



Start Innovating with Microsoft Azure SQL

Explore common migration and
modernization solutions

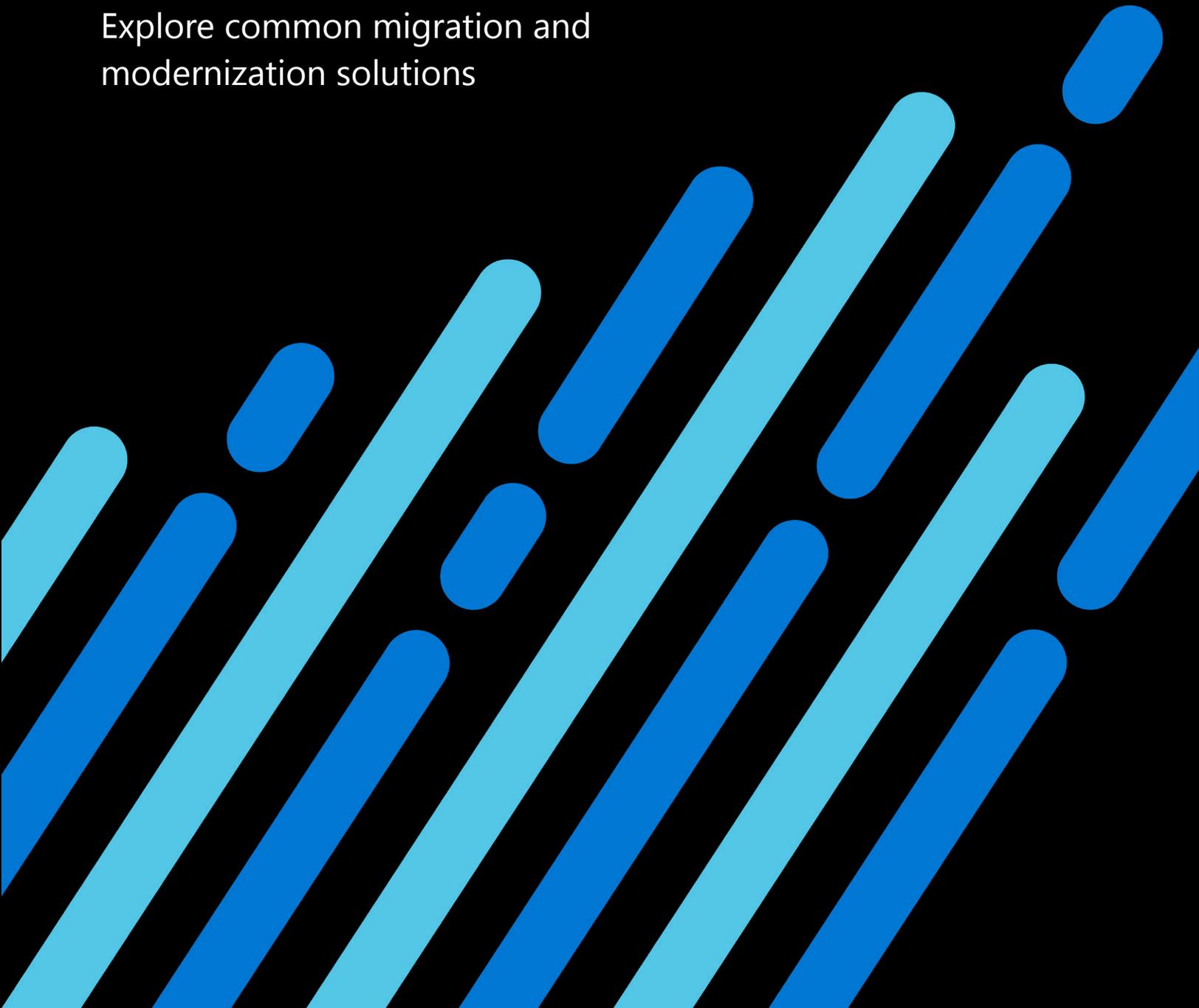


Table of contents

- 01**
Introduction..... 3

- 02**
Drive digital transformation with Azure
 - Why migrate to Azure? 4
 - The Microsoft Cloud Adoption Framework 5

- 03**
Migrate and modernize with Azure
 - Azure SQL family overview 7
 - Common migration and modernization approaches 9

- 04**
Accelerating innovation with Azure: Five common scenarios
 - Modernizing .NET apps and SQL data from on-premises to fully managed services on Azure 11
 - Gathering insights from multiple data sources through automated, on-demand business intelligence with Azure 13
 - Building fully managed solutions for large volumes of Internet of Things (IoT) data on Azure SQL Database 14
 - Building intelligent applications with Azure SQL Managed Instance and ML based Azure services 15
 - Supporting hybrid and multicloud environments with SQL Managed Instance and Azure Arc 17

- 05**
Start innovating 18

Introduction

Discover the benefits of migrating to the cloud. Take a deep dive into the Microsoft Cloud Adoption Framework and explore the most common scenarios—including solutions and technical architectures—that come up during the modernization process on Azure.

This e-book is designed to be a road map for IT professionals and organizations considering data migration and modernization in the cloud. It provides a closer look into common scenarios and architectural considerations across the full continuum of migration to modernization on Azure SQL—helping organizations simplify operations, reduce costs, and innovate.

With its limitless scalability and ability to develop once, deploy anywhere, Azure SQL is a great choice for migration, modernization, and innovation.

Drive digital transformation with Azure

Why migrate to Azure?

Improve your financial resilience by shifting from a traditional upfront capital expenditure to a more flexible pay-as-you-go model. Azure helps you migrate to the cloud securely and efficiently—on your own terms.

Learn more about [migrating to Azure with this simplified process guide](#) >



Optimize costs and migrate data with confidence

Save money with the most cost-effective offers for Windows Server and SQL Server. The cost structure of operational expenditures provides modern businesses with fully managed services in the cloud that help them stay agile.



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 resilience](#) to avoid costly business interruptions.



Scale your applications and workloads on demand

Increase agility with best-in-class [Azure infrastructure](#), reduce operational burden with fully managed [application](#) and [database](#) services in Azure, and get access to near-limitless storage capacity with Hyperscale and serverless computing.

The Microsoft Cloud Adoption Framework

The Microsoft [Cloud Adoption Framework](#) provides proven guidance, best practices, tools, and templates to support your adoption journey with Azure through the different phases. With this proven approach, you can execute your migration project with confidence.

The cloud adoption journey

Cloud migration involves significant organizational change management spanning people, process, and technology. A comprehensive approach can help you navigate the journey successfully while enabling your organization to realize new benefits—including efficiency, agility, and scale—once your workloads are running in the cloud.

Migration planning and execution



Figure 1. Cloud Migration Journey

Build your cloud environment with Azure

Address the deployment and operation needs of your cloud portfolio through scalable, modular implementation options to build out your cloud environment.

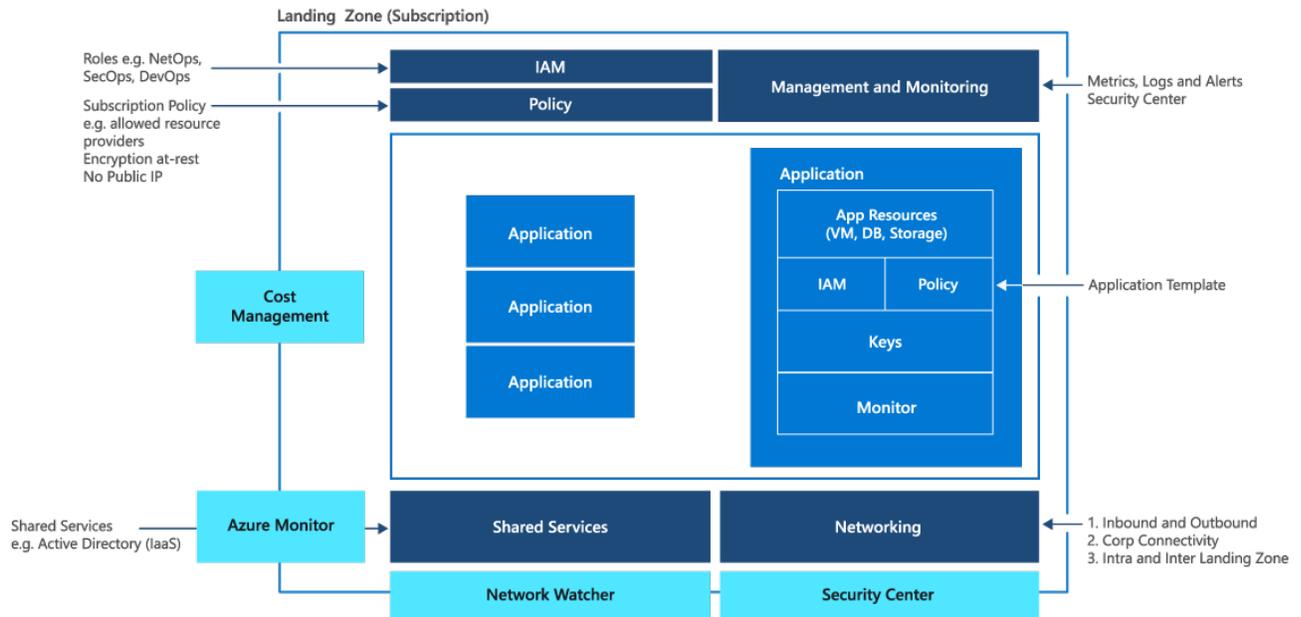


Figure 2. Azure landing zones

Migrate and modernize with Azure

The Azure SQL family overview

How your business responds in times of uncertainty is as varied as the business itself. When it comes to migrating your data, you have a variety of options to consider, and it's important to have the flexibility to choose a path that makes the most sense for your business. Azure SQL is here to help.

[Azure SQL](#) is a family of fully managed, secure, and intelligent SQL database services that supports a wide range of application patterns, from rehosting and modernizing existing SQL Server workloads to modern cloud application development.

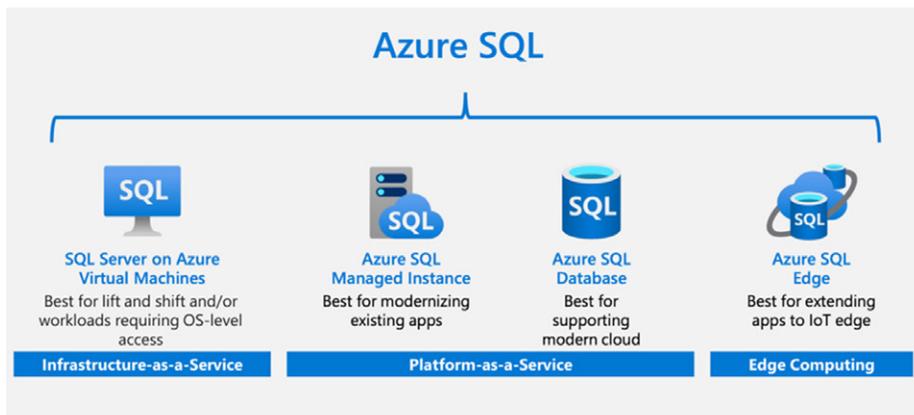


Figure 3. The Azure SQL Family

Because the entire Azure SQL family is built upon the same SQL Server database engine, you'll discover that your skills and experience transfer easily to the cloud, as the innovative features in Azure SQL help you operate more efficiently and save money along the way.

SQL Server on Azure Virtual Machines

Migrate your SQL workloads to Azure with ease while maintaining complete SQL Server compatibility and operating system-level access. Maximize the value of your current licensing investments while accelerating your migration to the cloud.

Up to 3.4 times faster at an 87 percent lower cost than SQL Server on AWS¹

Azure SQL Managed Instance

Modernize your existing SQL Server applications at scale with an intelligent, scalable, cloud database service that combines the broadest SQL Server engine compatibility with all the benefits of a fully managed and evergreen platform as a service (PaaS).

Stay confident with automatic updates, upgrades, and lasting support

Azure SQL Database

Optimize performance and durability with an intelligent, scalable, relational database service built for the cloud. With serverless compute and Azure SQL Database Hyperscale storage options that automatically scale resources on demand, you can focus on building new applications without worrying about storage size or resource management.

Build your new app faster on a fully managed SQL database

Azure SQL Edge

Extend your applications to IoT edge gateways and devices using an edge-optimized SQL database engine for real-time insights in connected, disconnected, or hybrid environments.

Develop your application once and deploy anywhere across the edge, your datacenter, and Azure

[Learn more about SQL Server on Azure Virtual Machines >](#)

[Learn more about Azure SQL Managed Instance >](#)

[Learn more about Azure SQL Database >](#)

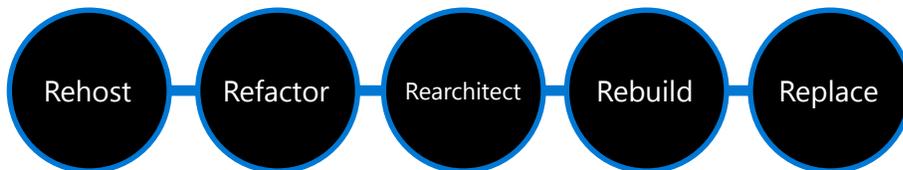
[Learn how to architect modern applications >](#)

[Learn more about Azure SQL Edge >](#)

¹ Price-performance claims based on data from a study commissioned by Microsoft and conducted by GigaOm in October 2019.

Common migration and modernization approaches

There are many reasons to migrate to the cloud, and several modernization and migration approaches to consider. Apply these five “Rs” of rationalization to a digital estate to help you determine the best way to migrate or modernize each asset in the cloud.



Rehost

Also known as a “lift-and-shift” migration, a rehost effort moves a current state asset to the chosen cloud provider, with minimal change to overall architecture and no changes to code. Rehosting your application enables you to:

- Reduce capital expenses.
- Free up more datacenter space.
- Get a rapid return on investment in the cloud.
- Provide more infrastructure-as-a-service options.

Refactor

PaaS options can reduce the operational costs that are associated with many applications. Refactoring your application enables you to:

- Perform faster and shorter updates.
- Ease code portability.
- Get greater cloud efficiency in terms of resources, speed, cost, and managed operations.

Rearchitect

Applications that are cloud-compatible, but not cloud-native, can create cost and operational efficiencies by rearchitecting the solution into a cloud-native application. Rearchitecting your application enables you to:

- Increase application scale and agility.
- Ease adoption of new cloud capabilities.
- Use a mix of technology stacks.

Rebuild

Sometimes, moving an application forward can be too large to justify further investment. Rebuilding your application enables you to:

- Accelerate innovation.
- Build applications faster.
- Reduce operational costs.

Replace

Sometimes, a software-as-a-service application can provide all the necessary functionality for the hosted application—a workload can be scheduled for future replacement, effectively removing it from the transformation effort. Replacing your application enables you to:

- Align with industry best practices.
- Accelerate adoption of business process-driven approaches.
- Reallocate development of investments in applications that create competitive differentiation or advantages.

[Learn more about migration by downloading our e-book, “Cloud Database Migration Simplified: A new framework for migrating infrastructure, databases, and applications.”](#)

[Learn how to plan and implement the migration of relational data from SQL Server to Azure SQL Database >](#)

Accelerating innovation with Azure: Five common scenarios

Be future-ready. Learn how to apply and take advantage of popular features and capabilities in Azure SQL to drive innovation to transform your business. The following scenarios and solutions provide guidance that enables you to support the unique needs of your business.

Modernizing .NET apps and SQL data from on-premises to fully managed services on Azure

Scenario:

In this scenario, a global online retail business needs to modernize their existing .NET application due to changes in customer demand. They migrate their web and mobile application to the cloud for increased efficiency, agility, and scale, as well as reduced costs. The proposed modernization architecture shown below highlights a fully managed platform for building, deploying, and scaling web apps with Azure App Service and Azure SQL Database. For the data tier of the app, this company chose Azure SQL Database for its dynamic scalability, built-in intelligence optimization, and global scalability and availability. They leveraged Azure Database Migration Service to migrate their on-premises database to Azure SQL. For the app tier, they chose Azure App Service, a PaaS service that enables them to deploy the app with just a few configuration changes using Visual Studio. They chose to deploy two web apps—one for the customer-facing front-end website, and the other a Windows communication framework or REST services app that talks to both the front-end app and the database and processes business logic.

[Learn how to develop and configure an ASP.NET application that queries an Azure SQL database >](#)

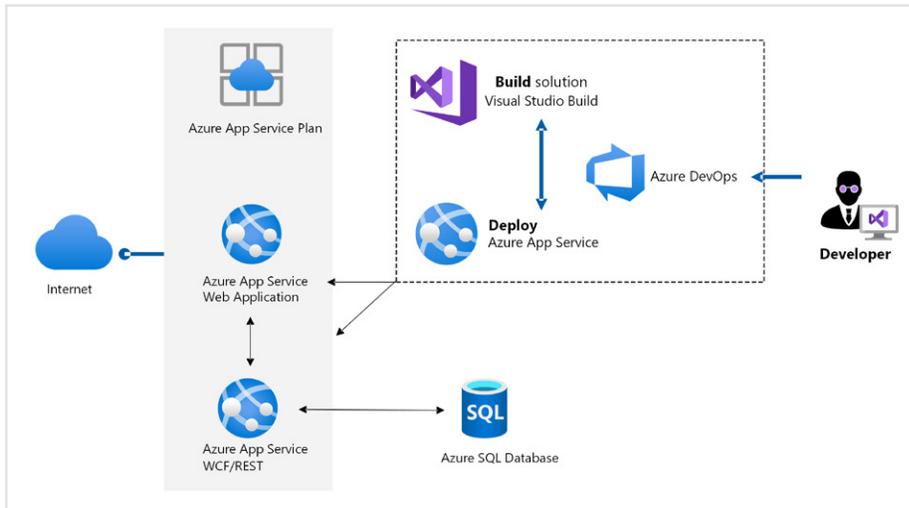


Figure 4. Proposed Modernization Architecture

Solutions:

Azure App Service

[Azure App Service](#) is an HTTP-based service for hosting web applications, REST APIs, and mobile back ends. You can develop in your favorite language, be it .NET, .NET Core, Java, Ruby, Node.js, PHP, or Python. Applications run and scale with ease on both Windows and Linux-based environments.

Azure SQL Database

[Azure SQL Database](#) is a fully managed PaaS database engine that handles most of the database management functions such as upgrading, patching, backups, and monitoring without user involvement. Azure SQL Database is always running on the latest stable version of the SQL Server database engine and patched OS with up to 99.995 percent availability. PaaS capabilities that are built into Azure SQL Database enable you to focus on the domain-specific database administration and optimization activities that are critical for your business.

Azure Database Migration Service

A fully managed service designed to enable seamless migrations from multiple database sources to Azure data platforms with minimal downtime from online migrations. The service uses the Data Migration Assistant to generate assessments that provide recommendations to guide you through

the changes required prior to performing a migration. When you're ready to begin the migration process, [Azure Database Migration Service](#) performs all of the required steps. You can initiate your migration projects with peace of mind, knowing that the process takes advantage of best practices as determined by Microsoft.

Data Migration Assistant

[Data Migration Assistant](#) recommends performance and reliability improvements for your target environment and allows you to move your schema, data, and uncontained objects from your source server to your target server. Upgrade to a modern data platform by detecting compatibility issues that can impact database functionality in your latest version of SQL Server or Azure SQL Database.

Gathering insights from multiple data sources through automated, on-demand business intelligence

Scenario:

A medium-sized company maintains multiple enterprise resource planning systems and needs to combine the different data sets into a solution that analyzes the aggregated data and surfaces insights on-demand via a Power BI front end. In the proposed architecture shown below, Azure SQL Database serverless is used as a cost-effective operational data store, ingesting and transforming data via Azure Data Factory. Azure Analysis Services provides data modeling capabilities that then output to Power BI to perform analysis.

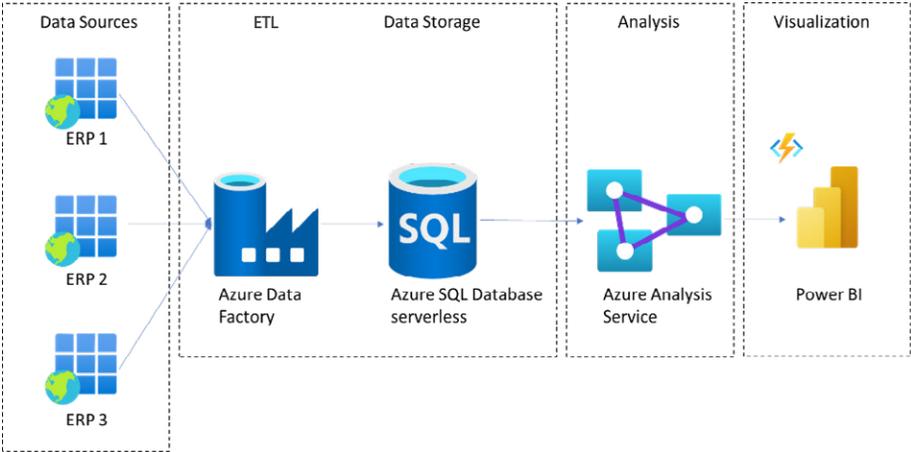


Figure 5. Proposed Architecture—Data Sources

Solutions:

The Data Store: Azure SQL Database Serverless

[Serverless](#) is a compute tier for single databases in Azure SQL Database that automatically scales compute based on workload demand and bills for compute used per second. The serverless compute tier also automatically pauses databases during inactive periods when only storage is billed and automatically resumes databases when activity returns.

Azure Data Factory

[Data Factory](#) is a managed service that orchestrates and automates data movement and data transformation. It's the cloud-based extract, transform, load and data integration service that allows you to create data-driven workflows for orchestrating data movement and transforming data at scale. Ultimately, through Azure Data Factory, raw data can be organized into meaningful data stores and data lakes for better business decisions.

Azure Analysis Services

[Analysis Services](#) is a fully managed service that provides data modeling capabilities. The semantic model is loaded into Analysis Services. Use advanced mashup and modeling features to combine data from multiple data sources, define metrics, and secure your data in a single, trusted tabular semantic data model. The data model provides an easier and faster way for users to perform ad hoc data analysis using tools like Power BI and Excel.

Power BI

[Power BI](#) supports two options for connecting to Azure Analysis Services. Import, where data is imported into the Power BI model, and Live Connection, where data is pulled directly from Analysis Services.

Building fully managed solutions for large volumes of IoT data on Azure SQL Database

Scenario:

A real estate company in New York City needed a way to integrate new safety measures for tenants. It created a Hyperscale-based solution—a comprehensive, public health-based, data-driven program that merges physical and digital assets to help keep employees informed and supported. The proposed architecture shown below is powered by IoT and the intelligent

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determine if Azure
SQL Edge is right
for your apps >**

edge, and firmly rooted in responsible AI principles. It combines real-time computer vision, sensors, AI, mobile apps and dashboards, and in-person service offerings.

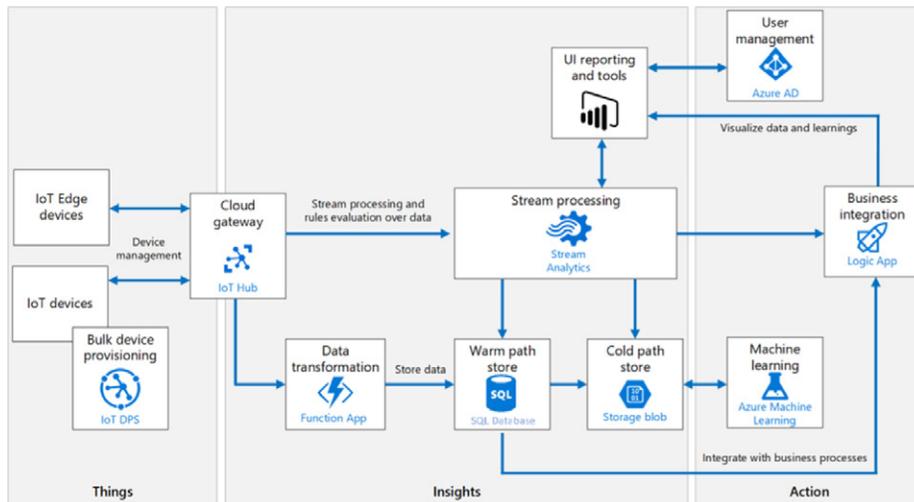


Figure 6. Proposed Architecture—Database Service Tier

Solution:

Azure SQL Database Hyperscale

[SQL Database Hyperscale](#) simplifies data management operations by enabling the ingestion of millions of messages/second and the storage of trillions of them in a single database instance. With storage support up to 100TB, SQL Database Hyperscale effectively “future-proofs” IoT solutions.

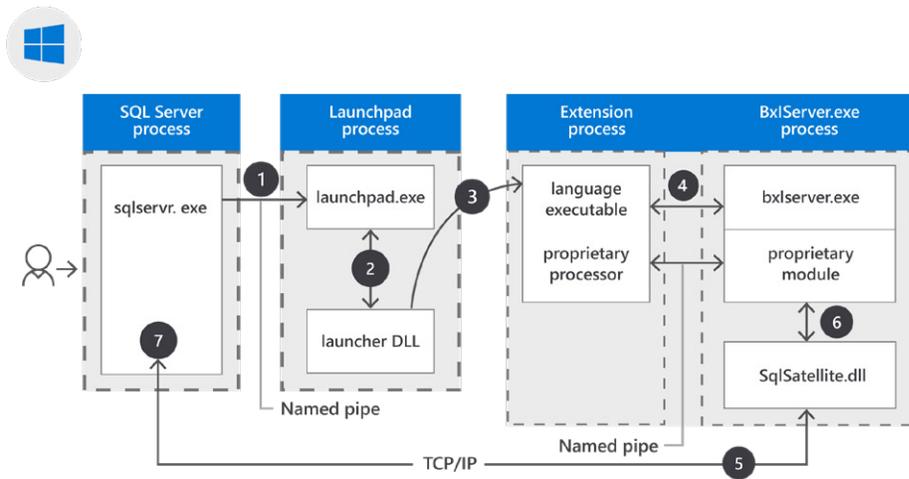
Back up Hyperscale databases virtually instantaneously. You can also scale a database in the tens of terabytes up or down in minutes. This capability frees you from concerns about being boxed in by your initial configuration choices.

Building intelligent applications with Azure SQL Managed Instance and machine learning-based Azure services

Scenario:

A large private bank needed to generate the best returns at the lowest possible risk and create fast, accurate credit risk models. So, it used Microsoft SQL Server Machine Learning Services to build scorecards for loan applications. With the proposed architecture shown below, using built-in Machine Learning Services in SQL Server, the bank has a single tool it can use for data preparation, advanced analytics, and machine learning.

Component architecture in Windows



Component architecture in Linux

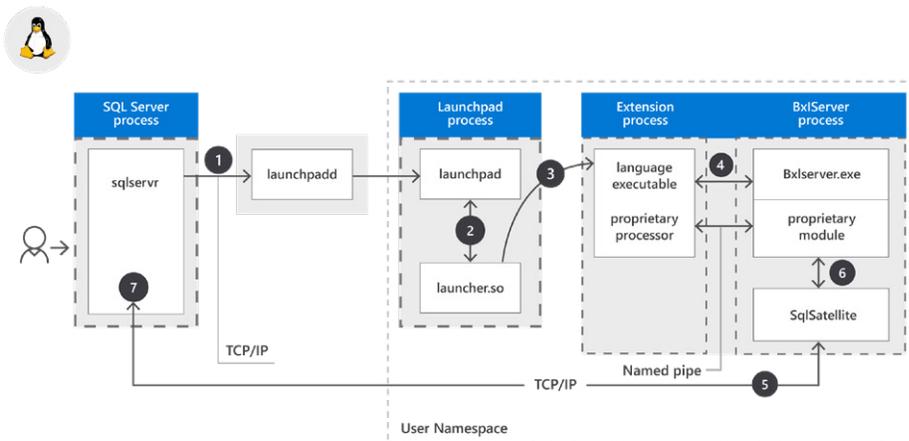


Figure 7. Proposed Architecture—Machine Learning Services

Solution:

Azure SQL Managed Instance

[Machine Learning Services in Azure SQL Managed Instance](#) lets you execute Python and R scripts in-database. You can use it to prepare and clean data; do feature engineering; and train, evaluate, and deploy machine learning models within a database. The feature runs your scripts where the data resides and eliminates transfer of the data across the network to another server.

Supporting hybrid and multicloud environments with SQL Managed Instance and Azure Arc

Scenario:

A large wholesale plumbing supply distributor used Microsoft Azure Arc to extend Azure to its on-premises datacenters. The proposed architecture below highlights how the company migrated a SQL Server database to an Azure Arc enabled SQL Managed Instance, enabling it to use SQL Managed Instance features such as automated updates, backup/restore, and monitoring. Azure Arc provided an inventory of the company's servers in the Azure Portal by grouping and tagging. Using Azure Policy, the IT staff monitored and enforced configurations across all of its servers.

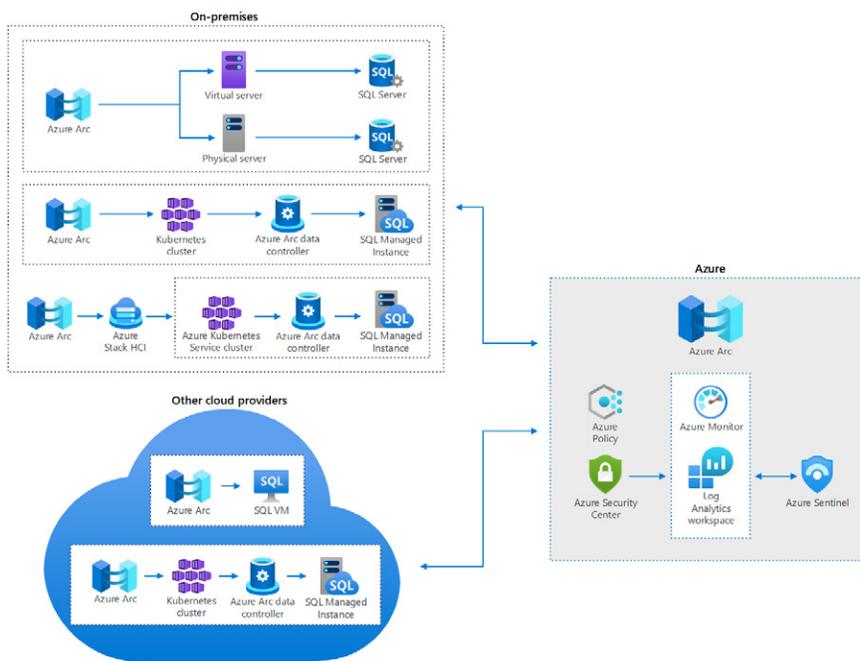


Figure 8. Proposed Architecture—Multicloud and On-Premises

Solution:

Azure Arc

[Azure Arc](#) simplifies governance and management by delivering a consistent multicloud and on-premises management platform. Azure Arc enables you to manage your entire environment by transferring your existing resources into Azure Resource Manager. You can now manage virtual machines, Kubernetes clusters, and databases as if they are running in Azure. Regardless of where they live, you can use familiar Azure services and management capabilities. Azure Arc enables you to continue using traditional IT operations, while introducing DevOps practices to support new cloud-native patterns in your environment.

Start innovating

Migrate and modernize your business with confidence. This e-book supports you—no matter where you are on your journey.

Azure makes it easier to deploy from anywhere while simplifying operations and reducing costs. At a time that's been unlike any other, the ability to bring your organization into the future in a secure and nimble fashion is more important than ever.



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Drive innovation for existing and future apps



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