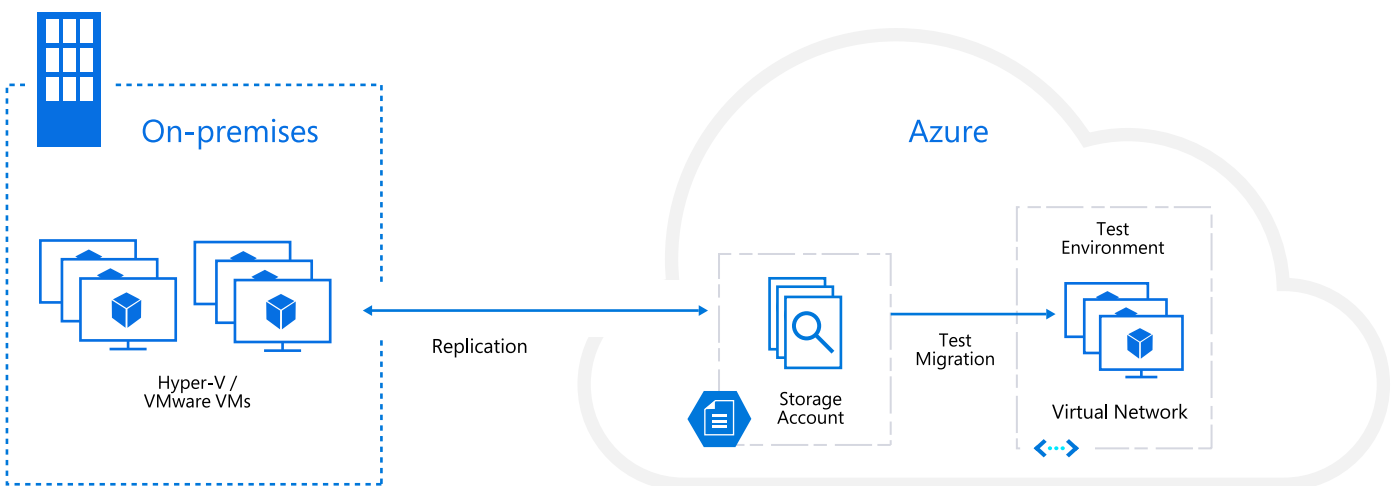

On-premises

Hyper-V /
VMware VMs

Replication

Azure

Storage
Account

Test
Migration

Test
Environment

Virtual Network

Figure 13. Test failover

Cutover to complete the migration

After you've verified that the migration works as expected through testing, it's time to perform the final cutover to migrate the on-premises machines. Azure Migrate can also perform the final launch in your cloud and turn off the on-premises application. In some cases, you'll have to update domain name system (DNS) records for the new cloud-based workloads. However, if you migrated using DNS in the cloud as part of your initial environment setup, this might happen automatically.
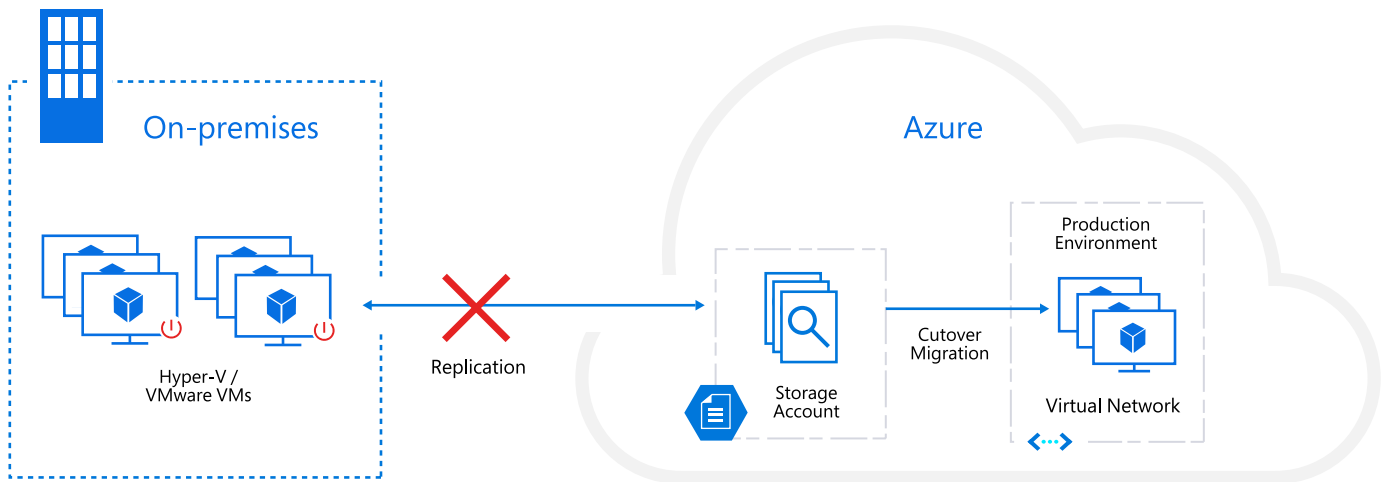

Figure 14. Final cutover

Decommissioning on-premises infrastructure

Once you've promoted a workload to production, the assets that previously hosted the production workload are no longer required to support business operations. At that point, the older assets are considered retired. Retired assets can then be decommissioned, reducing operational costs. Decommissioning a resource can be as simple as turning off the power to the asset and disposing of the asset responsibly.

Decommissioning is an important step when cost savings are your primary motivation for a migration. Until an asset is decommissioned, it continues to consume power, environmental support, and other resources. After retired assets are decommissioned, migration is complete.
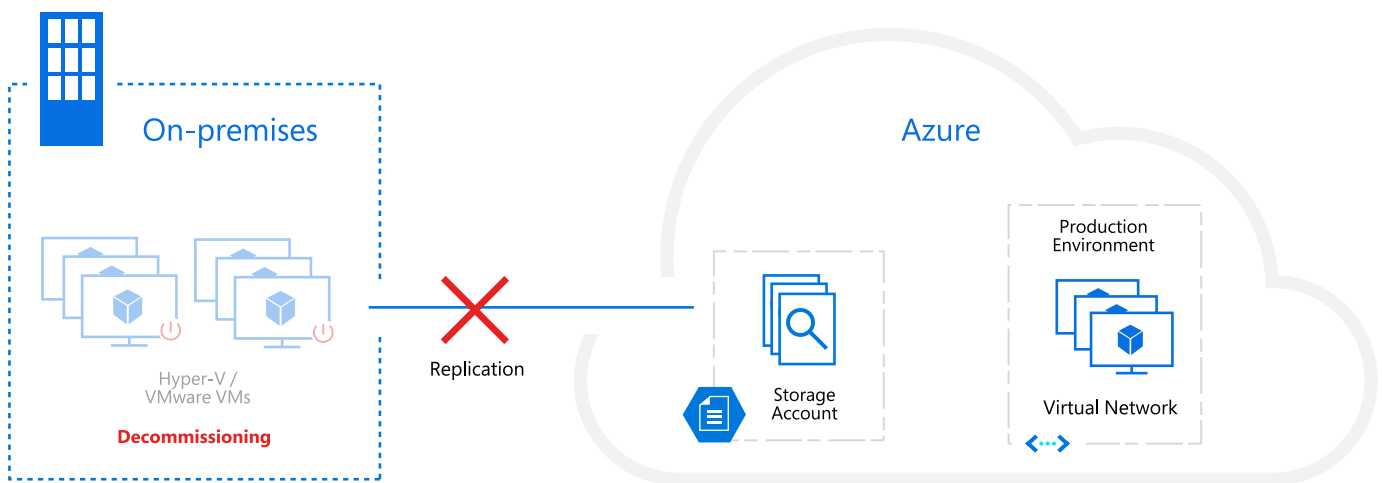

Figure 15. Decommissioning

Innovate through cloud capabilities

Now that you've migrated your application workloads to Azure, you have a chance to unlock and expand business capabilities through cloud adoption-related innovation. By developing a new innovative solution, you can modernize existing apps or create new solutions for your core business processes, ultimately driving business value.

Govern

Governance and compliance are required throughout a migration effort. But those efforts don't end with migration. Once you've migrated, you'll want to keep your VMs continuously secure, protect your data, and monitor your cloud health.

Governance provides mechanisms and processes to maintain control over your applications and resources in the cloud. It involves planning your initiatives and setting strategic priorities.

To begin with, identify key areas of importance during and after migration. These areas should relate to the different types of risks your company must address as it adopts the cloud service—and actions your cloud governance team should take.

Consider these principles of the governance model:

Corporate policies drive cloud governance. Governance focuses on specific aspects of corporate policy, including identifying business risks, converting risks into policy statements, and ensuring adherence to the stated policies.

Five disciplines of cloud governance. The disciplines are cost management, security baseline, resource consistency, identity baseline, and deployment acceleration. Each discipline supports corporate policies and protects your company from potential pitfalls.

Tools to govern

The Governance Benchmark Tool provides a first step to identify your organization's governance needs and get recommendations. This is a questionnaire-based tool designed to help you identify gaps in your organization. It provides a personalized report that outlines the difference between your current state and business priorities, and tailored resources to help you get started.

Govern

Define corporate policy

Business risks

Document evolving business risks and the organization's tolerance for risk, based on data classification and application criticality.

Policy & compliance

Convert risk decisions into policy statements to establish cloud adoption boundaries.

Process

Establish processes to monitor violations and adherence to corporate policies.

Five disciplines of cloud governance

Cost management

Evaluate and monitor costs, limit IT spend, scale to meet need, create cost accountability.

Security baseline

Ensure compliance with IT security requirements by applying a security baseline to all adoption efforts.

Resource consistency

Ensure consistency in resource configuration. Enforce practices for on-boarding, recovery, and discoverability.

Identity baseline

Ensure the baseline for identity and access are enforced by consistently applying role definitions and assignments.

Deployment acceleration

Accelerate deployment through centralization, consistency, and standardization across deployment templates.

Figure 16. Corporate policy and disciplines of cloud governance

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Manage

Establishing good operational practices for your migrated workloads helps to avoid costly business disruptions and ensures your applications run optimally.

As with governance, management is an ongoing process. Well-defined guidance can help your organization in expanding your IT management and operations so that you're using secure, cost-effective processes and modern, cloud-first tools for your cloud-based solutions.

The business and technical approaches you develop are key to cloud management. These approaches include establishing and expanding the management baseline by defining the criticality classifications, cloud management tools, and processes required to deliver your minimum commitment to operations management.

Define business commitments by documenting supported workloads and cloud management investments for each workload. Also take into account the advanced operations for platforms or workloads that have a higher level of business commitment. These workloads might require a deeper architecture review to deliver on resiliency and reliability commitments.

For simplified and optimal cloud management and operations, you should consider:

Business alignment efforts, which aid in capturing the business impact and negotiating management costs. Alignment assures everyone that you're using the most appropriate operational management processes and tools.

Cloud operations disciplines, to establish levels of operations management. These disciplines support workloads and business commitments such as inventory and visibility, operational compliance, and protect and recover.

Tools to manage

Simplify your strategy for data protection with Azure Backup, which provides secure and cost-effective solutions to back up your data and recover it from the Azure cloud platform.

Use Azure Monitor to gain full visibility into your applications, infrastructure, and network. Azure Monitor provides a comprehensive solution for collecting, analyzing, and acting on telemetry from your cloud and on-premises environments.

Azure Well-Architected Review allows you to assess your workloads with respect to best practices, and offers actionable next steps.

Manage

Business alignment

Criticality

Document the criticality and relative business value of each workload.

Impact

Establish clear performance expectations and business interrumption time/value metrics.

Commitment

Document, track and report on commitments to cost and performance.

Cloud operations disciplines

Inventory & visibility

Establish a defined inventory of assets. Develope visibility into the asset telemetry.

Operational compliance

Manage configuration drift and standards. Apply management automation and controls.

Protect & recover

Implement solutions to minimize performance interruptions and ensure rapid recovery when needed.

Platform operations

Custiomize operations to improve performace of the common platforms that support multiple workloads.

Workload operations

Understand workload telemetry. Align workload operations to performance and reliability commitments.

Figure 17. Business alignment and the cloud operations disciplines

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Summary

Regardless of the reasons for migration or the complexity of your current environment, a successful cloud migration relies on separating the process into phases:

- **Define strategy:** Identify a specific business case and commitment from leadership for application migration.

- **Plan:** Create a clear plan that takes into careful consideration your servers, VMs, and workloads you want to migrate—and what's required for these to function in the cloud. Along with this assessment, determine your true usage of resources and analyze any configuration dependencies for your workloads.

- **Ready:** Prepare your on-premises and cloud environment for migration.

- **Migrate:** Before you actually migrate a workload (or several) to the cloud, make sure that your workloads are in sync with your on-premises system in real time. Along with this, test the health of your system so that your final cutover is smooth.

- **Govern:** Govern the environment and migrated workloads to ensure industry standards and regulatory requirements are addressed.

- **Manage:** Define management baselines and business commitments to achieve tangible business outcomes.

Using the information outlined in this guide, start with a few applications, then expand to more of your environment. Continue your cloud journey by pursuing even greater cost efficiency through optimization and keeping your workloads operating securely at peak performance.

The benefits of migration can be immediate in terms of time and budget. Moving your Windows Server and SQL Server workloads from on-premises to the cloud can help you be more agile and, in many cases, help you respond to business needs faster. Reducing your TCO allows 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 further while expanding your IT capability.

Whether you're in the early stages of assessment or planning your approach, the Cloud Adoption Framework offers an easier approach for migration. With free integrated services, programs, a strong partner ecosystem, and proven guidance from Microsoft, you can tread a well-forged path to minimize risk to your business.

Additional resources

- Accelerate and automate your migration—visit the Azure Migration and Modenization Center for helpful migration tools.

- Get the guidance and expert help you need at every stage of the cloud migration journey with Azure Migrate and Modernize. Migrate infrastructure, databases, and apps—and move forward with confidence.

- Find curated, step-by-step guidance from Microsoft experts and specialized migration partners based on the Microsoft Cloud Adoption Framework for Azure.

- Get trained for your migration with foundational and role-specific courses to develop new Azure skills and long-term organizational readiness.

- As an existing Microsoft customer, your account representative can help you assess your organizational situation and suggest cloud migration options that best fit your business needs. Contact them for assistance and guidance on your path to the cloud.

- Save big with Azure Hybrid Benefit.

↓

Take the next step

Try Azure for free >

Appendix: customer stories

The following customer stories illustrate how organizations of all sizes, across a variety of industries, are migrating their Windows Server and SQL Server workloads to Azure to help lower costs, improve operating efficiencies, and enable better flexibility and scalability on demand.

Allscripts

Industry: partner professional services

Organization size: large (1,000 – 9,999 employees)

Allscripts helps reduce development costs with Azure

Allscripts is a healthcare software manufacturer that serves physician practices, hospitals, health plans, and pharmaceutical companies. While maintaining six development and non-hosting datacenters around the world, it needed to reduce costs, simplify management, and increase security.

Allscripts decided to rehost its applications on Microsoft Azure due to its global datacenter footprint and security posture, particularly regarding healthcare regulatory compliance. Allscripts made the move in just three weeks and saw immediate time-to-market improvements and cost savings.

Part of Allscripts' savings came from migrating 600 on-premises VMs, most of which ran older editions of Windows Server and SQL Server. For these, Allscripts took advantage of the Azure Hybrid Benefit, an offer which lets customers reuse their existing on-premises Windows Server and SQL Server licenses in Azure and realize licensing savings of up to 82 percent.

Allscripts also saved on costly capital expenditures. Previously, the company attempted to launch a key software project designed to help doctors locate the lowest-cost drug prescription source for patients, but it failed to get off the ground because the cost of the development hardware alone was $900,000. By using Azure, the team was able to proceed with development, using cloud resources that cost just $34 a day.

"

By using Azure, we can proceed with all manner of clever ideas that were previously off the table because of high development costs."

Jeff Brady, Senior Program Manager, Azure Transformation, Allscripts

TraXall
France

Industry: travel & transportation
Organization size: medium (50 – 999 employees)

TraXall France realizes unique price advantages of Azure

TraXall France provides vehicle fleet management services to more than 70 key account customers, with more than 40,000 managed vehicles. When its diverse private clouds became too labor-intensive to maintain, TraXall France turned to Microsoft Azure for a secure, easily managed infrastructure and GDPR compliance.

One of the greatest benefits of moving to Azure is its pricing and flexibility. When TraXall France needs additional capacity, it makes a simple change to its Reserved Instances subscription. Reserved Instances are cost-effective, prepaid reservations for Azure resources at discounted rates. Choosing this option helped saved TraXall France between 30 and 40 percent of its Azure licensing costs over three years.

"Our Azure pay-per-use contract helps us cut costs. If we don't need a server, then we don't pay for it, in contrast to having an on-premises server that we have to pay for constantly, regardless of usage."

Cyrille Pelatan, Infrastructure Manager, TraXall France

SENTARA ®

Industry: health provider
Organization size: large (10,000+ employees)

Sentara Healthcare decreases infrastructure costs with Azure

Sentara Healthcare is a not-for-profit organization that has been committed to improving health for 130 years.
It operates 12 hospitals in Virgini a and northeastern North Carolina and has 858,000 members in its Optima Health and Virginia Premier health plans.

Like many healthcare organizations, Sentara had ambitious goals: improve clinician experience, improve patient experience, lower costs, and facilitate better patient outcomes. However, the company found those aims increasingly challenging to reach when its volume of data exploded. As its medical data increased, Sentara needed to transition from costly datacenter storage to a scalable cloud solution.

In its digital transformation, Sentara migrated data to Microsoft Azure while modernizing its applications. Sentara moved its mixed Windows Server and Linux environment, including Microsoft SQL Server and Oracle databases using Azure Ultra Disk Storage, a managed disk offering that gives Sentara sub-millisecond latency and scalable performance. The organization also took advantage of Azure Hybrid Benefit to help migrate workloads to Azure in a cost-effective way.

As a result of the migration, Sentara improved clinician and member experiences, sped up reporting time, and decreased infrastructure costs by 30 percent.

In its COVID-19 response, Sentara's quick technology innovations have also enabled better responsiveness and patient treatment outcomes.

"Even as technology changes rapidly, we can respond and deploy what the organization needs thanks to the agility we gained with Azure, which leads to better clinical outcomes and more patient-first services."

Jeff Thomas, Vice President and Chief Technology Officer, Sentara Healthcare

Microsoft Azure