Microsoft

The Essential Guide to Data in the Cloud:

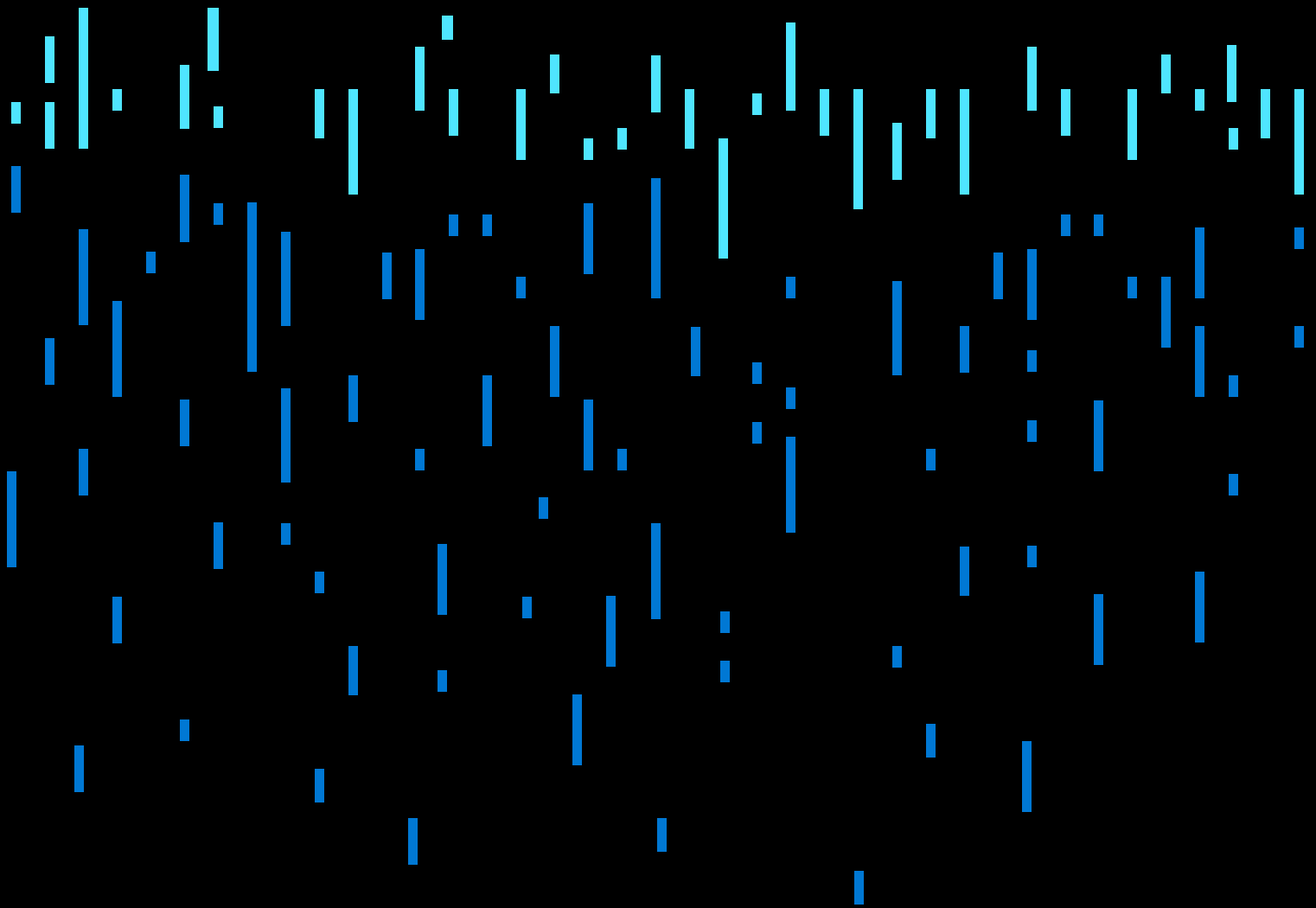## A Handbook for DBAs

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1.
Introduction

As a database administrator (DBA), you know how challenging it can be to keep enterprise databases humming as performance demands and data volumes increase. Moving to the cloud will also make your role a lot more visible—even as traditional maintenance tasks become more automated. Now is the time to prepare for moving your data to the cloud so you can maximize the benefits of lower costs, increased scalability, reduced infrastructure, and take advantage of opportunities to modernize your applications so you can focus less on day-to-day operations and more on value-added tasks.

The skills of managing and manipulating data will stay largely the same. However, you'll find yourself doing less patching, maintenance, and administration—and more optimization, experimentation, and high-level data architecture.

With your database environment in the cloud you'll spend less time on routine maintenance while providing more value to your business by:

- Exploiting cloud database capabilities like continuous, AI-powered automatic tuning and built-in high availability to maintain peak performance and durability; hyperscale service; and intelligent threat detection and proactive vulnerability assessment.Learning how to migrate data to the cloud with tools to help you learn the basic processes, as well as the easiest paths.

- Growing your database knowledge and branching out into more data formats and platforms, so you can design the optimal database ecosystem for your organization.

- Using automated tools that streamline and accelerate application modernization.

- Refactoring your applications to take advantage of a flexible, cloud-native architecture that allows storage to grow as needed and adapt to changing requirements.

- Understanding how to manage costs so you can optimize and justify monthly usage costs (instead of three- to five- year refresh cycles).

- Modernizing existing SQL Server applications at scale.

- Broadening your horizons with value-added activities to boost your career, including big data, AI and machine learning, and app development.

At Microsoft, we're committed to providing you with cloud data services that simplify your life, maximize your skills, and empower you to be the data hero of your organization. Becoming a cloud DBA requires you to tune your skill set, but the rewards can be great.
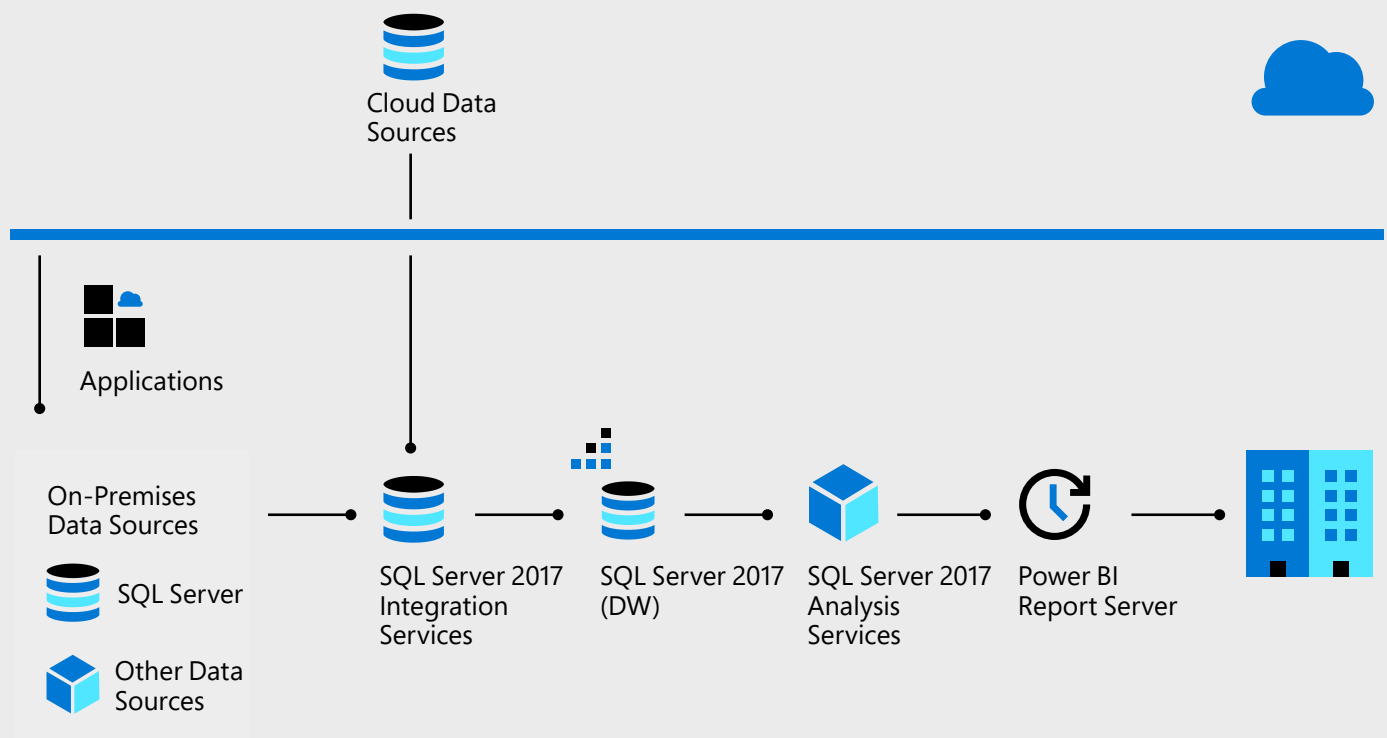
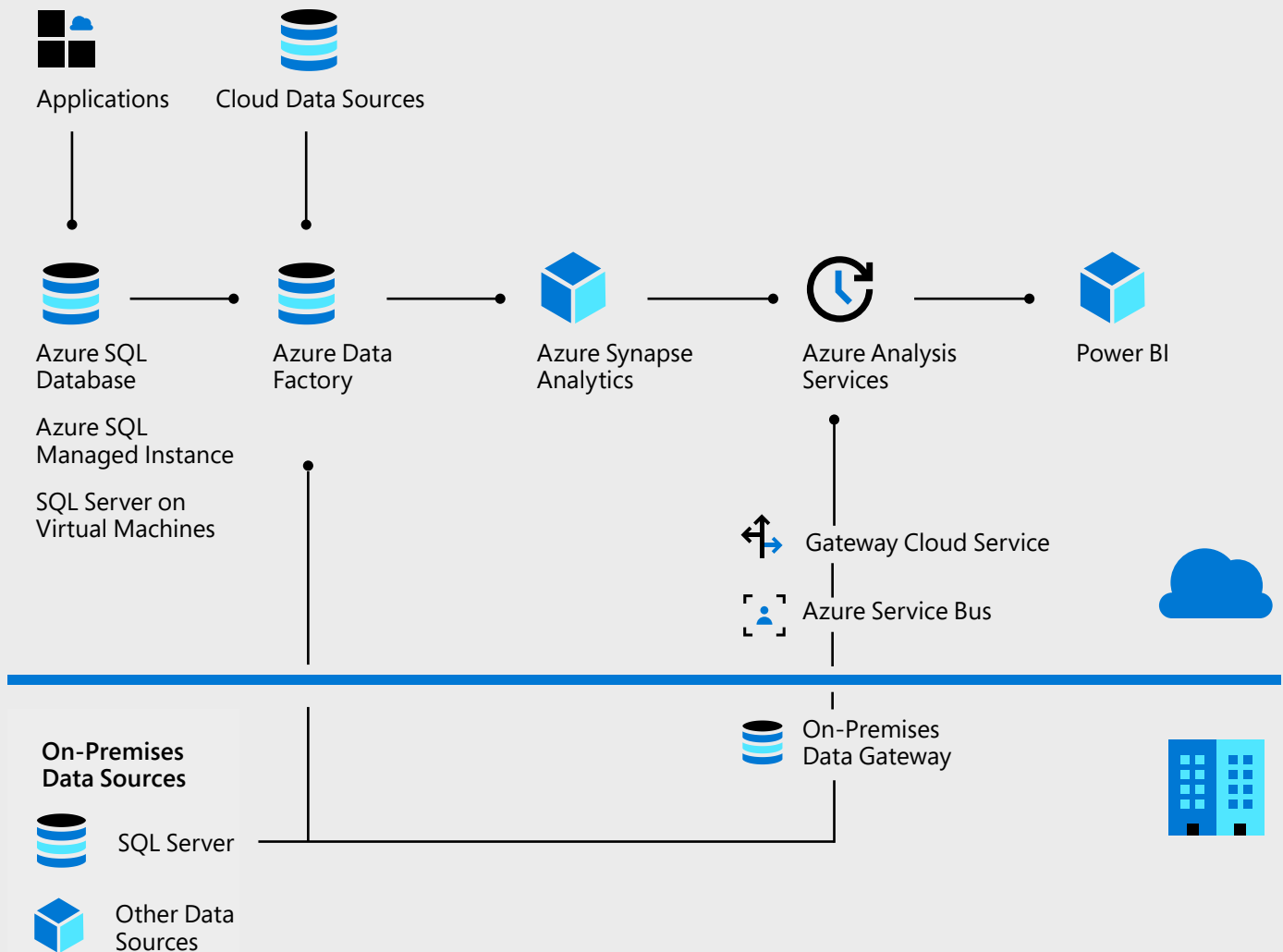→ Learn more about the five steps above and resources to help you achieve them.

2.
Evolution to the cloud: how things change, how they stay the same

Let's take a look at the differences between on-premises databases and cloud data services. The following diagrams show a common scenario: creating reports and visualizations from an SQL Server database. The on-premises scenario has a lot more for you to manage and may be more limited in terms of the technologies it incorporates. In the cloud, you have less infrastructure to worry about, while using more advanced services becomes much easier because they are all part of the same platform.

Before

Cloud Data Sources

Applications

On-Premises Data Sources

SQL Server

Other Data Sources

SQL Server 2017 Integration Services

SQL Server 2017 (DW)

SQL Server 2017 Analysis Services

Power BI Report Server

After

Applications

Cloud Data Sources

Azure SQL
Database

Azure SQL
Managed Instance

SQL Server on
Virtual Machines

Azure Data
Factory

Azure Synapse
Analytics

Azure Analysis
Services

Power BI

Gateway Cloud Service

Azure Service Bus

**On-Premises
Data Sources**

SQL Server

Other Data
Sources

On-Premises
Data Gateway

As you can see, many of the same steps and technologies are in the chain, but have moved from on-premises to the cloud. And many more technology options are available in the cloud for analyzing your data and optimizing it for business value.

So instead of spending time purchasing, configuring, maintaining, and updating server hardware and server and database software, you use the skills you already have to start turning your valuable data into real insights that move your business forward.

3.
The power
of choice

Intensive maintenance requirements with on-premises technology can limit the ability to expand your expertise beyond one database type. However, your company will likely expect you to cover a broader range of databases and related features in the cloud. The good news is that in the cloud, simplified operations give you more time to grow your skills.

For instance, you'll find that relational and non-relational databases are increasingly seen as complementary, and you'll learn to be conversant in both. Here's a quick overview of cloud database technologies available to you on Azure, and what they're best for.

Technology	Relational database (SQL, PostgreSQL, MySQL, Oracle)	Data warehouse	NoSQL database
Common use cases	Line of business functions such as HR, CRM, and ERP Inventory management Reporting Accounting Order management	Data analytics Enterprise business intelligence	IoT and telematics Gaming Web and mobile applications Globally distributed applications

Technology	Relational database (SQL, PostgreSQL, MySQL, Oracle)	Data warehouse	NoSQL database
Skills to focus on as a cloud DBA	Database programming Application design as it relates to data Schema design and data hygiene Data security Performance tuning Scripting	Big data concepts Data movement Visualization and reporting KPI value Data analysis and insights	Big data concepts Unstructured data Key value databases Graph databases Document stores Column family stores Data security Performance tuning
Azure data services	Azure SQL (Azure SQL Database, Azure SQL Managed Instance, SQL Server on Azure Virtual Machines) Azure Database for MariaDB Azure Database for MySQL Azure Database for PostgreSQL Oracle on Azure Virtual Machines	Azure SQL Data Warehouse	Azure Cosmos DB
Learn more	**Learn more about Azure SQL DB**	**Learn more about Azure SQL Data Warehouse**	**Learn more about Azure Cosmos DB**

Moving to the cloud relieves the burden of many maintenance tasks and provides unique opportunities to create a data-driven organization. It's worth your time to learn about the variety of cloud database options, to add value to your business, as well as advance your career.

→ <u>Learn more</u> about the breadth of cloud data services on Azure.

4.
Getting data to the cloud

When it comes to actual migration, DBAs are often responsible for helping move data from on-premises to the cloud. When you use Azure databases, you can take advantage of pre-built tools and resources to simplify this process.

From	➜	To	Tools
On-premises SQL Server database	➜	**Azure SQL (Azure SQL Database, Azure SQL Managed Instance, SQL Server on Azure Virtual Machines)**	**Azure Database Migration Service**
Oracle	➜	**Azure SQL (Azure SQL Database, Azure SQL Managed Instance, SQL Server on Azure Virtual Machines)**	**Microsoft SQL Server Migration Assistant** for **Oracle**
On-premises open source database	➜	**Azure Database for MariaDB Azure Database for MySQL Azure Database for PostgreSQL**	**Azure Database Migration Service**
JSON files CSV files SQL MongoDB Azure Table storage Amazon DynamoDB Azure Cosmos DB SQL API	➜	**Azure Cosmos DB**	**Azure Cosmos DB Data Migration Tool**

From	➜	To	Tools
Apache Cassandra	➜	**Azure Cosmos DB**	**Azure Cosmos DB Cassandra API**
MongoDB	➜	**Azure Cosmos DB**	**Azure Cosmos DB API for MongoDB**

No matter what migration path best fits your organization's needs, Microsoft has tools and documentation to help you make the transition. So you are free to pick from a range of database services, confident that we can help you with your specific migration requirements.

➜ **Find the best migration path** **for your scenario.**

Choosing the right relational database

When it comes to moving relational data to the cloud, maximizing the value of your existing skills and resources depends on choosing the right destination. Azure SQL is a family of fully managed, secure, and intelligent SQL database services offering the widest range of deployment options for SQL, from edge to cloud.

Azure SQL Database

Best for: Supporting modern cloud applications on an intelligent, managed service that includes serverless compute. Get the simplicity and flexibility of SLA-backed deployments and scale. Fully managed. No patching or maintenance required.

Azure SQL Managed Instance

Best for: Modernizing your existing SQL Server applications at scale with an intelligent, fully managed service. Rich, instance-centric programming model. No patching or maintenance required.

SQL Server on Azure Virtual Machines

Best for: Lift-and-shift migration of your SQL workloads, while maintaining 100% SQL Server compatibility and OS-level access.

Azure Database for MySQL
Azure Database for PostgreSQL
Azure Database for MariaDB

Best for: Organizations with existing investment in open-source SQL databases, skills, and tools.

→ **Learn more** about Azure **database options.**

5.
Optimizing your
app for the cloud

A lift-and-shift migration like SQL on Azure Virtual Machines can get you to the cloud quickly, but if you want to get the most out of your cloud investment and experience, you'll want to refactor your application for Azure SQL Database or Azure SQL Managed Instance.

Azure SQL Database Hyperscale's cloud-native architecture allows nearly instantaneous backups and fast database restores in minutes—regardless of the size of the data operation. A Hyperscale database supports up to 100 TB of data and provides high throughput and performance, as well as rapid scaling to adapt to the workload requirements. Scaling is transparent to the application. Connectivity, query processing, etc., work like any other database in Azure SQL Database.

Refactoring also enables you to optimize your application for the cloud, thereby reducing your costs. Azure SQL Database serverless automatically scales compute based on workload demand and bills for the amount of compute used per second. Serverless also automatically pauses databases during inactive periods when only storage is billed and automatically resumes databases when activity resumes.

Azure SQL eases the process of refactoring your application. Automated tools streamline and accelerate your application modernization efforts, and existing SQL Server applications can be modernized at scale with Azure SQL Managed Instances.

6.
Managing costs will become part of your job

In the on-premises world, you may only encounter the issue of database cost when capital refresh cycles are in the works. Once hardware is deployed, there's little incremental cost involved in deploying and running databases.

In the cloud, it's completely different. You pay based on what you actually use. Depending on the service, your cost can vary based on the number of hours a database runs, what type of processor it uses, the amount of data you store, and so on. What shows up on the monthly bill will be directly attributable to how you configure the database services.

Not only does this allow you to align your costs more closely with your needs, but it also creates more opportunities for you to demonstrate the value you provide to the business. However, it means you need to understand the billing models available to you and how to optimize costs. Here are a few tips and resources to get started in the Azure SQL world.

Azure SQL

Azure SQL Database and Azure SQL Managed Instance:
The [vCore-based purchasing model](#) enables you to choose the exact amount of storage capacity and compute that you need for your workload. The [DTU-based purchasing model](#) lets you choose bundled compute and storage packages balanced for common workloads. You can save money by using [Reserved Capacity](#) if you can commit to a one- or three-year term. [Azure Hybrid Benefit for SQL Server](#) helps you maximize the value from your current licensing investments and accelerate your migration to the cloud.

→ [Learn more](#) about Azure SQL Database pricing.

SQL Server on Azure Virtual Machines:
Costs vary based on the SQL Server edition that you select as well as underlying virtual machine type and size.

→ [Learn more](#) about SQL Server on Azure Virtual Machine pricing.

Azure Cosmos DB:
This option bills for provisioned throughput and consumed storage by the hour. The throughput is expressed as a normalized throughput currency called Request Units per second (RU/s). Once provisioned, RU/s can be used interchangeably across various database operations. You can increase or decrease the provisioned throughput at any time.

→ [Learn more](#) about Azure Cosmos DB and pricing.

Azure SQL Data Warehouse:
Compute is billed by the hour, while data storage and snapshots are billed by the TB/hour. Two different performance levels, Gen1 and Gen2, allow you to balance price and performance.

→ [Learn more](#) about Azure SQL Data Warehouse pricing.

Different services are billed a little differently depending on what configuration choices you make, but all cost more the more you use. That's why efficient database design and performance tuning become so important. You can save a lot by using cloud resources efficiently and taking advantage of scaling opportunities, rather than the old on-premises strategy of simply throwing more hardware at the problem.

7.
Use what
you know

Because cloud databases automatically handle most daily maintenance and availability issues, some traditional DBA skills will become less important, while new skills will become essential. However, moving to the cloud doesn't mean throwing your existing knowledge out the window. Several skills translate directly to the cloud, while others will be new. Here's a quick checklist of common shifts.

Skill	Reduced focus	Increased focus	New skills
Scaling	✓		
Backup management	✓		
Infrastructure maintenance	✓		
Disaster recovery	✓		
Infrastructure security	✓		
Data movement		✓	
Cost optimization		✓	
Performance tuning		✓	
Understanding of business outcomes		✓	
Database optimization for applications		✓	
Cloud security and governance			✓
Cloud architecture			✓

Leveraging existing skills in the cloud

With all the time you won't be spending on infrastructure duties, you can dive deeper into your most valuable skills. Performance tuning is one example that will continue to be important, even more so with the monthly bill arriving to show your progress up the chain of command. And your background and expertise in data movement position you perfectly to take on a strategic and advisory role during the migration and beyond. Your strongest value lies in understanding the mechanics and details of your databases and their runtime characteristics and configuration.

If you simply migrate your SQL Server databases over to one or more Azure Virtual Machine instances, then you can use all your existing skills. This scenario replicates exactly what you did on-premises so you can achieve all the same tasks the same way you always have, just through Azure.

And whether you're choosing the SQL or NoSQL route, you can also maximize existing skills and tooling with Azure. In the relational world, choosing Azure SQL Database Managed Instance means you can migrate to the cloud while continuing to use the version of SQL Server you use on-premises today.

The SQL querying and data management skills you have will remain strong assets.

For open-source DBAs, Azure Database for MySQL, Azure Database for MariaDB, and Azure Database for PostgreSQL offer the programming environment you know with the benefits of a managed service. For Oracle migrations to Azure SQL Database, the Oracle Extension Pack can enable you to continue using familiar Oracle features.

Finally, if you're using a non-relational database, Azure Cosmos DB provides a wide range of APIs so you can use the language and schema you know best, including options for:

- .NET
- Java
- Node.js
- Python
- Xamarin

- SQL
- MongoDB
- Gremlin
- Cassandra
- Table

8.
Expand your options

Managing your databases in the cloud offers unprecedented opportunity to focus on adding more value to your business, and less on mundane maintenance and break/fix activities. Here are some areas to explore.

⟨•••⟩ App development

Database infrastructure doesn't have much to do with application performance, but database architecture and optimization does. With less time spent keeping the lights on, you can work more closely with app dev teams to select, deploy, and optimize the right database solutions for various use cases.

Relevant solution: Use built-in intelligence that automatically tunes performance based on usage patterns. Plus, Common Data Service (CDS) for Apps lets you securely store and manage data that's used by business applications.
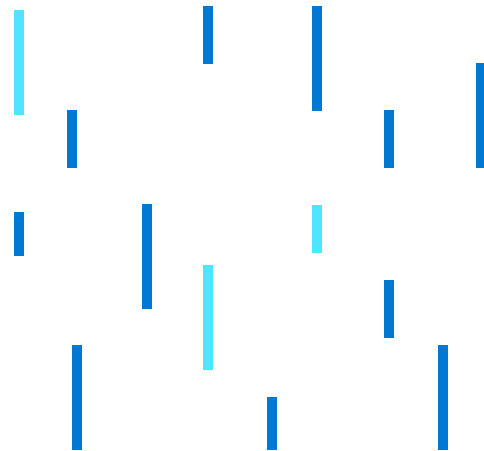
▗▟ Big data

As data becomes increasingly critical to business success, cloud data services can empower you to become an all-around expert focused on the broader information universe, with a strategic view of your architecture.

Relevant solution: Azure Data Lake removes the complexities of ingesting and storing your data while making it faster to get up and running with batch, streaming, and interactive analytics.

Intelligent insights

Help people extract more insights out of data through visualization and business intelligence.

Relevant solution: With [DirectQuery](#), queries are sent back to your Azure SQL Database as users explore the data in the report view, providing the ability to have live data in reports.
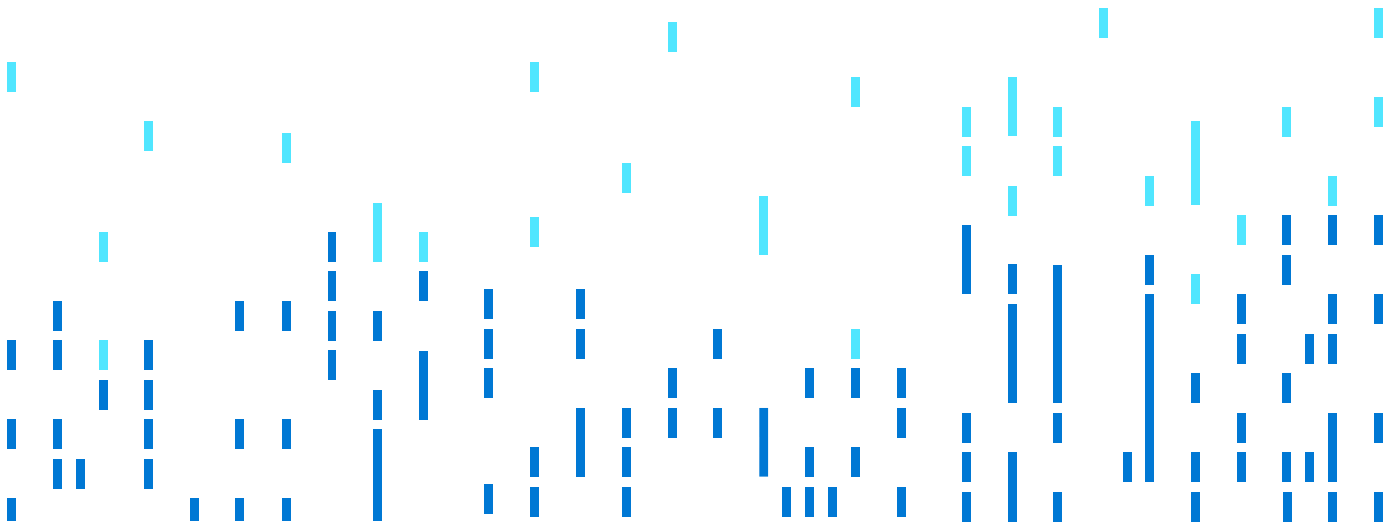
AI and machine learning

Combine the power of DBA and data scientist with pre-built capabilities for discovering insights and automating actions. (There's more about this in the next section.)

Smart security

In the cloud, you can take advantage of advanced security capabilities without having to become a single-minded security expert. This helps your organization pursue innovative architecture and capabilities with less risk.

Relevant solution: Take advantage of [built-in intelligent security](#) such as [threat detection](#), [vulnerability assessment](#), [transparent data encryption](#), [data discovery and classification](#), and [Azure AD](#).

9.
AI at work

AI and machine learning consistently top lists of key technology trends—and as a DBA, once your data is in the cloud, it's easier than ever for you to dive in. Here are a few ways you can get started exploring AI using Azure services.

Machine learning: Azure Machine Learning Studio is a powerfully simple browser-based, visual drag-and-drop authoring environment where no coding is necessary. You can also use R and Azure SQL Database together for machine learning use cases.

Cognitive services: Use intelligent algorithms to see, hear, speak, understand, and interpret user needs through natural methods of communication.

Bots: Give users new ways to interact naturally with data by building, connecting, deploying, and managing intelligent bots.

→ Get a quick guide to machine learning for technology professionals.

Getting started with data in the cloud
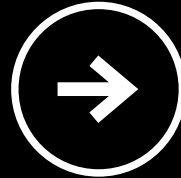
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