Microsoft

GPS Data/AI Strategy FY23

Delivered by CSA Team

22/09/2022

Franck Gaillard
Cloud Solution Architect
Data AI
frgail@microsoft.com

Narjes Majdoub
Cloud Solution Architect
Data AI
nmajdoub@microsoft.com

Ali Bouhaddou
Cloud Solution Architect
Data Analytics
albouhad@microsoft.com

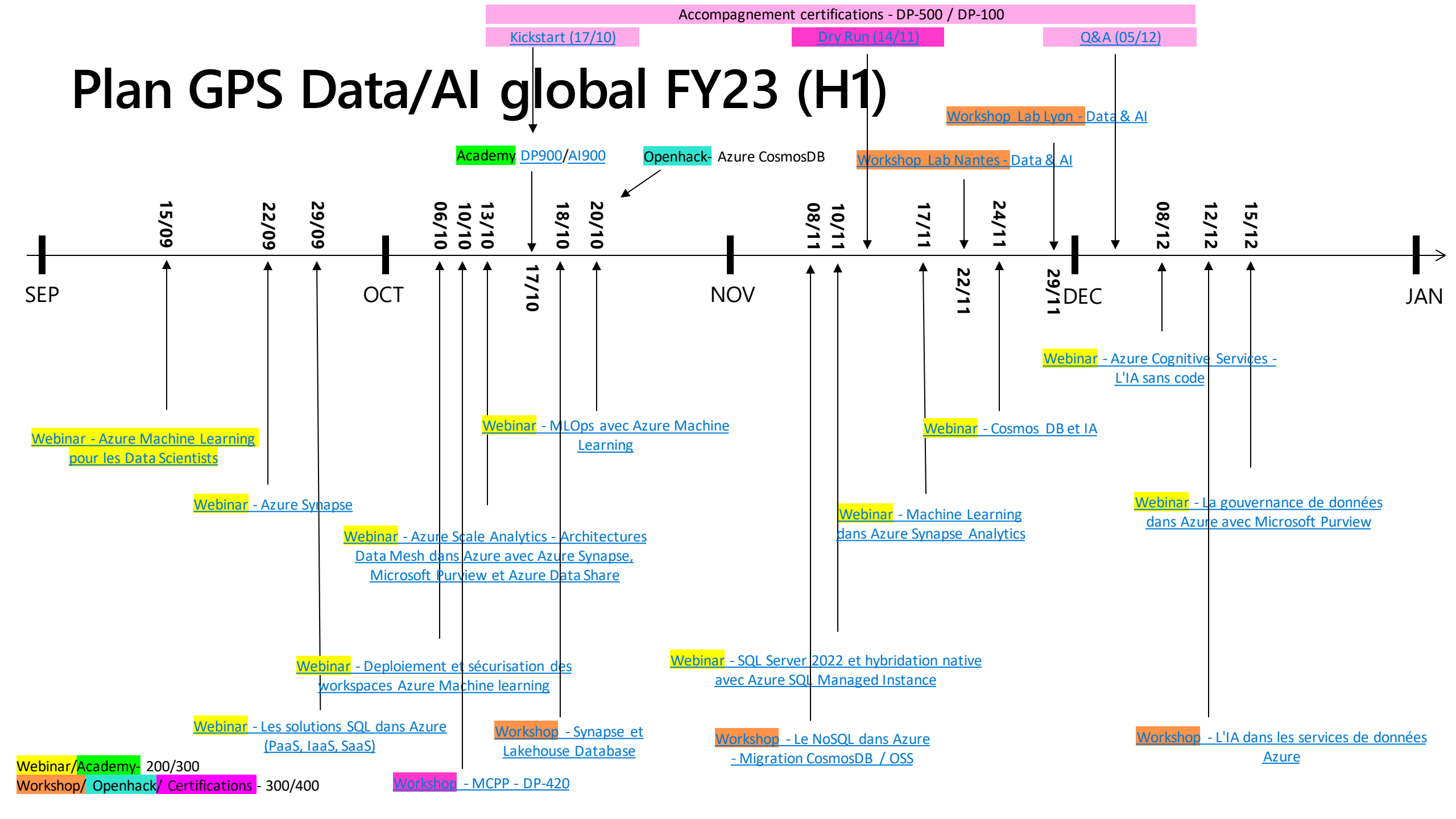
Frederic Gisbert
Cloud Solution Architect
Data Analytics
frgisber@microsoft.com

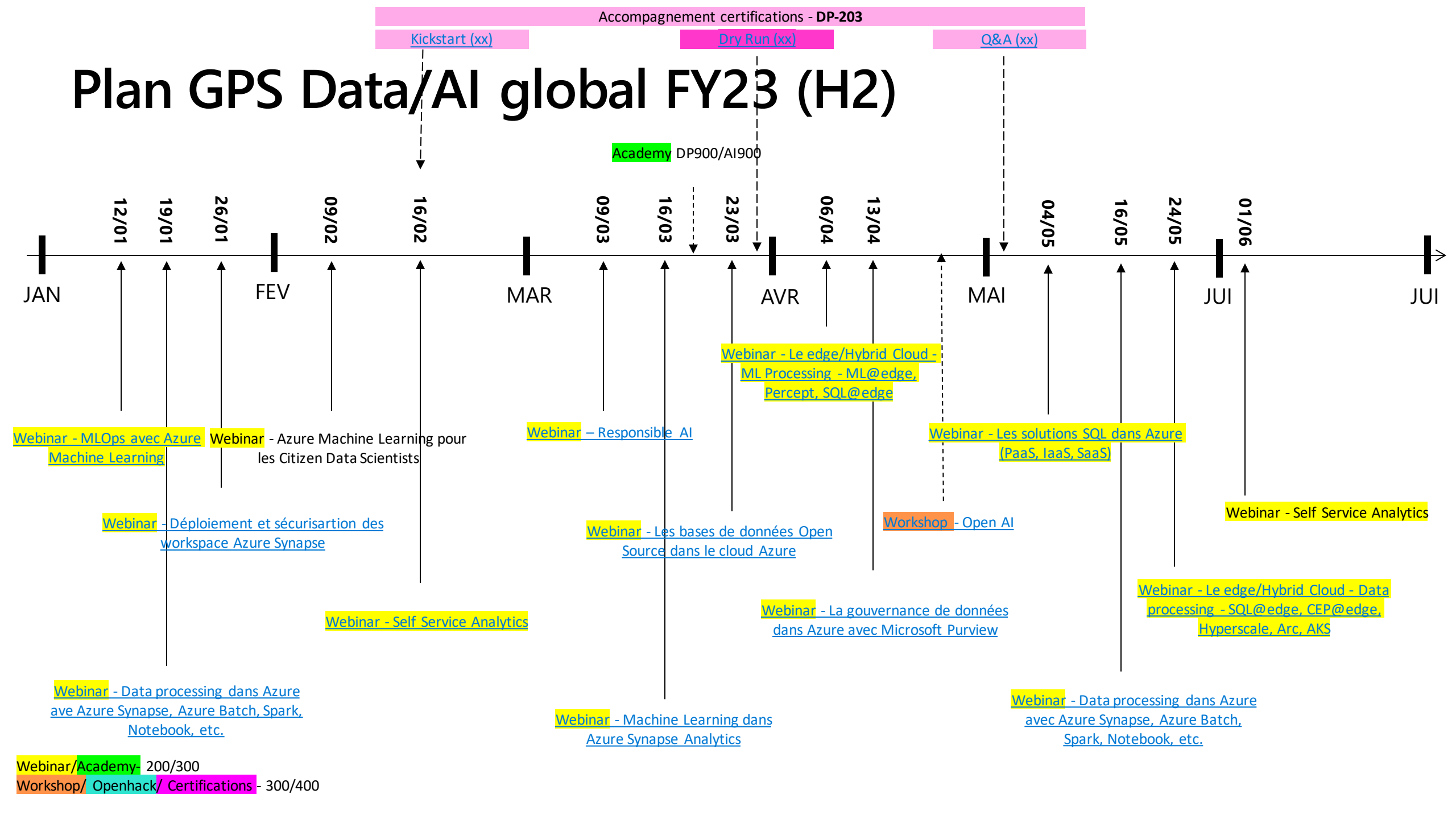
Azure Data & AI technical intensity plan

- From June 2022 to June 2023
- Focus on "Azure Data & AI" tech intensity

- Many content, from L100 Beginner to L400 Expert level
  - Academy L100
  - Webinar L200/L300
  - Workshop L300/L400
  - Certification kickstart L300/L400
  - Openhack / Microhack L400

Plan GPS Data/AI global FY23 (H1)




Accompagnement certifications - DP-203
Kickstart (xx)
Dry Run (xx)
Q&A (xx)
Plan GPS Data/AI global FY23 (H2)
Academy DP900/AI900
12/01
19/01
26/01
09/02
16/02
09/03
16/03
23/03
06/04
13/04
04/05
16/05
24/05
01/06
JAN
FEV
MAR
AVR
MAI
JUI
JUI
Webinar - MLOps avec Azure Machine Learning
Webinar - Azure Machine Learning pour les Citizen Data Scientists
Webinar – Responsible AI
Webinar - Le edge/Hybrid Cloud - ML Processing - ML@edge, Percept, SQL@edge
Webinar - Les solutions SQL dans Azure (PaaS, IaaS, SaaS)
Webinar - Déploiement et sécurisartion des workspace Azure Synapse
Webinar - Les bases de données Open Source dans le cloud Azure
Workshop - Open AI
Webinar - Self Service Analytics
Webinar - Self Service Analytics
Webinar - La gouvernance de données dans Azure avec Microsoft Purview
Webinar - Le edge/Hybrid Cloud - Data processing - SQL@edge, CEP@edge, Hyperscale, Arc, AKS
Webinar - Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.
Webinar - Machine Learning dans Azure Synapse Analytics
Webinar - Data processing dans Azure avec Azure Synapse, Azure Batch, Spark, Notebook, etc.
Webinar/Academy- 200/300
Workshop/ Openhack/ Certifications - 300/400

Liste des évènements de type Webinar 2H

Event Webinar (Les jeudis de la Data & AI) - L200/300	Date	Duration (min)	Link
Azure Machine Learning pour les Data Scientists	15/09/2022	120	https://msevents.microsoft.com/event?id=2454281594
Azure Synapse	22/09/2022	120	https://msevents.microsoft.com/event?id=857781749
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	29/09/2022	120	https://msevents.microsoft.com/event?id=502366997
Déploiement et sécurisation des workspaces Azure Machine learning	06/10/2022	120	https://msevents.microsoft.com/event?id=1505714138
Azure Scale Analytics - Architectures Data Mesh dans Azure avec Azure Synapse, Microsoft Purview et Azure Data Share	13/10/2022	120	https://msevents.microsoft.com/event?id=139685175
MLOps avec Azure Machine Learning	20/10/2022	120	https://msevents.microsoft.com/event?id=1245885767
SQL Server 2022 et hybridation native avec Azure SQL Managed Instance	10/11/2022	120	https://msevents.microsoft.com/event?id=145826476
Machine Learning dans Azure Synapse Analytics	17/11/2022	120	https://msevents.microsoft.com/event?id=3637723312
Azure Cosmos DB et IA	24/11/2022	120	https://msevents.microsoft.com/event?id=2646013445
Azure et les Services Cognitifs	08/12/2022	120	https://msevents.microsoft.com/event?id=3772037220
La gouvernance de données dans Azure avec Microsoft Purview	15/12/2022	120	https://msevents.microsoft.com/event?id=1499560981
MLOps avec Azure Machine Learning	12/01/2023	120	https://msevents.microsoft.com/event?id=4115194515
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	19/01/2023	120	https://msevents.microsoft.com/event?id=1537241181
Déploiement et sécurisation des workspace Azure Synapse	26/01/2023	120	https://msevents.microsoft.com/event?id=1806467748
Azure Machine Learning pour les Citizen Data Scientists	09/02/2023	120	En cours
PowerBI - Self Service Analytics	16/02/2023	120	https://msevents.microsoft.com/event?id=1401519679
L'IA responsable avec Azure machine learning	09/03/2023	120	https://msevents.microsoft.com/event?id=2072953112
Machine Learning dans Azure Synapse Analytics	16/03/2023	120	https://msevents.microsoft.com/event?id=3413014857
Les bases de données Open Source dans le cloud Azure	23/03/2023	120	https://msevents.microsoft.com/event?id=2727487131
Hybridation des services de Machine Learning Azure	06/04/2023	120	https://msevents.microsoft.com/event?id=1624914222
La gouvernance de données dans Azure avec Microsoft Purview	13/04/2023	120	https://msevents.microsoft.com/event?id=3909342839
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	04/05/2023	120	https://msevents.microsoft.com/event?id=1162207895
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	16/05/2023	120	https://msevents.microsoft.com/event?id=3517068442
Hybridation des services de données Azure	24/05/2023	120	https://msevents.microsoft.com/event?id=2996507398
Self Service Analytics	01/06/2023	120	En cours
Total	**25**		

Liste des évènements de type Workshop/Prepa Cert/Academy

Event Workshop L300/400	Date	Duration (min)	Link
Synapse et Lakehouse Database	18/10/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u
Le NoSQL dans Azure - Migration CosmosDB / OSS	08/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u
Lab Lyon - Data & AI	22/11/2022	240	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUMlZZOURET0RSWjcyTERYRkJGTlFFUjJaUi4u
Lab Nantes - Data & AI	29/11/2022	240	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUMlZZOURET0RSWjcyTERYRkJGTlFFUjJaUi4u
L'IA dans les services de données Azure	12/12/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u
Open AI	H2	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdURE1RMVgwTDNISTE1TDFYSDVLR0cyS1kwWS4u

Event Academy, kickstart certifications, workshop certifications	Date	Duration (min)	Link
MCPP - DP-420	10/10/2022	420	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUMkJISlRKSU1RRFA0OVgzSFdTSTY0RE9WQy4u
Micro Hack CosmosDB	20/10/2022	420	H1 - Inscriptions PTA
Academy DP900	17-21/10/2022	300	https://msevents.microsoft.com/event?id=3250818161
Academy AI900	17-21/10/2022	300	https://msevents.microsoft.com/event?id=2717528090
Kickstart DP-500	17/10/2022	60	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNEk3WFQ1TEdNNTQ2Uk85V0cxQzM3TE9ZRS4u
Dry Run DP-500	14/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNEk3WFQ1TEdNNTQ2Uk85V0cxQzM3TE9ZRS4u
Q&A DP-500	05/12/2022	90	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNEk3WFQ1TEdNNTQ2Uk85V0cxQzM3TE9ZRS4u
Kickstart DP-100	17/10/2022	60	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNDAxV0hSN0FHM1YzUzI3OUNMUFYxSkRIMi4u
Dry Run DP-100	14/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNDAxV0hSN0FHM1YzUzI3OUNMUFYxSkRIMi4u
Q&A DP-100	05/12/2022	90	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUNDAxV0hSN0FHM1YzUzI3OUNMUFYxSkRIMi4u
Kickstart DP-203	17/10/2022	60	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUOVFWOUVCNFcyQk5SVjFBUFczNktCUFpLMi4u
Dry Run DP-203	14/11/2022	120	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUOVFWOUVCNFcyQk5SVjFBUFczNktCUFpLMi4u
Q&A DP-203	05/12/2022	90	https://forms.office.com/Pages/ResponsePage.aspx?id=v4j5cvGGr0GRqy180BHbR3zwJTO3s11AuaqpNnBbrwdUOVFWOUVCNFcyQk5SVjFBUFczNktCUFpLMi4u

Total 16

Microsoft Azure Solutions Business

Les solutions SQL dans Azure (PaaS, IaaS, SaaS)

La modernisation des bases de données SQL est au coeur de vos enjeux de transformation digitale ? Rejoignez-nous pour une session découverte des services SQL dans Azure pour tirer pleinement bénéfice des avantages du cloud natif.
Nous détaillerons tous les types de déploiement disponibles, PaaS, Managed Instance et Serverless.

Agenda (2h)

+ Introduction à « SQL dans Azure »
+ Déploiement de SQL Server en mode IaaS à l'aide de l'extension SQL (IaaS managé)
+ Azure SQL Database (PaaS), nouveautés, spécifications, déploiements et cas d'usages
+ Azure SQL Managed Instance (PaaS), présentations, nouveautés, déploiements et cas d'usages
+ Et si on parlait migration ?


Ali Bouhaddou
Cloud Solution Architect
Data Analytics


Frederic Gisbert
Cloud Solution Architect
Data Analytics


Franck Gaillard
Cloud Solution Architect
Data AI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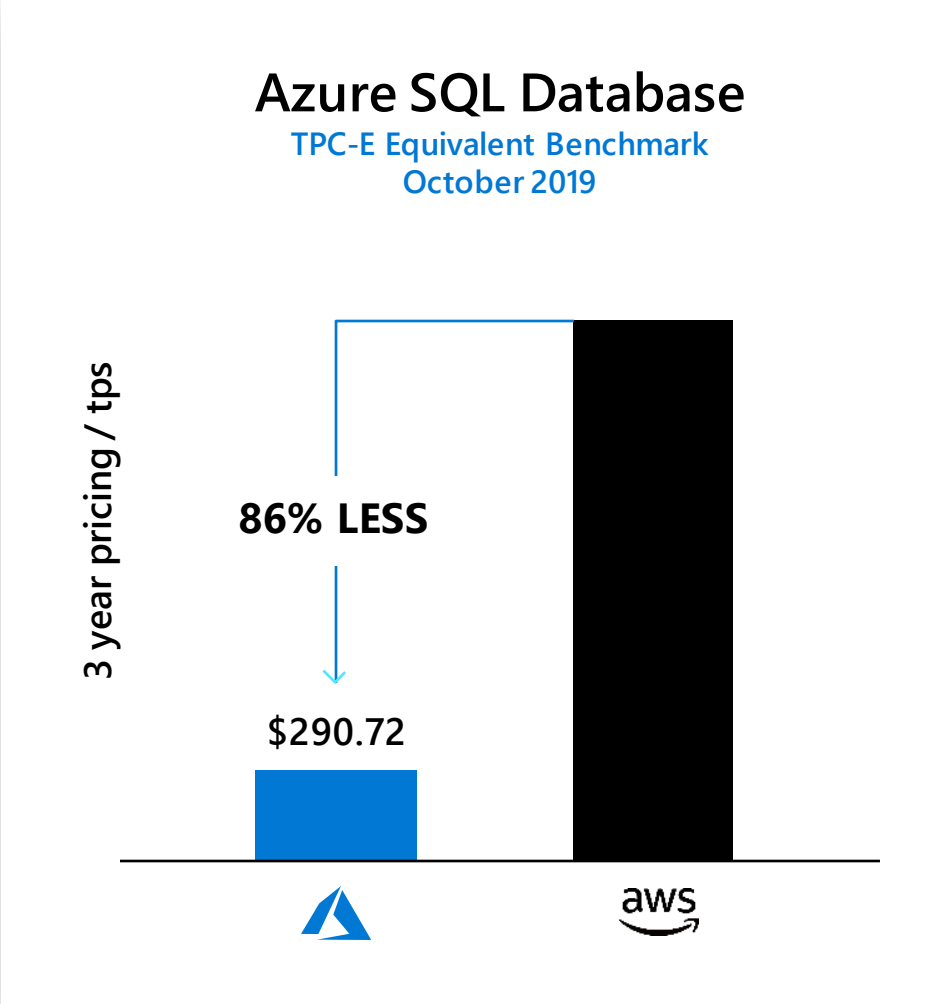
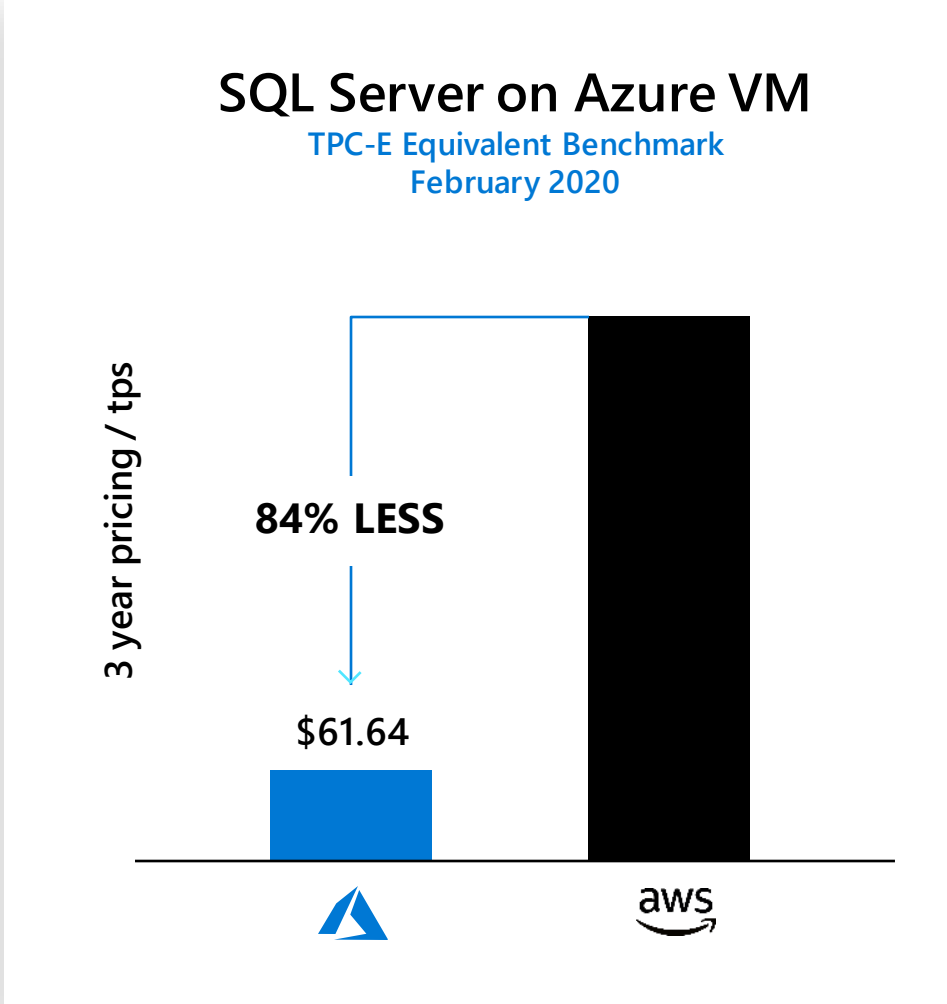
Azure SQL provides more price-performance value



price performance between a single, 80 vCore, Gen 5 Azure SQL Database on the business critical service tier and the db.r4.16xlarge offering for SQL Server on AWS RDS

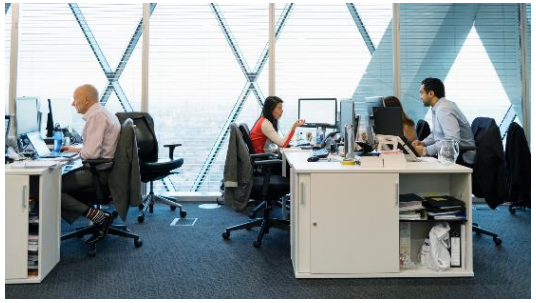


price performance between SQL Server 2019 Enterprise Edition on Windows Server 2019 Datacenter edition in Azure E32as_v4 instance type with P30 Premium SSD Disks and the SQL Server 2019 Enterprise Edition on Windows Server 2019 Datacenter edition in AWS EC2 r5a.8xlarge instance type with General Purpose (gp2) volumes

Source:
GigaOm

Key use cases

Rehost on-premises workloads to Linux-based SQL Server virtual machines



TeamSystem

"Using Microsoft SQL Server 2017 on Azure, we've reduced the effort and cost of running our platform while increasing our agility and speed of deployment—and optimizing performance."

Matteo Lazzari, Product Owner and CloudOps ERP Product Team Lead

Modernize in the cloud for efficient business operations

Life Is On Schneider Electric

"With Azure, we didn't have to reinvent everything. We could manage the database, its scale, backups, and redundancy right out of the box."

Paul Hill, Principal Cloud Architect

Optimize costs of unpredictable and intermittent workloads

icertis Applied Cloud

"We've realized three major benefits. One: We only pay for what we use. Two: relying on serverless automatic scaling instead of our own home-grown solution frees more time for innovation. And three: It helps our customers always get the right performance levels they need, day or night."

Purna Rao, Senior DevOps Architect

Simplify and secure IoT data with hybrid or edge computing

FUGRO

"We can remotely deploy Azure SQL Edge and gain SQL capabilities almost instantly. This is a game-changer, opening up possibilities of having multiple dedicated instances, all maintained remotely. "

Pim Peereboom, Global Project Manager, Integrated Marine Management

Migrate to IaaS, continue to PaaS and boost your ROI

Enterprise Strategy Group examined potential cost savings and business benefits enterprises would achieve from migrating on-premises workloads to Azure SQL, first to IaaS then to PaaS.

Key report benefits and findings[1]

Up to 47%
Cost savings on Azure SQL VMs vs on-premises SQL Server

Modernizing on Azure SQL yields even **greater** benefits…

+17%
Additional cost savings on Azure SQL managed databases vs Azure SQL VMs

53%
Lower cost of application administration

90%
Lower cost of systems administration

+$30M
Additional revenue due to faster time to market

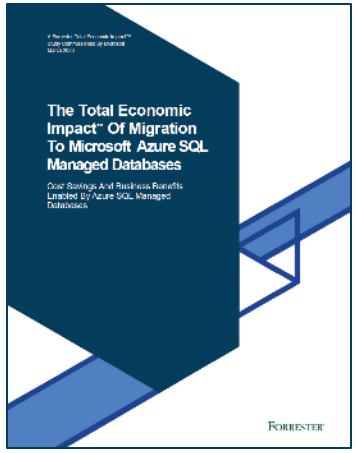
[1] Results are based on interviewed customers. "The Economic Value of Migration On-premises SQL Server Instances to Microsoft Azure SQL Solutions," a commissioned study conducted by The Enterprise Strategy Group on behalf of Microsoft, October 2020.

Modernize directly onto PaaS for maximum benefit

Forrester Consulting examined potential cost savings and business benefits enterprises would achieve from migrating on-premises workloads to fully managed Azure SQL Database and Azure SQL Managed Instance

"We needed our DBAs and IT staff to focus on improving the customer experience and other things critical to our company, not on patching databases and trying to manage our own infrastructure."

Chief architect, financial services company
Head of development, technology company



Key report benefits and findings[1]

238% Total ROI
3 years after initial investment & migration to Azure SQL's managed databases

3 months or less
Payback post migration

25%
Increase in productivity for IT teams

40%
Improvement in productivity for in-house DBAs

$10.9M
Savings from avoided hardware, network, storage and ongoing maintenance costs

[1] Results are for a composite organization based on interviewed customers. "The Total Economic Impact™ of Migration to Microsoft Azure SQL Managed Databases," a commissioned study conducted by Forrester Consulting on behalf of Microsoft, March 2020.

Choose the right Azure SQL database service for you

Let us help point you in the right direction in three easy steps

1. Visit our interactive tool
2. Answer a few simple questions
3. Receive a service recommendation

Try it at aka.ms/choose_your_AzureSQL_database
https://azure.microsoft.com/en-us/products/azure-sql/#choose-your-database

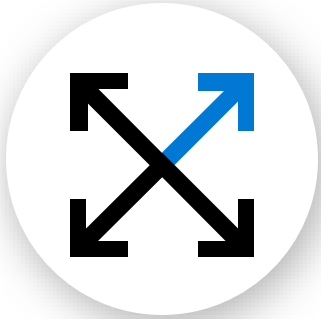
Azure SQL

Azure SQL Database and Azure SQL Managed Instance

Streamline app modernization

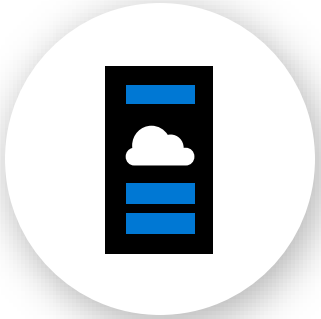
Accelerate app modernization with minimal code changes on the only cloud with evergreen SQL

Hyperscale demanding workloads



Rapidly adapt to changing requirements with Hyperscale storage up to 100 TB

Optimize price-performance with serverless compute



Build modern apps your way with flexible compute options that include auto-scaling serverless. Pay only for what you use.

Save with the best total cost of ownership

Meet mission critical requirements while costing up to 86% less than the competition

Built-in AI

Optimizes performance and durability for you

Advanced data security

Secure your data with layers of protection, built-in controls and leading compliance

Always On reliability

Maximize uptime with built-in high availability and an industry-leading availability SLA up to 99.995%

Azure SQL

SQL Server on Azure Virtual Machines

Save with the best total cost of ownership

Pay up to 84% less than AWS

Rehost onto an industry-leading database

Built on an enterprise-grade, unified data platform

Experience high performance on any operating system

High performance virtual machines for SQL Server on Linux and Windows

Protect your data and ease maintenance

Automatic security updates and built-in availability

Get the performance, security, and analytics of SQL Server backed by the flexibility and hybrid connectivity of Azure

Azure SQL

Azure SQL Edge

Time series, data streaming and AI

Stream, store, and analyze IoT data and apply business logic using built-in AI & ML capabilities

Native data movement to Azure

Consistent app development and management from cloud to data center to edge

Your choice of platform

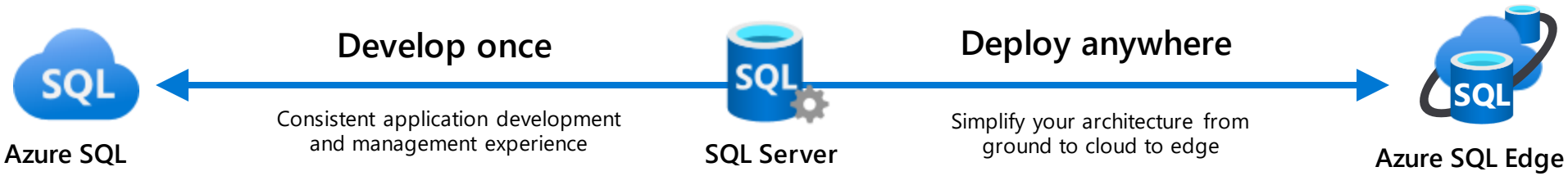
Run SQL on your choice of platform Including ARM 64 and x64 architecture

Unparalleled performance & security

Flexible high availability and industry-leading data protection and security tools

Simplified pricing for IoT

$10 per month/device or as low as $60 per year/device for a 3-year commitment*.



Optimized for IoT edge gateways and devices, this small-but-mighty SQL engine enables real-time insights, in **connected, disconnected, or hybrid** environments

* Terms and conditions apply. See Azure.com for details.

Microsoft Azure

SQL IaaS Extension

Driving customer adoption of IaaS++ benefits

Microsoft

Save time, save money, and enhance security with SQL Server on Azure Virtual Machines

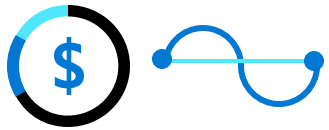
Turn on SQL Server IaaS Agent Extension* for automated virtual machine management at no additional cost

Only on Azure

Enjoy a suite of **free** manageability capabilities for SQL Server on Azure Virtual Machines that enable you to run your virtual machines in a cost effective, secured and optimized manner. Available only on Azure.

Optimize Cost

Simplified license conversion between SQL BYOL (Azure Hybrid Benefit) and pay-as-you-go licensing to optimize your cost.

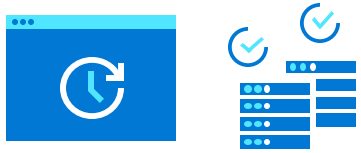


Enhance Security

Automate security patching and easily implement encryption features for
better security and compliance.

Boost Uptime

Easily configure high availability, automate backup, and take advantage of HA/DR license benefits to enhance business continuity.



Simplify Management

Implement best practices automatically and configure your storage settings more optimally for SQL Server.

* Formerly SQL Resource Provider

SQL IaaS Agent Extension benefits

Simplify management and save with SQL Server on Azure Virtual Machines

Optimize cost

See all your **SQL Server on Azure VMs in one location**, **convert between license types**, and save by paying only for what you use.

- **Inventory Management-** Counts licenses of different types. Helps you understand your data estate
- **Flexible licensing** – Enables **immediate conversions between pay as you go** (PAYG) and **Azure Hybrid Benefit** (AHB) license models with no availability impact. Enables **conversion between Developer and Enterprise edition**
- **In-place edition updates** – Enables **upgrades or downgrades of SQL Server edition** for supported upgrade paths **with no availability impact**. Automatically reflects the pricing change

Enhance Security

Manage **security patching** and easily implement **encryption features** for better security and compliance.

- Automated Patching–Automates installation of SQL Server **Security updates within customer defined maintenance window**
- Azure Key Vault Integration- Configure Azure Key Vault for the SQL Server instance to leverage Key Vault for **Transparent Database Encryption**(TDE), **Column Level Encryption and Always Encrypted** features of SQL Server to enable encryption of data at rest and in motion

Boost uptime

Automate backup, easily configure **high availability,** and take advantage of HA/DR license benefits to enhance business continuity.

- Automated backup–set up **SQL Server backups** with various options **including encrypting backups**, setting a **retention period**, **backing up system databases**, configuring **a manual backup schedule**, or setting up an **automated backup**.
- Automated high availability configuration – Configure **Always On availability groups for SQL Server on virtual machines**, easing complex administration task such as **creating a new cluster or onboarding an existing cluster**
- Disaster Recovery license type –**Leverage SQL Server HA/DR Software Assurance benefits** in Azure**.** Enable **using Azure as a Disaster Recovery site for your on-premises SQL Server at no additional license cost for customers with Software Assurance or SQL Server subscription licenses.**

Simplify management

Automatically implement storage best practices and **configure your storage settings more optimally** for SQL Server.

- Automated storage management – simplify storage configuration **while setting up the virtual machine using pre-configured storage**. This ensures that you are picking the right storage configuration for your data, log and tempdb files
- **Centralized administration** - Easily manage your SQL VM and SQL PaaS deployments from one central location
- **Implement best practices** - Deploy SQL Server with pre-configured best practices

SQL VM registration become easy

What's coming: Easy opt-in for SQL IaaS Agent Extension

In October we will launch a SQL VM registration button in the SQL Virtual Machine blade on Azure Portal

- Checking the box provides consent to register all existing and future SQL Server on Azure VMs in the subscription
- An automated job will run at a scheduled frequency, registering any new SQL Server on Azure VM created in the subscription as well

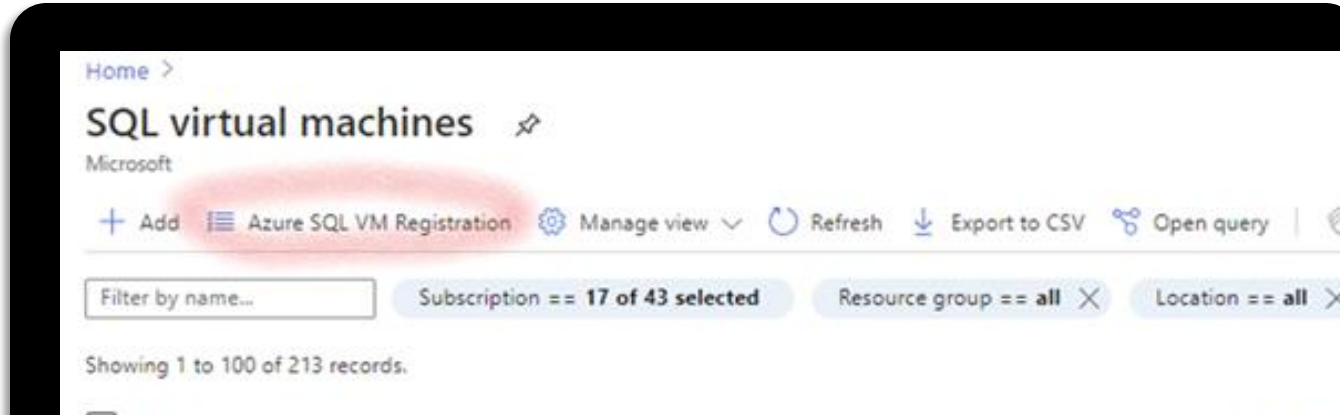
Benefits

- Fast and easy vs. script or manually adding VMs. One person can ack by portal or CLI for the whole subscription. Customer can register all versions 2008+ (on WS 2008 R2+), without needing to turn on telemetry

Statement of no SQL IaaS Agent Extension data use for audit

Change to data privacy policy to shield SQL registration data from audit

Enables to-customer statement in the opt-in that data can't be used for audit unless the customer agrees: "**SQL Server VM registration data will not be used for a SAM audit unless the customer asks us to leverage the data for the same"**



Internal FAQ – SQL IaaS Agent Extension registration

Q: What is SQL IaaS Agent Extension (aka SQL resource provider)?

SQL IaaS Agent Extension is an Azure VM Extension that enables additional management capabilities for self-installed SQL Server on Azure VMs. SQL RP is an easy way to adopt PaaS-like capabilities with IaaS-based SQL Server. Read more in this recent blog.

Q: What is self-installed SQL Server?

Self-installed SQL Server is created when a customer brings their own VM image to Azure rather than using a SQL Server image from the Azure portal.

Q: Why is SQL IaaS Agent Extension registration a priority?

SQL IaaS Agent Extension provides differentiating capabilities on Azure VMs and starts the customer down the path to PaaS. In addition, registered VMs count as both ADS & ACR, regardless of when the VM was created.

Q: What are we announcing about SQL IaaS Agent Extension in October?

In October we will launch a new registration button in the SQL Virtual Machine blade on Azure Portal. Checking the box provides consent to register all existing and future SQL Server VMs in the subscription. An automated job will run at a scheduled frequency, registering any new SQL Server VM created in the subscription.

Q: What will customers be able do that they could not do before?

Customers will now register in a fast and easy way, instead of running a script or manually adding VMs. One person can agree to register by portal or CLI for the whole subscription, and they don't have to be a subscription admin. The customer can register all SQL Server 2008 and higher versions (on WS 2008 R2+), with or without SQL Server telemetry turned on.

Q: Will turning on SQL IaaS Agent Extension cause a licensing audit?

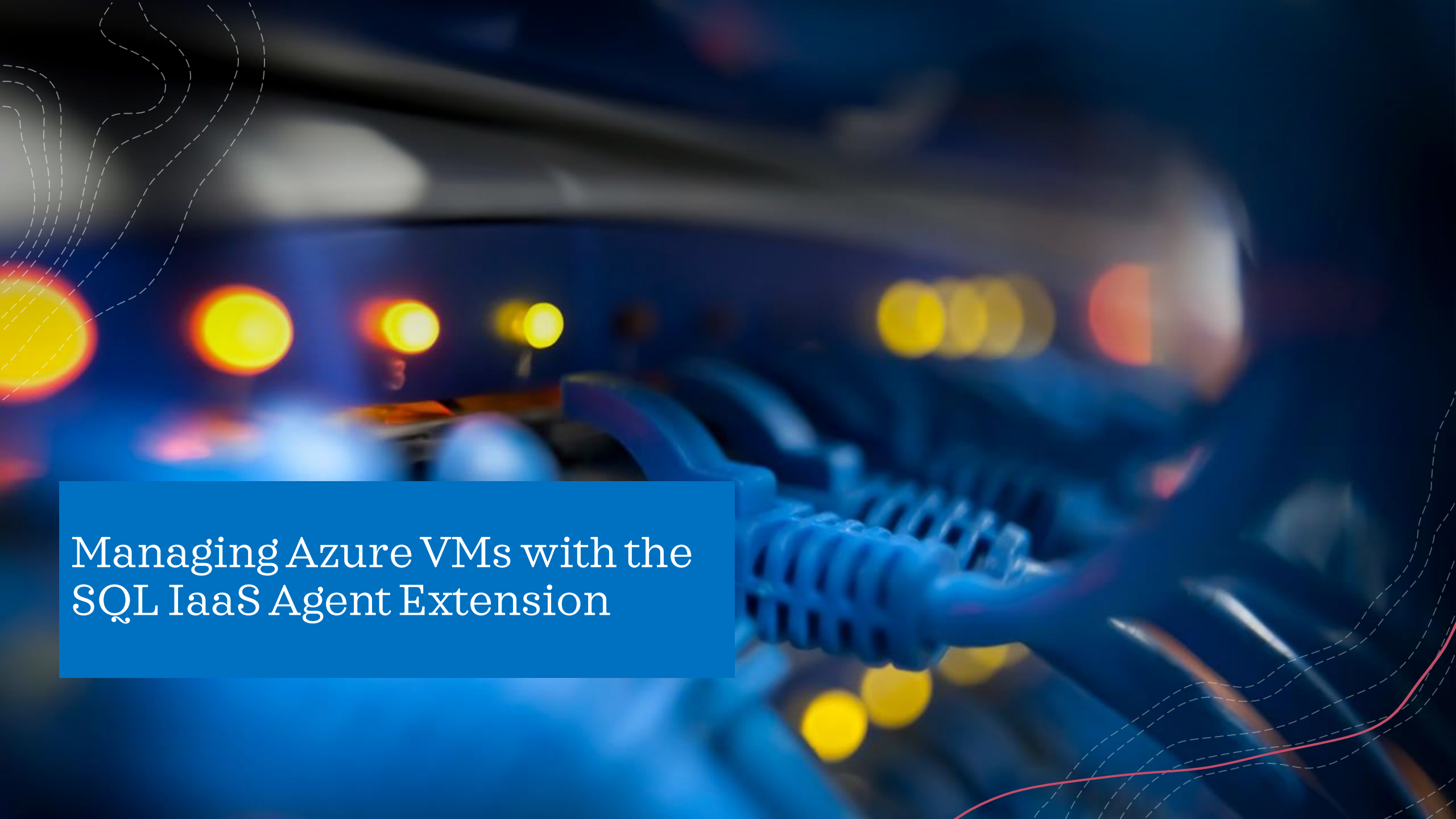
In response to customer concerns, we have recently clarified the usage rules for SQL IaaS Agent Extension (OII) data. Now, the data can only be used for license audit if the customer volunteers it. This enables a statement in the opt-in "SQL Server VM registration data will not be used for a SAM audit unless the customer asks us to leverage the data for the same."

Q: How does this affect our competitive positioning vs. SQL on other cloud providers?

SQL IaaS Agent Extension continues to offer a unique set of cost optimization, manageability, HA, and security features not offered by SQL Server on IaaS in other major cloud vendors.

Q: What seller actions are required?

Drive this sales play with your customers, landing the benefits of SQL IaaS Agent extension and asking them to use the registration button when it becomes available beginning early October.



Managing Azure VMs with the SQL IaaS Agent Extension

Microsoft Azure (Preview) | Report a bug | Search resources, services, and docs (G+/)

Home > Virtual machines >

Virtual machines

Microsoft

Add | Reservations | Manage view | Refresh | Export to CSV | Open query | Assign tags | Start | Restart | Stop | Delete | Services | Feedback | Leave preview

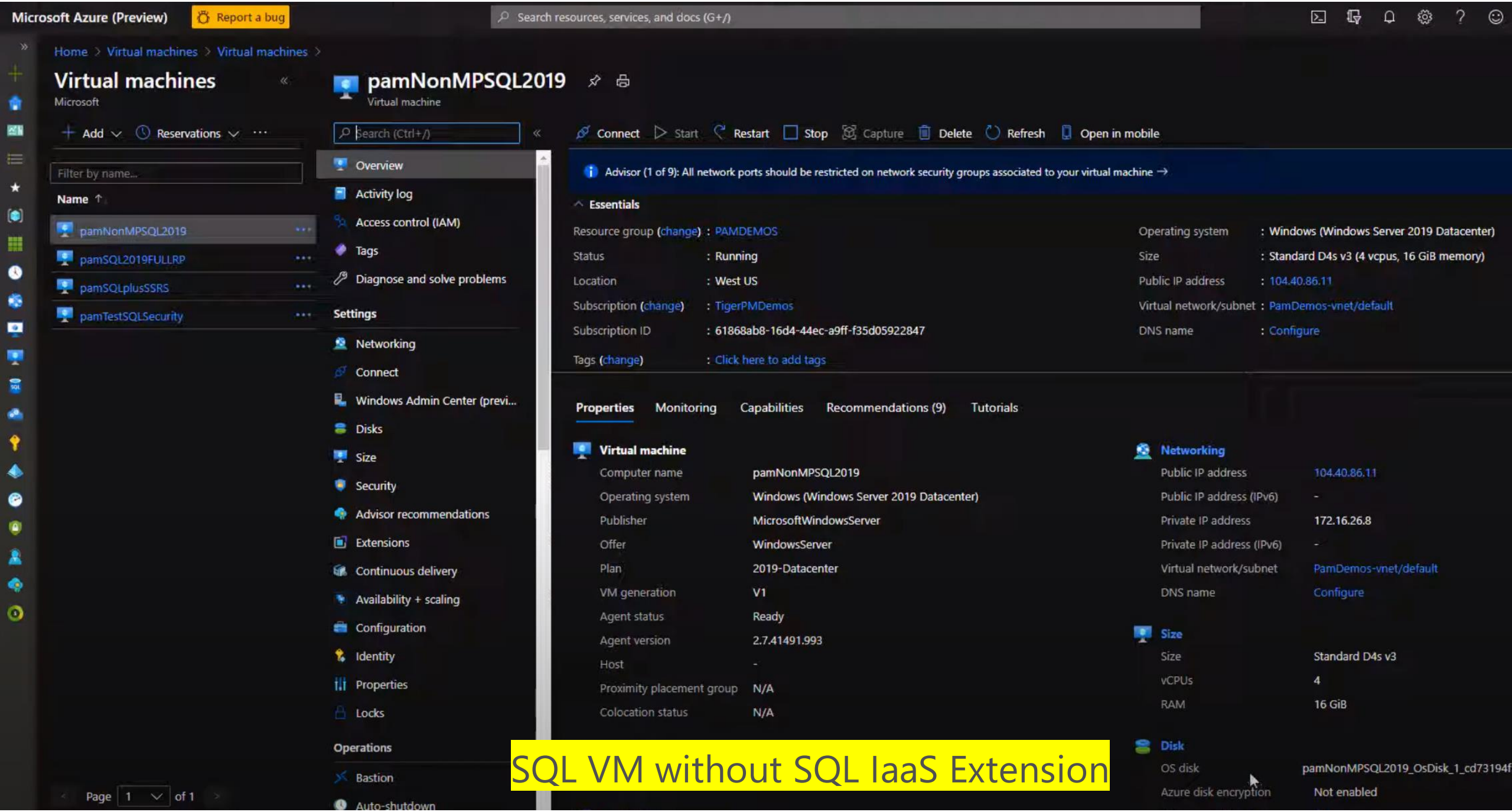
Filter by name... | Subscription == **TigerPMDemos** | Resource group == **pamdemos** | Location == **all** | Add filter

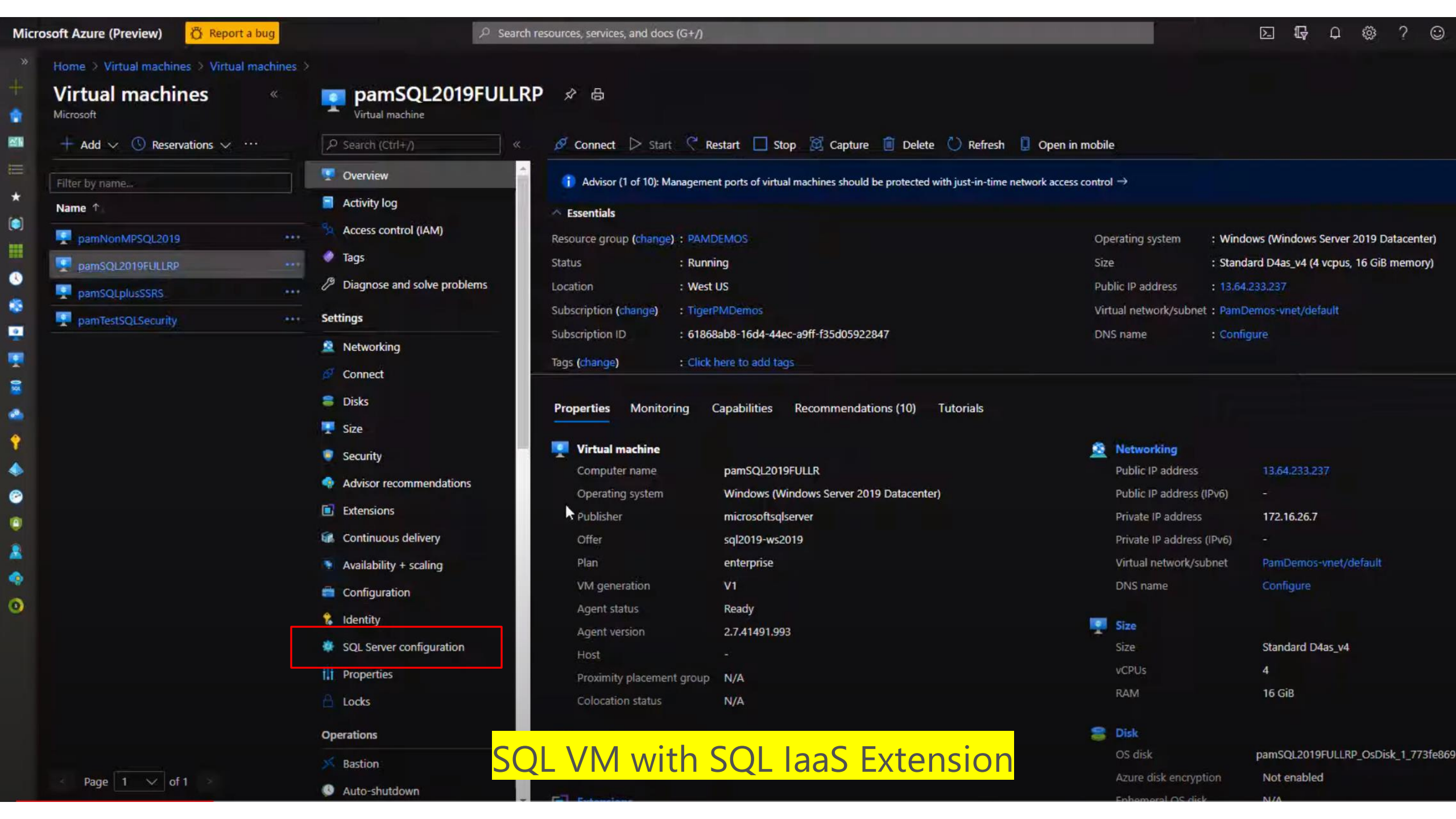
Showing 1 to 4 of 4 records.

No grouping

Name	Subscription	Resource group	Location	Status	Operating system	Size	Public IP address
pamNonMPSQL2019	TigerPMDemos	PAMDEMOS	West US	Running	Windows	Standard_D4s_v3	104.40.86.11
pamSQL2019FULLRP	TigerPMDemos	PAMDEMOS	West US	Running	Windows	Standard_D4as_v4	13.64.233.237
pamSQLplusSSRS	TigerPMDemos	PAMDEMOS	West US	Running	Windows	Standard_D4as_v4	13.88.18.99
pamTestSQLSecurity	TigerPMDemos	PAMDEMOS	West US	Running	Windows	Standard_D4as_v4	13.64.95.186

Previous | Page 1 of 1 | Next


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home > Virtual machines > Virtual machines
Virtual machines
Microsoft
Add
Reservations
Filter by name...
Name
pamNonMPSQL2019
pamSQL2019FULLRP
pamSQLplusSSRS
pamTestSQLSecurity
Page 1 of 1
pamNonMPSQL2019
Virtual machine
Search (Ctrl+/)
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Settings
Networking
Connect
Windows Admin Center (previ...
Disks
Size
Security
Advisor recommendations
Extensions
Continuous delivery
Availability + scaling
Configuration
Identity
Properties
Locks
Operations
Bastion
Auto-shutdown
Connect
Start
Restart
Stop
Capture
Delete
Refresh
Open in mobile
Advisor (1 of 9): All network ports should be restricted on network security groups associated to your virtual machine →
Essentials
Resource group (change) : PAMDEMOS
Status : Running
Location : West US
Subscription (change) : TigerPMDemos
Subscription ID : 61868ab8-16d4-44ec-a9ff-f35d05922847
Tags (change) : Click here to add tags
Operating system : Windows (Windows Server 2019 Datacenter)
Size : Standard D4s v3 (4 vcpus, 16 GiB memory)
Public IP address : 104.40.86.11
Virtual network/subnet : PamDemos-vnet/default
DNS name : Configure
Properties
Monitoring
Capabilities
Recommendations (9)
Tutorials
Virtual machine
Computer name pamNonMPSQL2019
Operating system Windows (Windows Server 2019 Datacenter)
Publisher MicrosoftWindowsServer
Offer WindowsServer
Plan 2019-Datacenter
VM generation V1
Agent status Ready
Agent version 2.7.41491.993
Host -
Proximity placement group N/A
Colocation status N/A
Networking
Public IP address 104.40.86.11
Public IP address (IPv6) -
Private IP address 172.16.26.8
Private IP address (IPv6) -
Virtual network/subnet PamDemos-vnet/default
DNS name Configure
Size
Size Standard D4s v3
vCPUs 4
RAM 16 GiB
Disk
OS disk pamNonMPSQL2019_OsDisk_1_cd73194f
Azure disk encryption Not enabled
SQL VM without SQL IaaS Extension


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home > Virtual machines > Virtual machines
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Microsoft
Add
Reservations
Filter by name...
Name
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pamSQL2019FULLRP
pamSQLplusSSRS
pamTestSQLSecurity
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Extensions
Continuous delivery
Availability + scaling
Configuration
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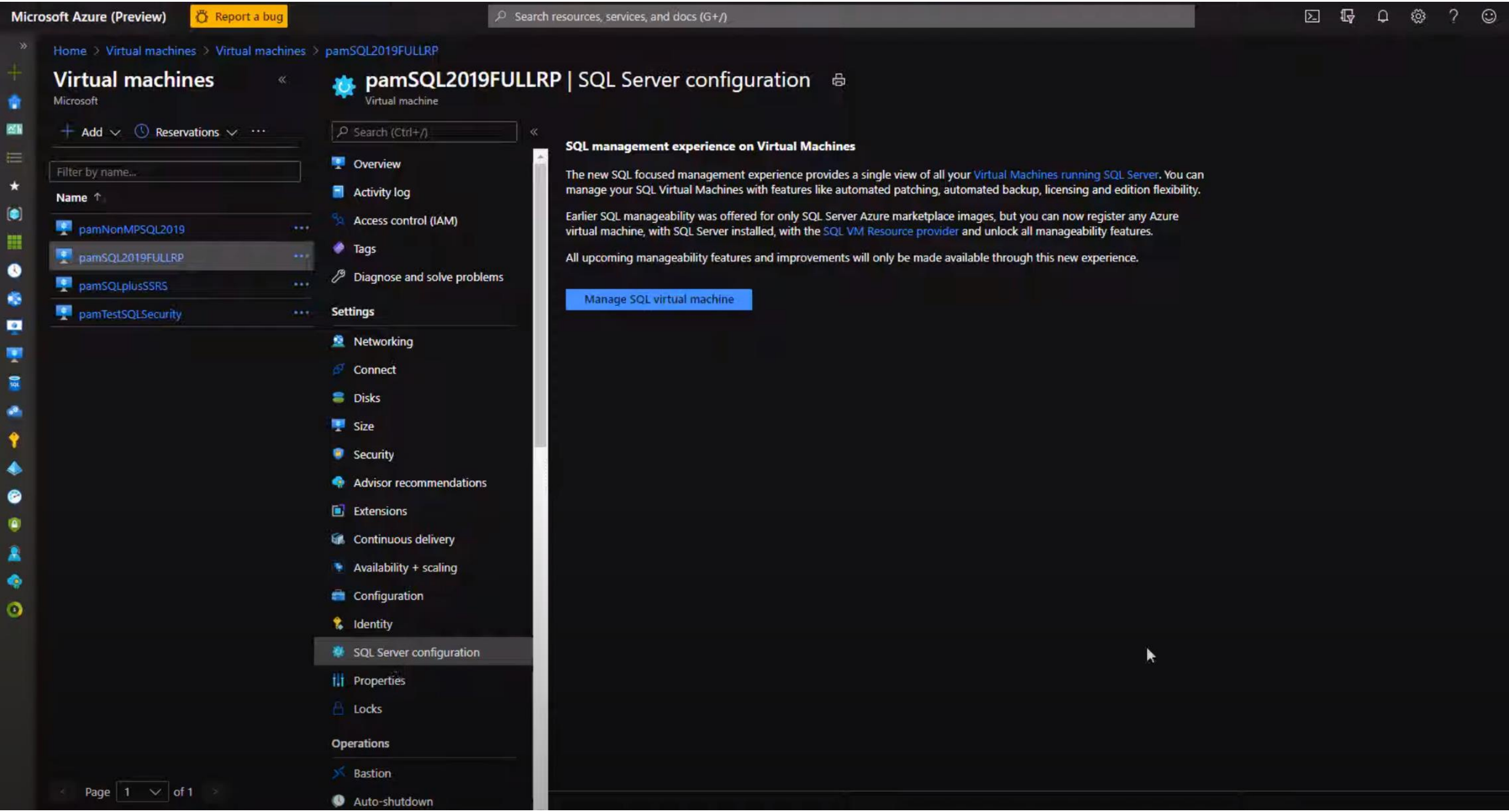
SQL Server configuration
Properties
Locks
Operations
Bastion
Auto-shutdown
Connect
Start
Restart
Stop
Capture
Delete
Refresh
Open in mobile
Advisor (1 of 10): Management ports of virtual machines should be protected with just-in-time network access control →
Essentials
Resource group (change) : PAMDEMOS
Status : Running
Location : West US
Subscription (change) : TigerPMDemos
Subscription ID : 61868ab8-16d4-44ec-a9ff-f35d05922847
Tags (change) : Click here to add tags
Operating system : Windows (Windows Server 2019 Datacenter)
Size : Standard D4as_v4 (4 vcpus, 16 GiB memory)
Public IP address : 13.64.233.237
Virtual network/subnet : PamDemos-vnet/default
DNS name : Configure
Properties
Monitoring
Capabilities
Recommendations (10)
Tutorials
Virtual machine
Computer name pamSQL2019FULLR
Operating system Windows (Windows Server 2019 Datacenter)
Publisher microsoftsqlserver
Offer sql2019-ws2019
Plan enterprise
VM generation V1
Agent status Ready
Agent version 2.7.41491.993
Host -
Proximity placement group N/A
Colocation status N/A
Networking
Public IP address 13.64.233.237
Public IP address (IPv6) -
Private IP address 172.16.26.7
Private IP address (IPv6) -
Virtual network/subnet PamDemos-vnet/default
DNS name Configure
Size
Size Standard D4as_v4
vCPUs 4
RAM 16 GiB
Disk
OS disk pamSQL2019FULLRP_OsDisk_1_773fe869
Azure disk encryption Not enabled
SQL VM with SQL IaaS Extension


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home > Virtual machines > Virtual machines > pamSQL2019FULLRP
Virtual machines
Microsoft
Add
Reservations
Filter by name...
Name
pamNonMPSQL2019
pamSQL2019FULLRP
pamSQLplusSSRS
pamTestSQLSecurity
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pamSQL2019FULLRP | SQL Server configuration
Virtual machine
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Diagnose and solve problems
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Continuous delivery
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Configuration
Identity
SQL Server configuration
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Locks
Operations
Bastion
Auto-shutdown
SQL management experience on Virtual Machines
The new SQL focused management experience provides a single view of all your Virtual Machines running SQL Server. You can manage your SQL Virtual Machines with features like automated patching, automated backup, licensing and edition flexibility.
Earlier SQL manageability was offered for only SQL Server Azure marketplace images, but you can now register any Azure virtual machine, with SQL Server installed, with the SQL VM Resource provider and unlock all manageability features.
All upcoming manageability features and improvements will only be made available through this new experience.
Manage SQL virtual machine

pamSQL2019FULLRP

SQL virtual machine

Search (Ctrl+/)

Overview
Access control (IAM)
Tags

Settings
Configure
Security
Patching
Backups
Additional features
High Availability (Preview)
Properties

Automation
Tasks

Support + troubleshooting
New support request

Refresh | Delete | Feedback

Essentials

Resource group (change)	: PAMDEMOS	Version	: SQL Server 2019
Status	: Online	Edition	: Enterprise
Location	: West US	Virtual machine	: pamSQL2019FULLRP
Subscription (change)	: TigerPMDemos	Virtual machine OS	: Windows (Windows Server 2019 Datacenter)
Subscription ID	: 61868ab8-16d4-44ec-a9ff-f35d05922847	Virtual machine size	: Standard D4as v4
SQL configuration	: Click here to view SQL extension configuration	License type	: Azure Hybrid Benefit
Tags (change)	: Click here to add tags		

Notifications (0) | **Features (7)**

All | Pricing (2) | Security (2) | Configuration (3)

License type
Configure the licensing model and SQL server edition for the SQL Server virtual machine.
CONFIGURED

Storage configuration
Automate your storage configuration by attaching storage to the VM, making that storage accessible to SQL Server.
CONFIGURED

SQL connectivity
Configuration the connection to the SQL Server instance running on your Azure virtual machine.
CONFIGURED

Azure Key Vault integration
Configure the Azure Key Vault (AKV) service to manage and store the cryptographic keys.
NOT CONFIGURED

Automated patching
Establish a maintenance window for an Azure Virtual Machine running SQL Server.
NOT CONFIGURED

Automated backup
Configure the backups options for SQL Server running in a Windows virtual machine.
NOT CONFIGURED

R Services (Advanced analytics)

SQL virtual machines

Microsoft

Add | Automatic SQL Server VM registration | Manage view | Refresh | Export to CSV | Open query | Assign tags | Feedback

Filter by name... | Subscription == **TigerPMDemos** | Resource group == **pamdemos** | Location == **all** | Add filter

Showing 1 to 2 of 2 records.

No grouping

Name	Resource group	License type	Version	Edition	Location	Subscription
pamSQL2019FULLRP	PamDemos	Azure Hybrid Benefit	SQL2019-WS2019	Enterprise	West US	TigerPMDemos
pamTestSQLSecurity	PamDemos	Pay As You Go	SQL2019-WS2019	Enterprise	West US	TigerPMDemos

< Previous Page 1 of 1 Next >

SQL virtual machin...
Microsoft

Add ...

Filter by name...

Name ↑

pamSQL2019FULLRP
pamTestSQLSecurity

pamSQL2019FULLRP | Configure
SQL virtual machine

Search (Ctrl+/)

Overview
Access control (IAM)
Tags

Settings

Configure
Security
Patching
Backups
Additional features
High Availability (Preview)
Properties

Automation

Tasks

Support + troubleshooting

New support request

Feedback

SQL Server License

Save up to 43% with a license you already own with Azure Hybrid Benefit. Get a free SQL server licenses in Azure for High Availability and Disaster Recovery through Software Assurance. These discounts are only supported for Standard and Enterprise editions. Learn more

SQL Server License: Pay As You Go | Azure Hybrid Benefit | HA/DR

Confirmation *: ☑ I confirm that I have a SQL server license with Software Assurance to apply this Azure Hybrid Benefit for SQL Server

Edition

Edition of SQL Server running on the virtual machine. SQL Server is billed based on this edition type.

Edition: Enterprise

STORAGE USAGE

Review your storage optimization configuration here or extend your storage capacity by selecting from a variety of disk types.

Storage for this virtual machine is optimized for Transactional processing use.

Drive	Drive capacity	
Data	SQLVMDATA1 (F:) 1022 Gib free of 1023 Gib	Not extendable
Log	SQLVMLOG (G:) 1023 Gib free of 1023 Gib	Not extendable
TempDb	Temporary Storage (D:) 30 Gib free of 32 Gib	Not extendable

Page 1 of 1

Apply Cancel

SQL virtual machin...

Microsoft

Add ...

Filter by name...

Name

- pamSQL2019FULLRP
- pamTestSQLSecurity

Page 1 of 1

pamSQL2019FULLRP | Security

SQL virtual machine

Search (Ctrl+/)

- Overview
- Access control (IAM)
- Tags

Settings

- Configure
- Security
- Patching
- Backups
- Additional features
- High Availability (Preview)
- Properties

Automation

- Tasks

Support + troubleshooting

- New support request

Feedback

Security & Networking

SQL connectivity * Private (within Virtual Network)

Port * 1433

SQL CREDENTIALS

SQL Authentication (i) Disable Enable

AZURE KEY VAULT INTEGRATION

Configure your virtual machine to be able to connect to the Azure Key Vault service.

Azure Key Vault integration (i) Disable Enable

Apply Cancel

SQL virtual machin...

Microsoft

Add ...

Filter by name...

Name

- pamSQL2019FULLRP
- pamTestSQLSecurity

Page 1 of 1

pamSQL2019FULLRP | Patching

SQL virtual machine

Search (Ctrl+/)

- Overview
- Access control (IAM)
- Tags

Settings

- Configure
- Security
- Patching
- Backups
- Additional features
- High Availability (Preview)
- Properties

Automation

- Tasks

Support + troubleshooting

- New support request

Feedback

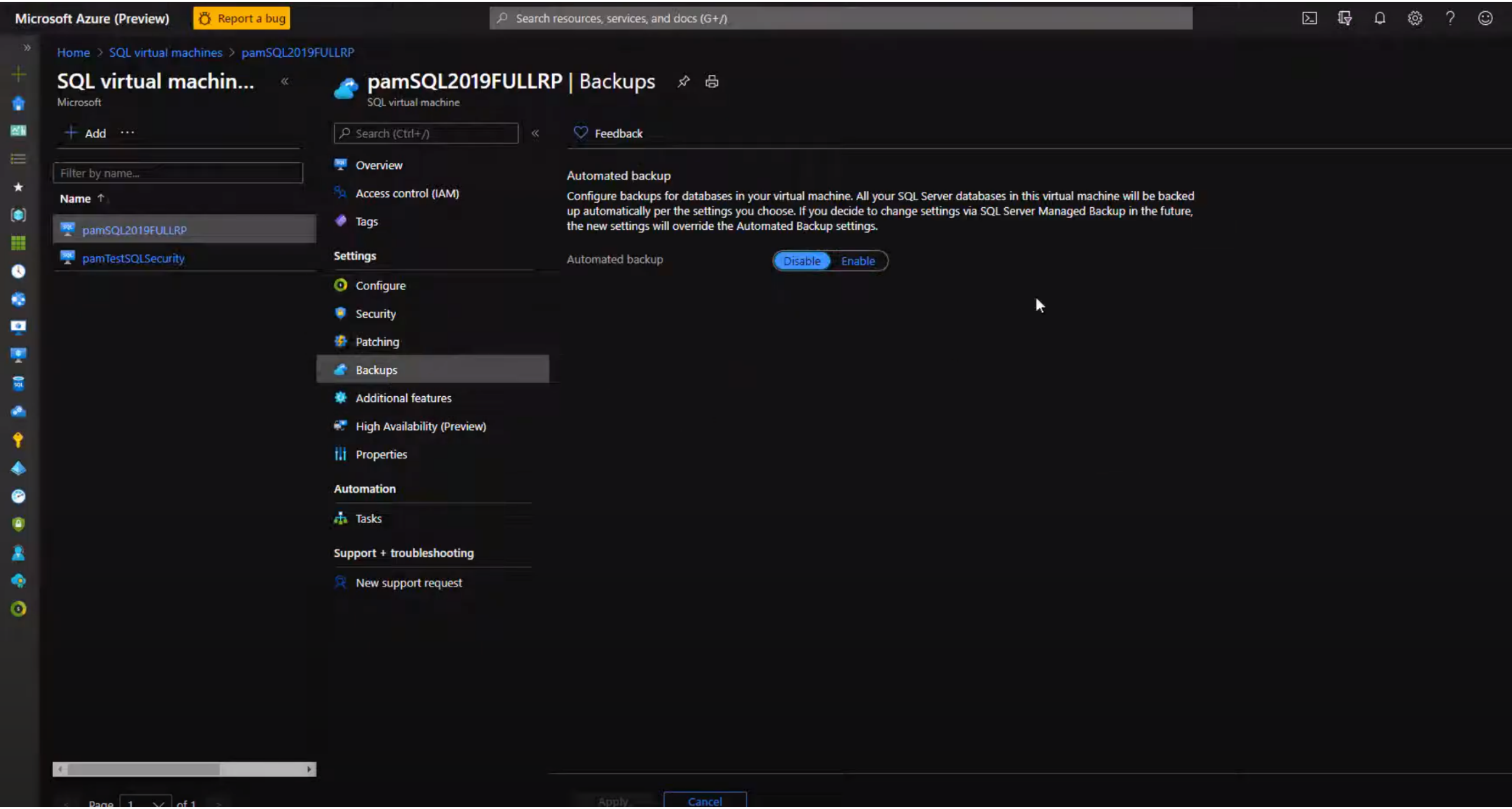
Automated patching

Set a patching window during which all Windows and SQL patches will be applied.

Only Windows and SQL Server updates marked Important are installed. Other SQL Server updates, such as Cumulative Updates, must be installed manually.
Learn more

Automated patching Disable Enable

Apply Cancel


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home > SQL virtual machines > pamSQL2019FULLRP
SQL virtual machin...
Microsoft
Add
Filter by name...
Name
pamSQL2019FULLRP
pamTestSQLSecurity
pamSQL2019FULLRP | Backups
SQL virtual machine
Search (Ctrl+/)
Feedback
Overview
Access control (IAM)
Tags
Settings
Configure
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Backups
Additional features
High Availability (Preview)
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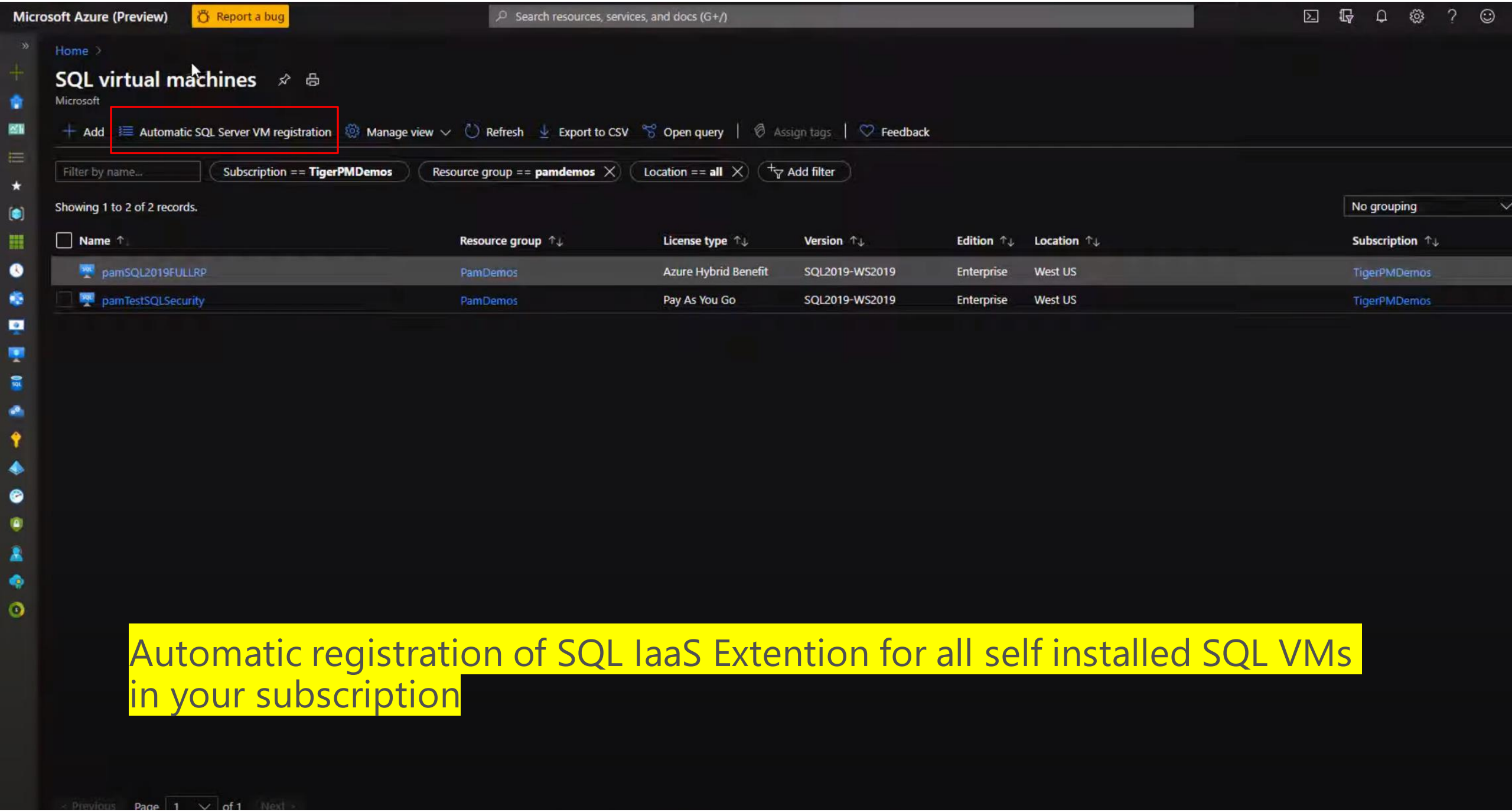
Automation
Tasks
Support + troubleshooting
New support request
Automated backup
Configure backups for databases in your virtual machine. All your SQL Server databases in this virtual machine will be backed up automatically per the settings you choose. If you decide to change settings via SQL Server Managed Backup in the future, the new settings will override the Automated Backup settings.
Automated backup
Disable
Enable
Page 1 of 1
Apply
Cancel



Automatic registration of SQL IaaS Extention for all self installed SQL VMs in your subscription

Microsoft Azure (Preview) | Report a bug | Search resources, services, and docs (G+/)

Home >

SQL virtual machines

Microsoft

Add | Automatic SQL Server VM registration | Manage view | Refresh | Export to CSV | Open query | Assign tags | Feedback

Filter by name... | Subscription == **TigerPMDemos** | Resource group == **pamdemos** | Location == **all** | Add filter

Showing 1 to 2 of 2 records.

Name	Resource group	License type	Version
pamSQL2019FULLRP	PamDemos	Azure Hybrid Benefit	SQL2019-WS2019
pamTestSQLSecurity	PamDemos	Pay As You Go	SQL2019-WS2019

Previous | Page 1 of 1 | Next

Automatic SQL Server VM registration

SQL virtual machine

Registering SQL Server on Azure virtual machines (VMs) with the SQL VM resource provider has several advan
manageability capabilities (such as automated patching and automated backup), as well as unlocking licensing
capabilities provided will expand over time as Microsoft will continue to add new benefits over time. Learn mo

Automatic SQL VM resource provider registration

The automatic registration of a subscription will register all currently available SQL VMs with the SQL VM reso
mode as well as any SQL VMs deployed to the subscription in the future. This process does not restart the SQ
upgrading to full manageability mode is recommended to take advantage of the full feature set. Learn more

Subscription * TigerPMDemos

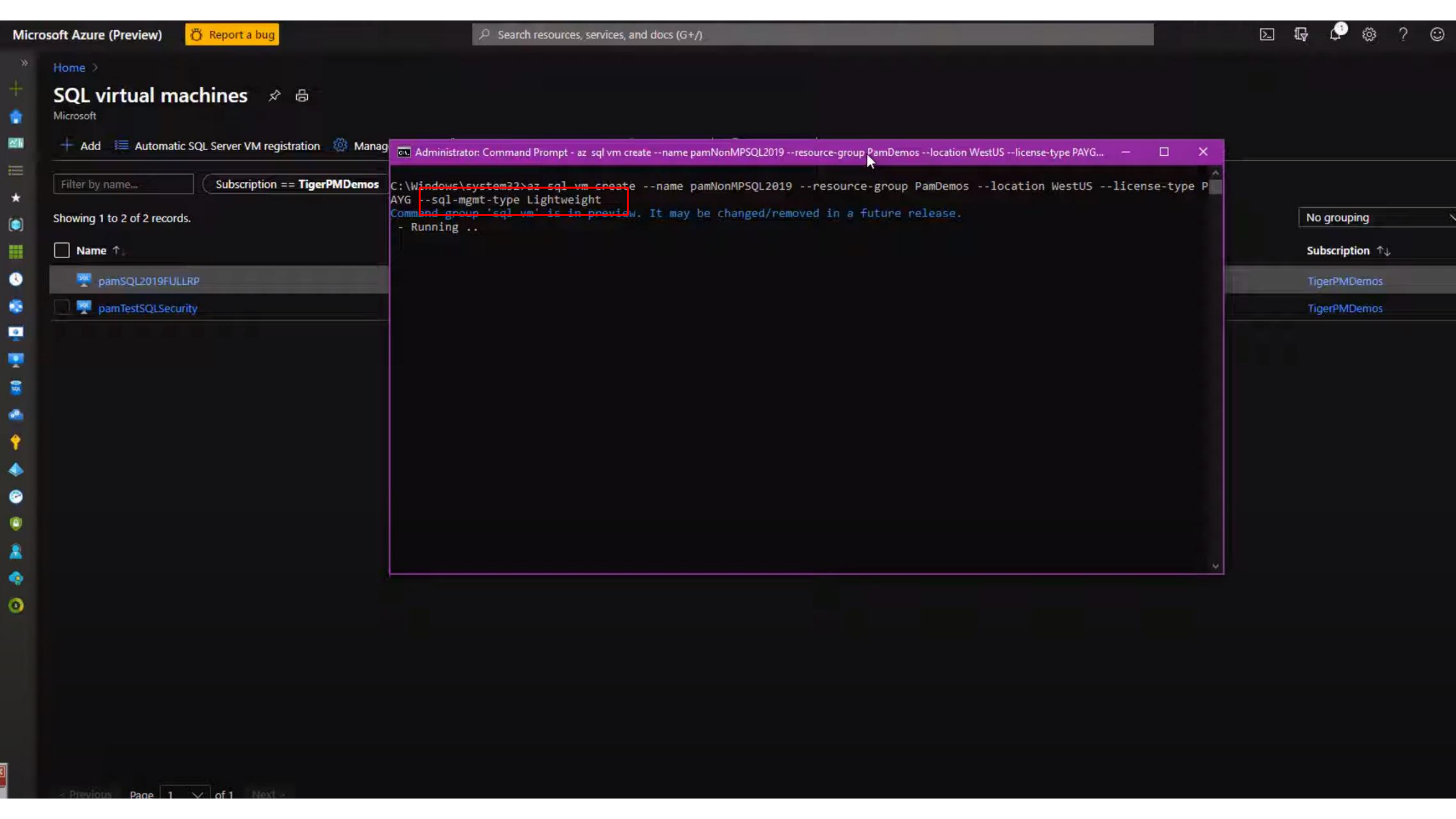
EULA

I accept the terms in the agreement *

By clicking "I accept", I confirm that I have authority to enter into agreements on behalf of the above subscript
I consent to allow Microsoft to access SQL Server environment information on all Azure Virtual Machines belong
subscription ID. Furthermore, I permit Microsoft to register all SQL Server instances with the SQL VM resource pr
more

To learn more about SQL Server data processing and privacy controls, please see the SQL Server Privacy Suppl

Register | Cancel


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home
SQL virtual machines
Microsoft
Add
Automatic SQL Server VM registration
Manag
Filter by name...
Subscription == TigerPMDemos
Showing 1 to 2 of 2 records.
No grouping
Name
Subscription
pamSQL2019FULLRP
TigerPMDemos
pamTestSQLSecurity
TigerPMDemos
Administrator: Command Prompt - az sql vm create --name pamNonMPSQL2019 --resource-group PamDemos --location WestUS --license-type PAYG...
C:\Windows\system32>az sql vm create --name pamNonMPSQL2019 --resource-group PamDemos --location WestUS --license-type P
AYG --sql-mgmt-type Lightweight
Command group 'sql vm' is in preview. It may be changed/removed in a future release.
- Running ..
Page 1 of 1

Microsoft Azure (Preview) | Report a bug | Search resources, services, and docs (G+/)

Home >

SQL virtual machines

Microsoft

Add | Automatic SQL Server VM registration | Manage view | Refresh | Export to CSV | Open query | Assign tags | Feedback

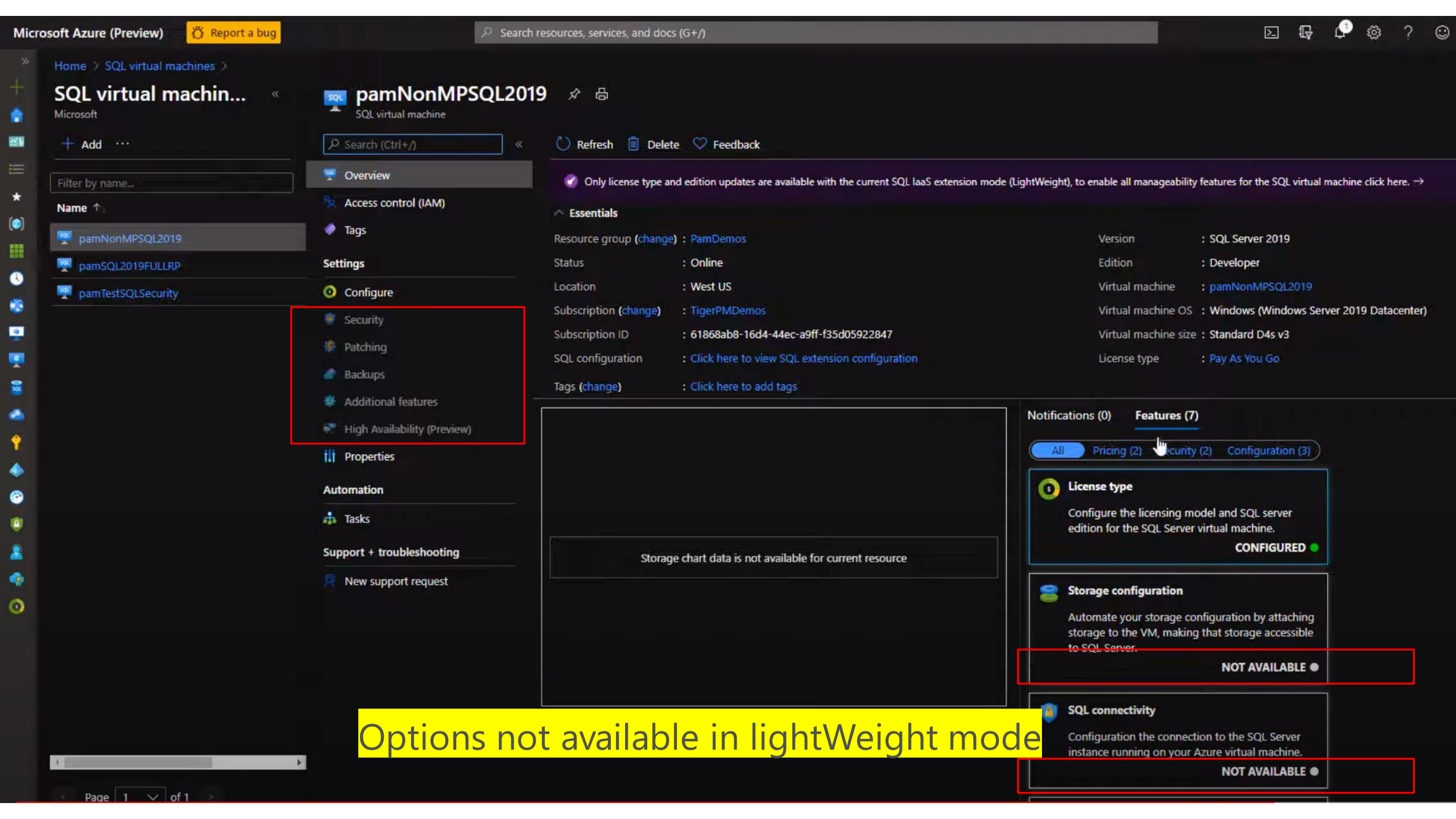
Filter by name... | Subscription == **TigerPMDemos** | Resource group == **pamdemos** | Location == **all** | Add filter

Showing 1 to 3 of 3 records.

No grouping

Name	Resource group	License type	Version	Edition	Location	Subscription
pamNonMPSQL2019	PamDemos	Pay As You Go	SQL2019-WS2019	Developer	West US	TigerPMDemos
pamSQL2019FULLRP	PamDemos	Azure Hybrid Benefit	SQL2019-WS2019	Enterprise	West US	TigerPMDemos
pamTestSQLSecurity	PamDemos	Pay As You Go	SQL2019-WS2019	Enterprise	West US	TigerPMDemos

< Previous | Page 1 of 1 | Next >


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home > SQL virtual machines >
SQL virtual machin...
Microsoft
Add
Filter by name...
Name
pamNonMPSQL2019
pamSQL2019FULLRP
pamTestSQLSecurity
pamNonMPSQL2019
SQL virtual machine
Search (Ctrl+/)
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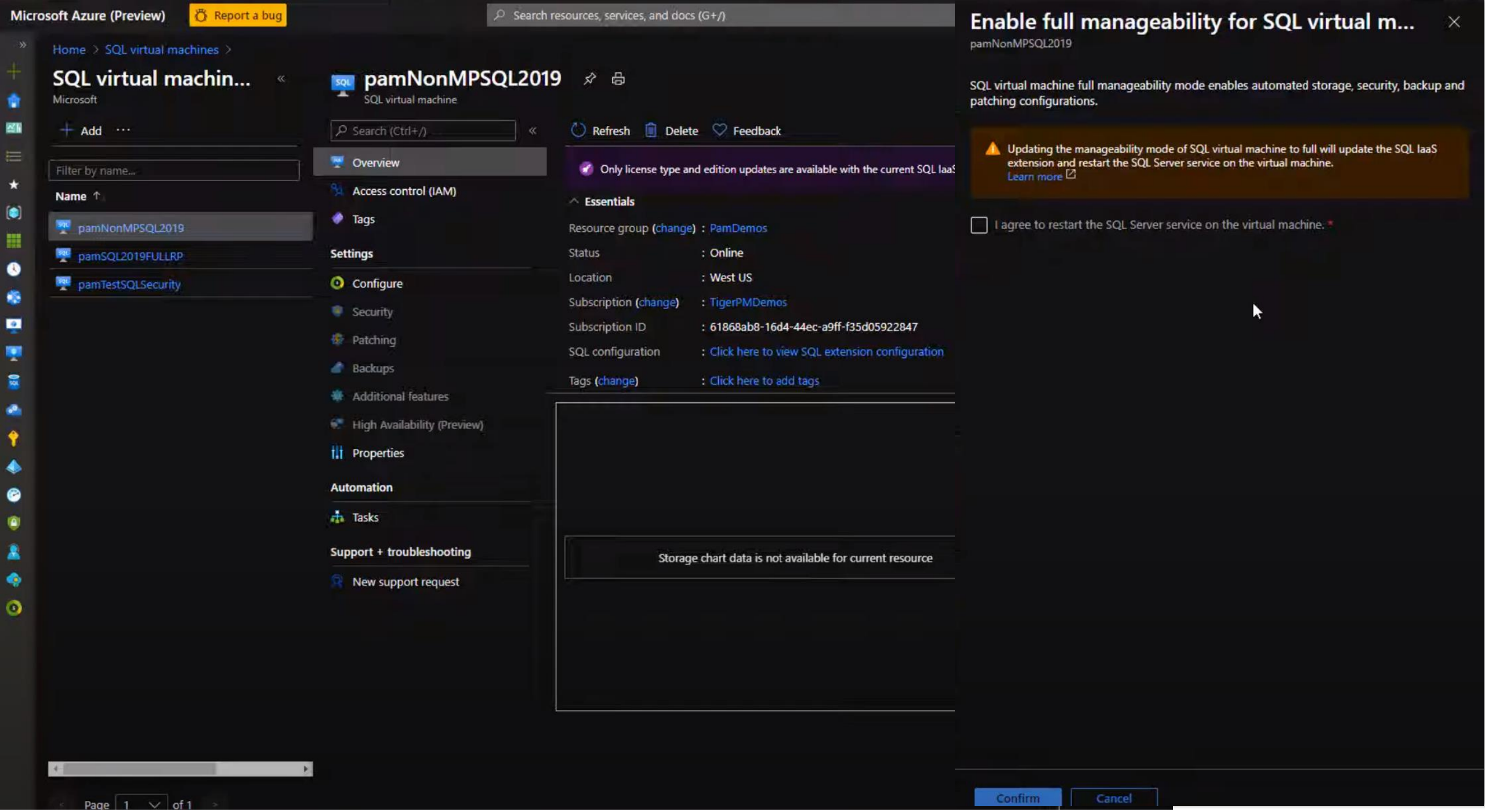
Access control (IAM)
Tags
Settings
Configure
Security
Patching
Backups
Additional features
High Availability (Preview)
Properties
Automation
Tasks
Support + troubleshooting
New support request
Refresh
Delete
Feedback
Only license type and edition updates are available with the current SQL IaaS extension mode (LightWeight), to enable all manageability features for the SQL virtual machine click here.
Essentials
Resource group (change) : PamDemos
Status : Online
Location : West US
Subscription (change) : TigerPMDemos
Subscription ID : 61868ab8-16d4-44ec-a9ff-f35d05922847
SQL configuration : Click here to view SQL extension configuration
Tags (change) : Click here to add tags
Version : SQL Server 2019
Edition : Developer
Virtual machine : pamNonMPSQL2019
Virtual machine OS : Windows (Windows Server 2019 Datacenter)
Virtual machine size : Standard D4s v3
License type : Pay As You Go
Storage chart data is not available for current resource
Notifications (0)
Features (7)
All
Pricing (2)
Configuration (3)
License type
Configure the licensing model and SQL server edition for the SQL Server virtual machine.
CONFIGURED
Storage configuration
Automate your storage configuration by attaching storage to the VM, making that storage accessible to SQL Server.
NOT AVAILABLE
SQL connectivity
Configuration the connection to the SQL Server instance running on your Azure virtual machine.
NOT AVAILABLE
Page 1 of 1
Options not available in lightWeight mode


Microsoft Azure (Preview)
Report a bug
Search resources, services, and docs (G+/)
Home > SQL virtual machines >
SQL virtual machin...
Microsoft
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pamSQL2019FULLRP
pamTestSQLSecurity
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SQL virtual machine
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Properties
Automation
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Support + troubleshooting
New support request
Refresh
Delete
Feedback
Only license type and edition updates are available with the current SQL IaaS
Essentials
Resource group (change) : PamDemos
Status : Online
Location : West US
Subscription (change) : TigerPMDemos
Subscription ID : 61868ab8-16d4-44ec-a9ff-f35d05922847
SQL configuration : Click here to view SQL extension configuration
Tags (change) : Click here to add tags
Storage chart data is not available for current resource
Enable full manageability for SQL virtual m...
pamNonMPSQL2019
SQL virtual machine full manageability mode enables automated storage, security, backup and patching configurations.
Updating the manageability mode of SQL virtual machine to full will update the SQL IaaS extension and restart the SQL Server service on the virtual machine.
Learn more
I agree to restart the SQL Server service on the virtual machine. *
Confirm
Cancel

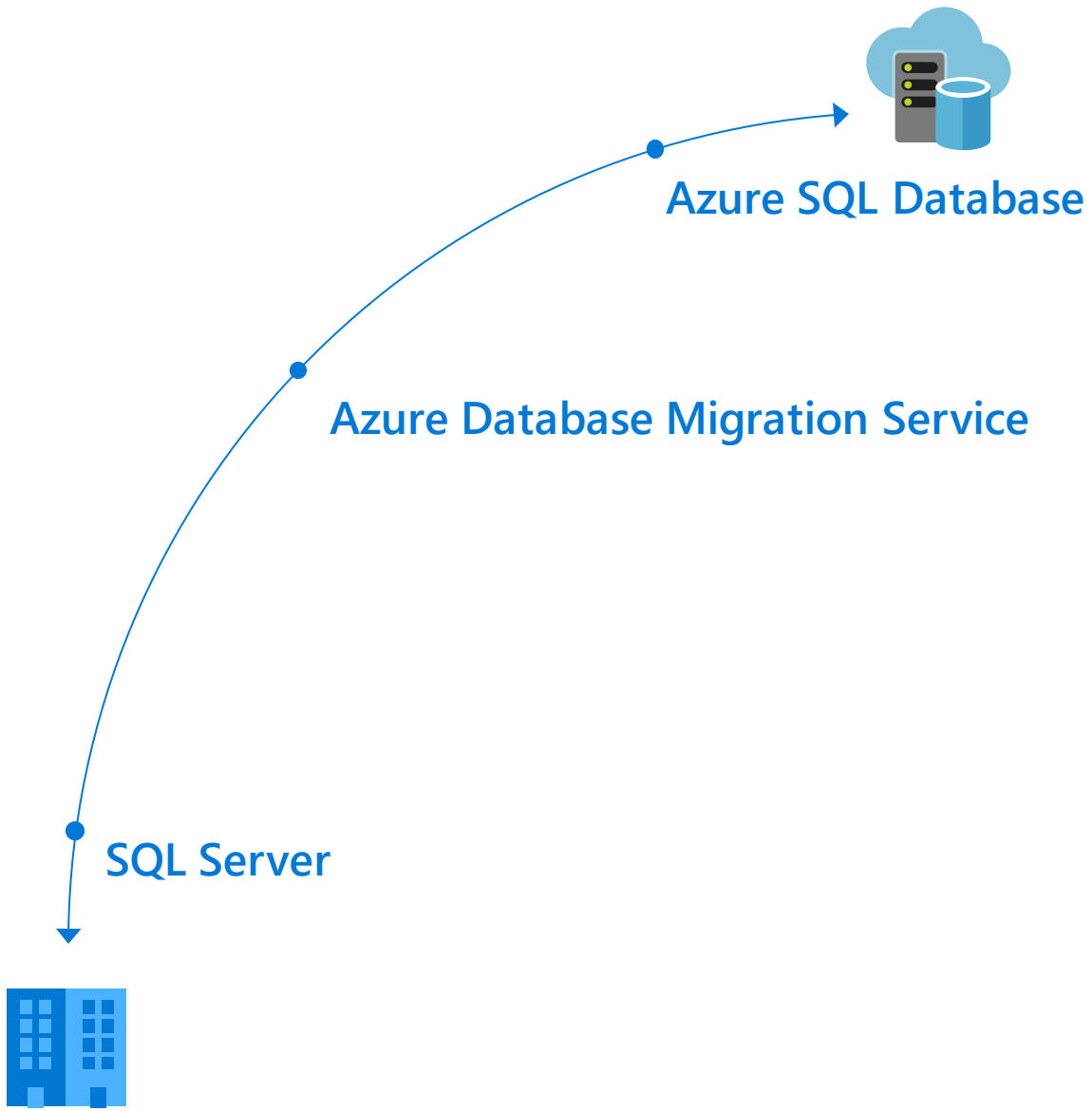
A hybrid Journey to the Cloud

Seamless hybrid deployment with integrated data synchronization

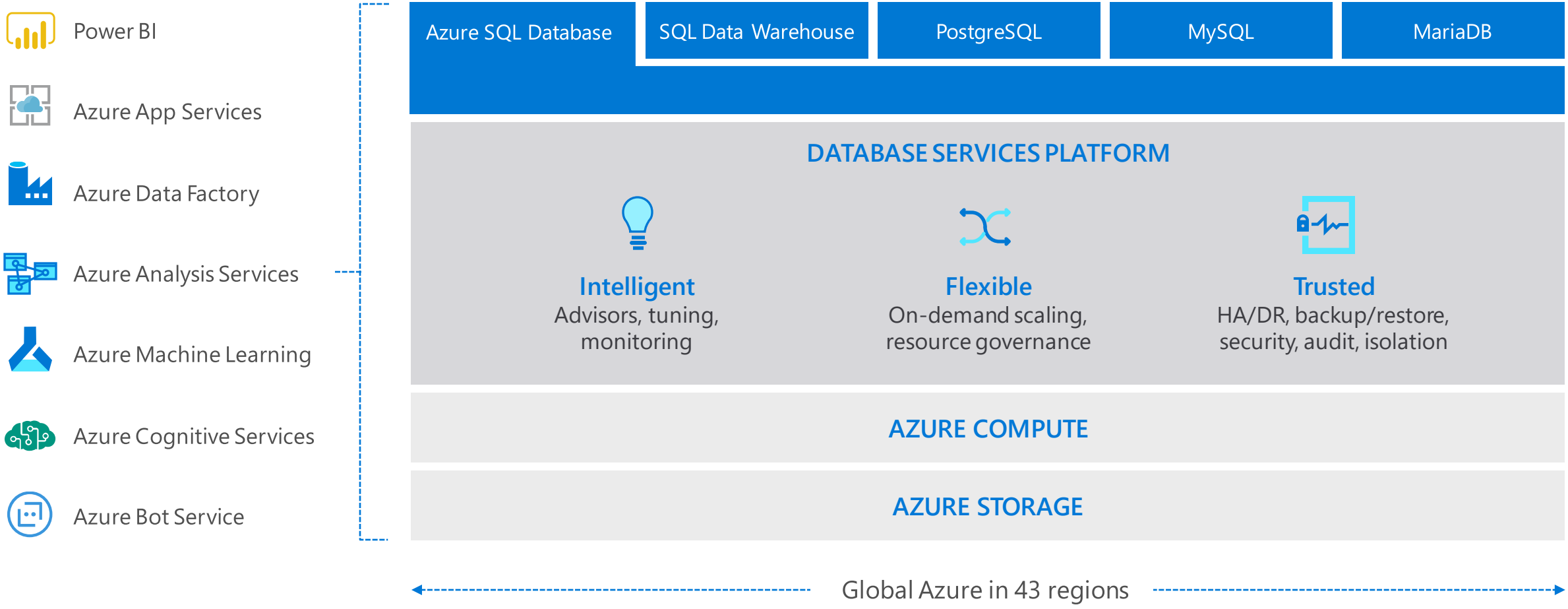
Reliable migration at scale

Lift and shift to the cloud with no code changes

Up to 55% cost savings



Azure Relational Database Platform



Azure SQL Database deployment option

Azure SQL Database

Single

Database-scoped deployment option with predictable workload performance

Best for apps that require **resource guarantee at database level**

Elastic Pool

Shared resource model optimized for greater efficiency of multi-tenant applications

Best for SaaS apps with multiple databases that can **share resources at database level**, achieving better cost efficiency

Managed Instance

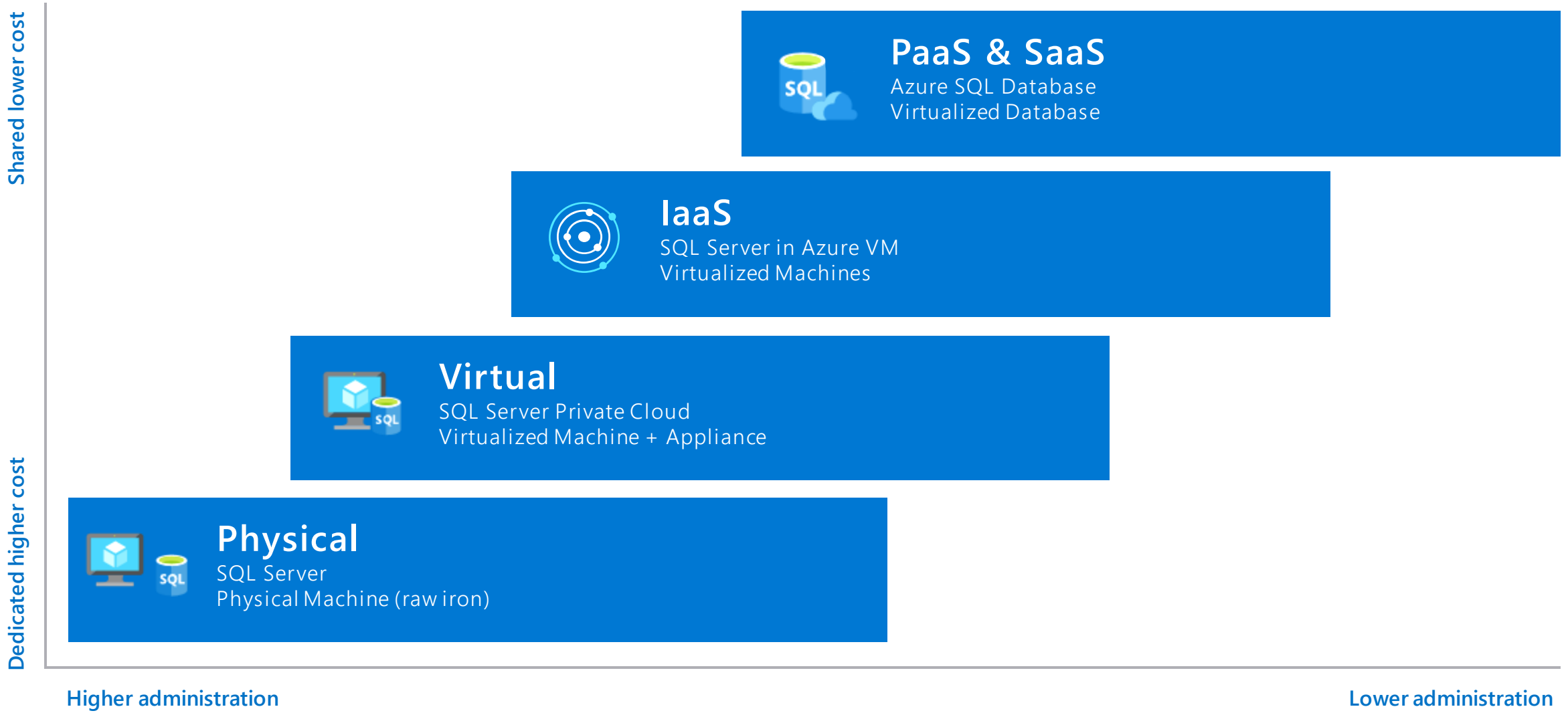
Instance-scoped deployment option with high compatibility with SQL Server and full PaaS benefits

Best for **modernization at scale with low friction and effort**

Service Tiers

- General Purpose
- Business Critical
- Hyperscale
- Serverless

Data platform continuum



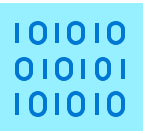
Key benefits of Azure SQL Database

Independently scale compute and storage to match both performance and financial needs

High availability and disaster recovery with 99.99% uptime availability SLA and active-geo replication, point-in-time restore, and geo-restore

Up to 100x performance improvements with support for In-Memory Columnstore queries

Improved monitoring and troubleshooting with Extended Events and visibility into more than 100 new table views



Support for key programmability functions to drive more robust application design

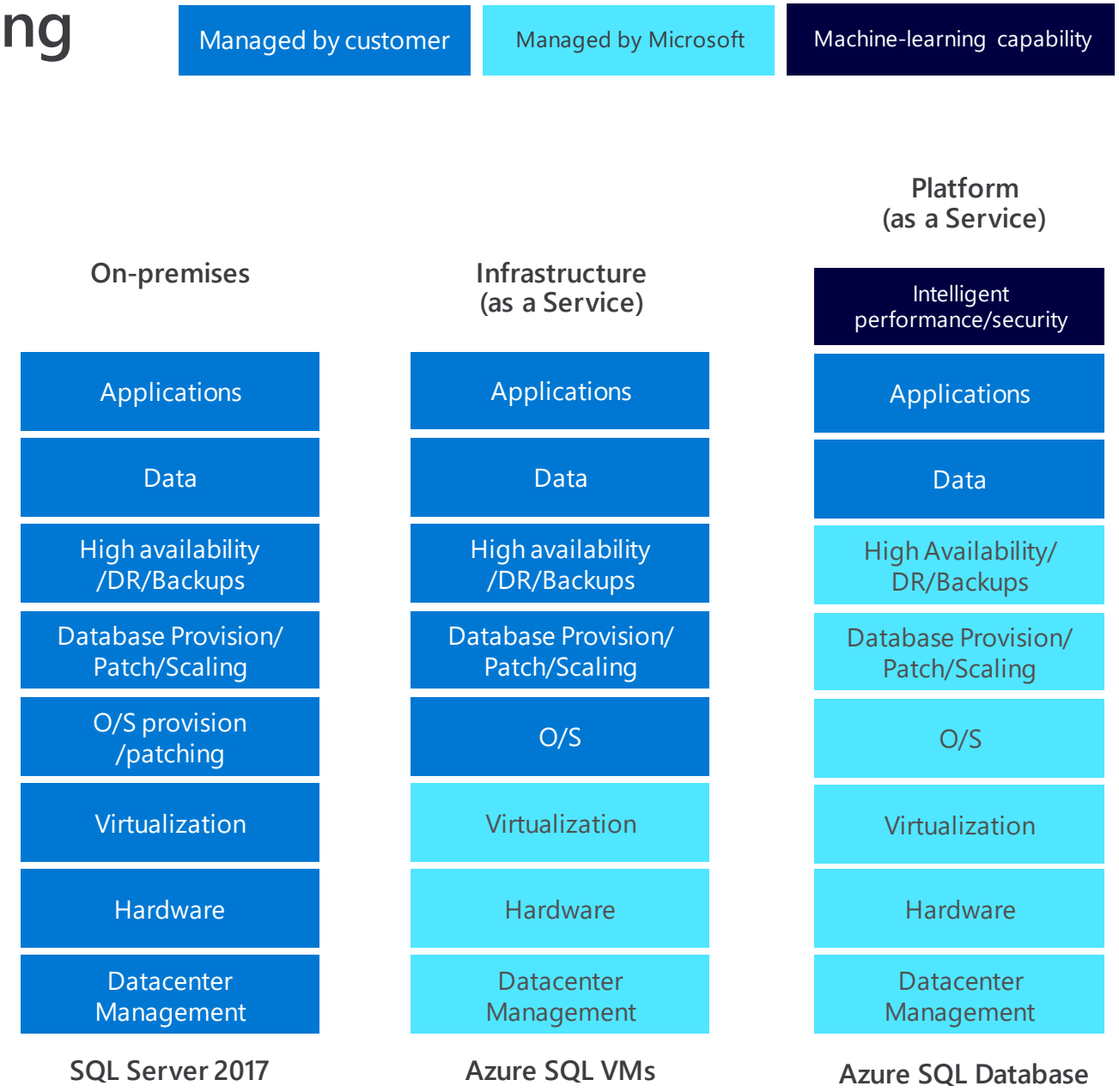
Saving opportunity for modernizing your data estate is significant

On-premises costs tend to be driven by hardware and data center management costs

Infrastructure-as-a-Service reduces cost categories related to data center and compute

Platform-as-a-Service off-loads customers' most administrative tasks to Azure, further improving efficiency with machine-learning capabilities for performance and security

- **Managed Instance**: instance-level deployment for lift-shift existing apps to Azure, fully backward compatible
- **Single database**: database-level deployment for new apps



Focus on your business

Your work so far	How PaaS helps
Hardware purchasing and management	**Built-in** scale on-demand
Protect data with backups (with health checks and retention)	**Built-in** point-in-time restore
High availability implementation	**Built-in** 99.99% SLA and auto-failover
Disaster recovery implementation	**Built-in** geo-redundancy and geo-replication
Ensure compliance with standards on your own	**Built-in** easy to use features
Secure your data from malicious users and mistakes	**Built-in** easy to use features
Role out updates and upgrades	**Built-in** updates and upgrades
Monitor, troubleshoot, and manage at scale	**Built-in** easy to use features
Tune and maintain for predictable performance	**Built-in** easy to use features

We take care of your database chores

Updates to Azure SQL Database

Hybrid

Azure Hybrid Benefit
Managed Instance Business Critical – GA

Managed Instance General Purpose - GA

vCore Purchasing Model - GA

Reserved Capacity Pricing - GA

Data Sync – GA

More vCore compute levels - GA

Performance & scale

Zone Redundancy - Prev

Elastic DB library for Java - GA

Columnstore in Standard tier - GA

Long Term backup retention - GA

Zone Redundancy - GA

Read Scale - Prev

.Net/ODBC and SSDT - Prev

Resumable Online Index Create – GA

Storage add-ons - GA

Adding DTU Standard perf levels- GA

Elastic Jobs - Prev

Auto Failover - GA

Hyperscale – Prev

Dev/test pricing for MI, single DB- GA

Serverless - Prev

Security

TDE with Azure Key Vault – GA

Information Protection – Prev

Vulnerability Assessment - GA

Intelligence

Automatic Tuning Improvements - GA

Intelligent QP updates - Prev

For latest information:
https://azure.microsoft.com/en-us/updates/?product=sql-database
https://docs.microsoft.com/en-us/azure/sql-database/sql-database-release-notes

Previous updates to Azure SQL Database

Learn & Adapt

Operational analytics
- Columnstore
- In-Memory OLTP

Predictable performance
- Query Store
- Index Optimization
- Automatic tuning
- Auto query plan correction
- Performance Insight in OMS
- Adaptive Query Processing

SQL Graph Advanced analytics
- Native PREDICT
- R Services

Privacy & trust

Activity monitoring
- Engine Audit
- Threat Detection
- Centralized dashboard OMS

Access control
- SQL Firewall
- RLS, Dynamic data masking
- AAD and MFA

Data protection
- Encrypt in motion (TLS)
- Always Encrypted (equality)
- TDE & BYOK
- Service endpoint
- Always Encrypted (secure enclave)

Discovery & assessment
- Vulnerability assessment

Business Continuity

HA-DR built-in
- 99.99% SLA
- Geo-restore
- Active geo replicas (4)
- Multi-AZ
- Zone-redundant

Backup and restore
- Backup with health check
- 35 days PITR
- 10 years data retention

Distributed application
- Change Tracking
- Transaction replication
- Data sync
- SSIS service
- Read scale-out
- VNET endpoints

Seamless and Compatible

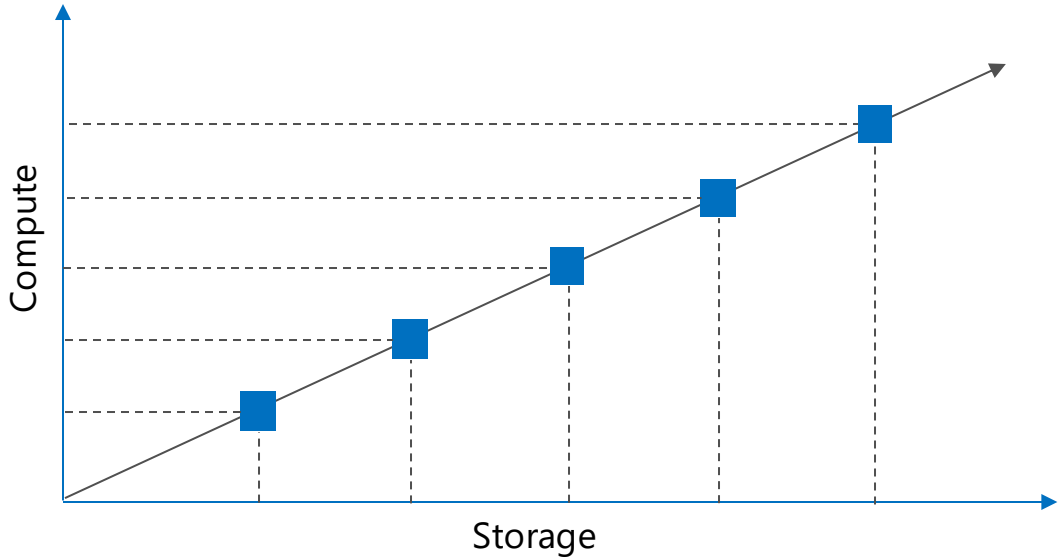
Biz model & SKUs
- DTU/eDTU
- <=1TB
- Bigger std: S4-S12
- Separate compute and storage
- Azure Hybrid Benefit
- vCore-based purchasing

Cost optimization
- Intelligent PaaS

Flexible compute & storage options

DTU model

Simple, preconfigured



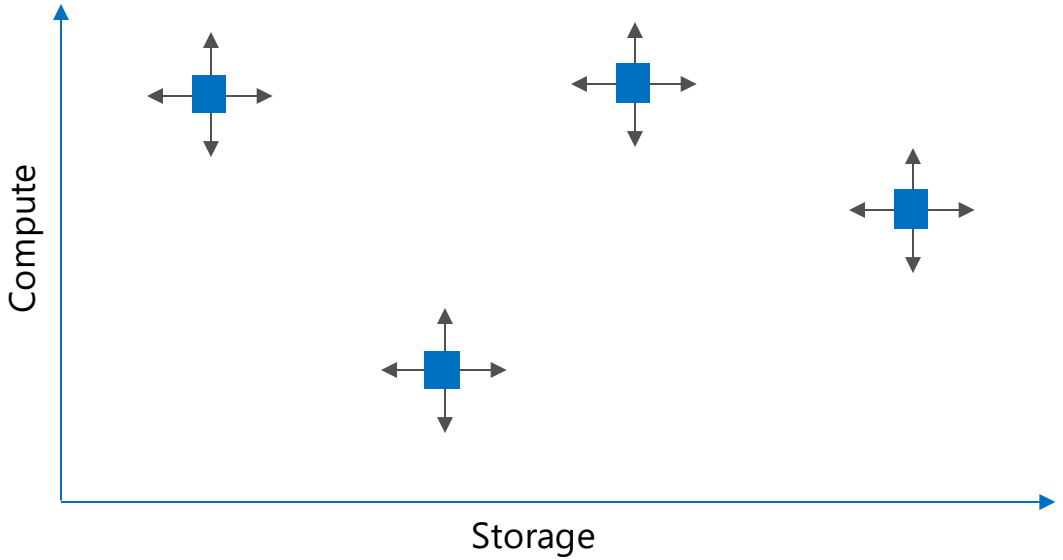
Pre-packaged, bundled unit that represents the database power

Designed for predictable performance, but somewhat inflexible and limited in options

DTU sizing offers simplicity of choice

vCore model

Independent scalability



This model allows you to independently choose compute and storage resources. It also allows you to use Azure Hybrid Benefit for SQL Server to gain cost savings.

Best for customers who value flexibility; control and transparency

Benefits of virtual cores

Choice between vCores and DTUs in Azure SQL Database as a unit of measure for available CPU

Understand your compute requirements in the cloud vs. what you use on-premises today

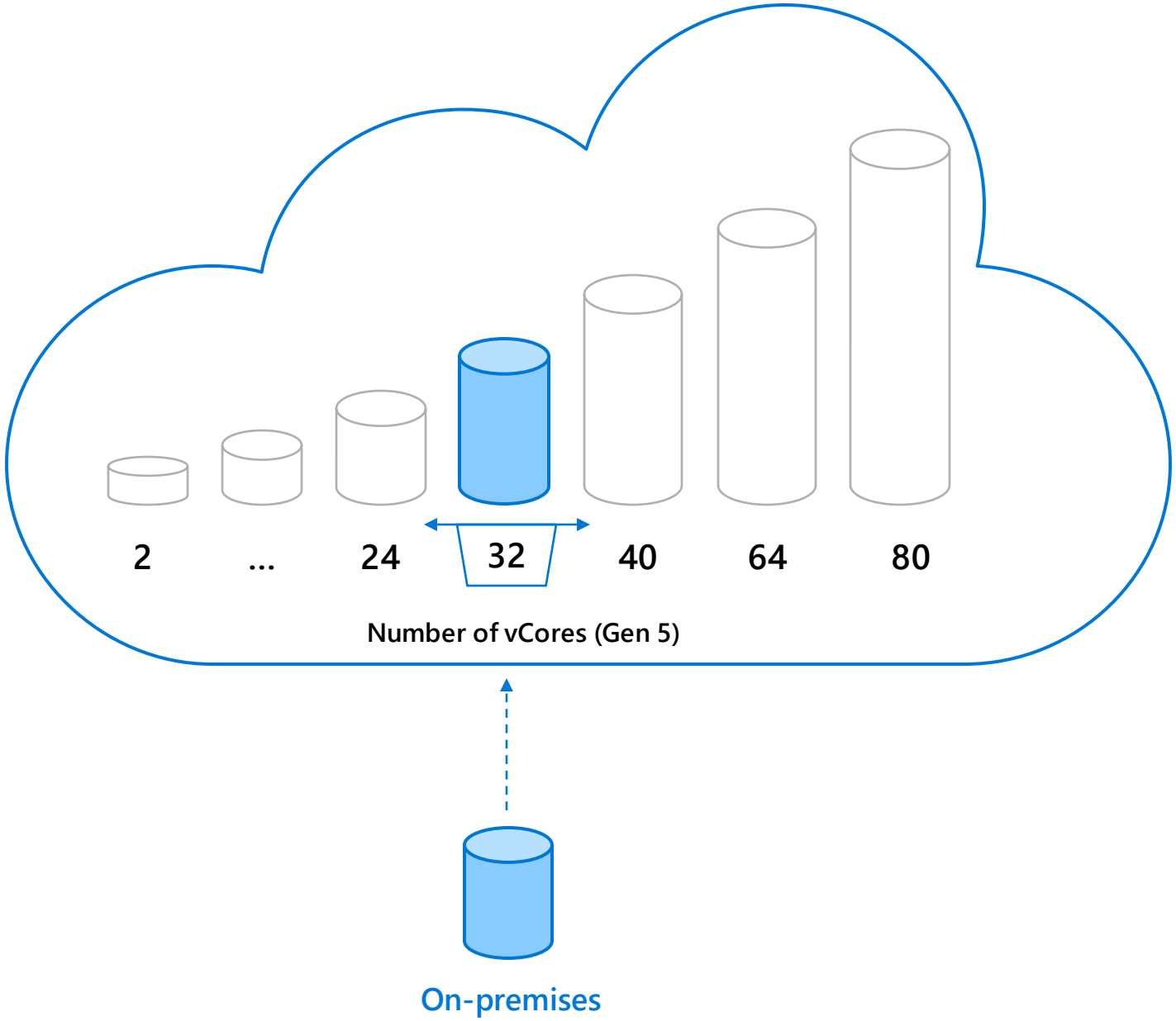
Easier to right-size the destination environment by removing the guesswork of DTUs

Gen 4 CPUs are based on Intel E5-2673 v3 (Haswell) 2.4 GHz processors. In Gen 4, 1 vCore = 1 physical CPU

1-24 vCores

Gen 5 logical CPUs are based on Intel E5-2673 v4 (Broadwell) 2.3 GHz processors. In Gen 5, 1 vCore = 1 hyper thread

2-80 vCores



Azure Hybrid Benefit for SQL Server

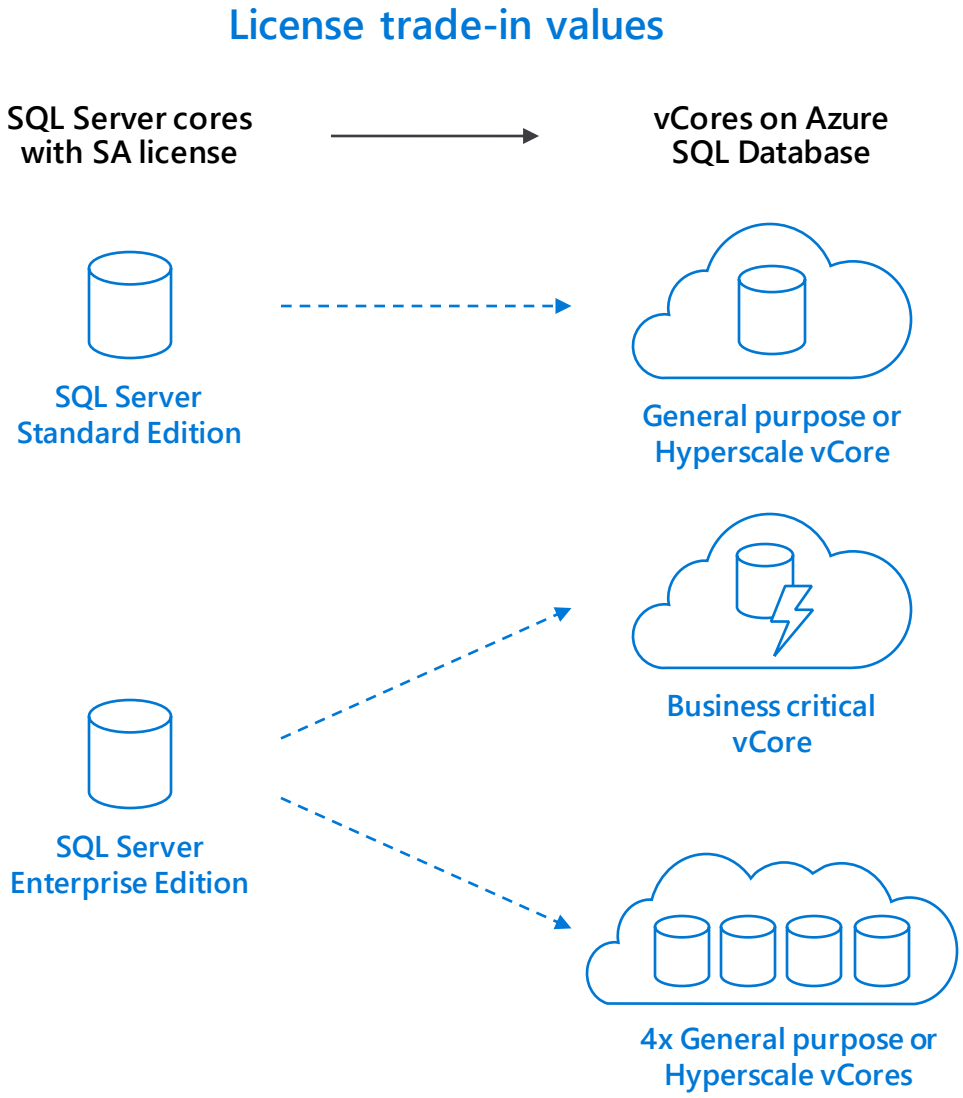
Take an inventory of on-premises licenses to determine potential for conversion

Convert on-premises cores to vCores to maximize value of investments

1 Standard license core =
1 General Purpose or Hyperscale core

1 Enterprise license core =
1 Business Critical core

1 Enterprise license core =
4 General Purpose or Hyperscale cores
(virtualization benefit)



Flexible compute, storage & performance options

Simplicity

We remain committed to the DTU-based model and the simplicity it offers customers who want a pre-configured solution

Flexibility:

The vCore-based model reflects our commitment to customer choice and to simplify the hybrid benefit for customers migrating from on-premises

Customers pay for:

Service tier + number of vCores

Type and amount of data storage

Number of IO

Backup storage (RA-GRS)

Service tier	General purpose		Business critical		Hyperscale
Best for	Most **budget-oriented** workloads		Critical business applications with **high IO requirements**.		**VLDB OLTP and HTAP workloads** with highly scalable storage and read-scale requirements
Deployment option	Single / Elastic Pools	Managed Instance	Single / Elastic Pools	Managed Instance	Single
Compute tiers	Gen4: 1 to 24 vCore Gen5: 2 to 80 vCore	Gen4: 4 to 24 vCore Gen5: 4 to 80 vCore	Gen4: 1 to 24 vCore Gen5: 2 to 80 vCore	Gen4: 4 to 24 vCore Gen5: 4 to 80 vCore	Gen4: 1 to 24 vCore Gen5: 2 to 80 vCore
Storage	**Premium remote**		**Local SSD**		**Local SSD Cache**
	32GB – 8TB per instance	32GB – 8TB per instance	32GB – 4TB per instance	32GB – 8TB per instance	Scale from 5GB to 100TB of storage in 1GB increments
In-Memory	Not supported		Supported		Not supported
Read-write IO	~2ms for all data access		<0.5ms for all data access		<0.5ms for hot data access ~2ms otherwise
Availability	2 read replicas		3 replicas, 1 read-scale replica, zone-redundant HA		Primary read/write replica + up to 4 read replicas
Backups	RA-GRS, 7-35 days (7 days by default)		RA-GRS, 7-35 days (7 days by default)		LRS, ZRS, RA-GRS, 7-35 days (7 days by default)

For latest information reference: https://azure.microsoft.com/en-us/pricing/details/sql-database/

Choose from two hardware generations

Balance performance requirements and price with two hardware generations

Match your on-premise application behavior

	Gen 4	Gen 5
Hardware	Intel E5-2673 v3 (Haswell) 2.4 GHz processors vCore = 1 PP (physical core)	Intel E5-2673 v4 (Broadwell) 2.3 GHz processors, fast eNVM SSD vCore=1 LP (hyper-thread)
Performance levels	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 16, 24 vCores	2, 4, 6, 10, 12, 14, 16, 18, 20, 24, 32, 40, 80 vCores
Memory	7 GB per vCore	5.1 GB per vCore
Storage	5 GB to 4 TB with 1 GB increments. Premium blob storage	5 GB to 4 TB with 1GB increments. Local SSD storage. Hyperscale tier 5 GB to 100 TB with 1GB increments and only charge for storage based on usage.

For latest information reference: https://azure.microsoft.com/en-us/pricing/details/sql-database/

Pay only for what you need

DTUs			vCores		
Basic	**Standard**	**Premium**	**General Purpose**	**Business Critical**	**Hyperscale**
Small databases particularly those in development phases	General purpose databases with moderate performance requirements	Mission-critical databases with high performance and high-availability requirements	Data applications with basic IO and basic availability requirements	Business critical data applications with fast IO and high availability requirements	VLDB OLTP and HTAP workloads with highly scalable storage and read-scale requirements

Elastic scale and performance: Three service tiers within DTU-based model, and two tiers within vCore-based model let you scale up and down based on throughput needs, and offer better resource isolation and an improved billing experience

Business continuity and data protection: A spectrum of business-continuity features across tiers lets you dial up control over data recovery and failover

Familiar and fully-managed: Near-complete SQL Server compatibility and unprecedented efficiencies as your applications scale with a near-zero maintenance service and a variety of familiar management tools and programmatic APIs

Scale your data workloads with Azure SQL Database

Challenges with managing Very Large Databases (VLDB)

Size of data

Operations take a LONG time (days in some cases)

Ongoing operations degrade database performance

Can cause outages and downtime

Provisioning more storage to expand the database can be painful

Scaling Compute

Logistics of moving to larger box

Economics of sizing for max peaks

Hyperscale is the foundation for massive app growth

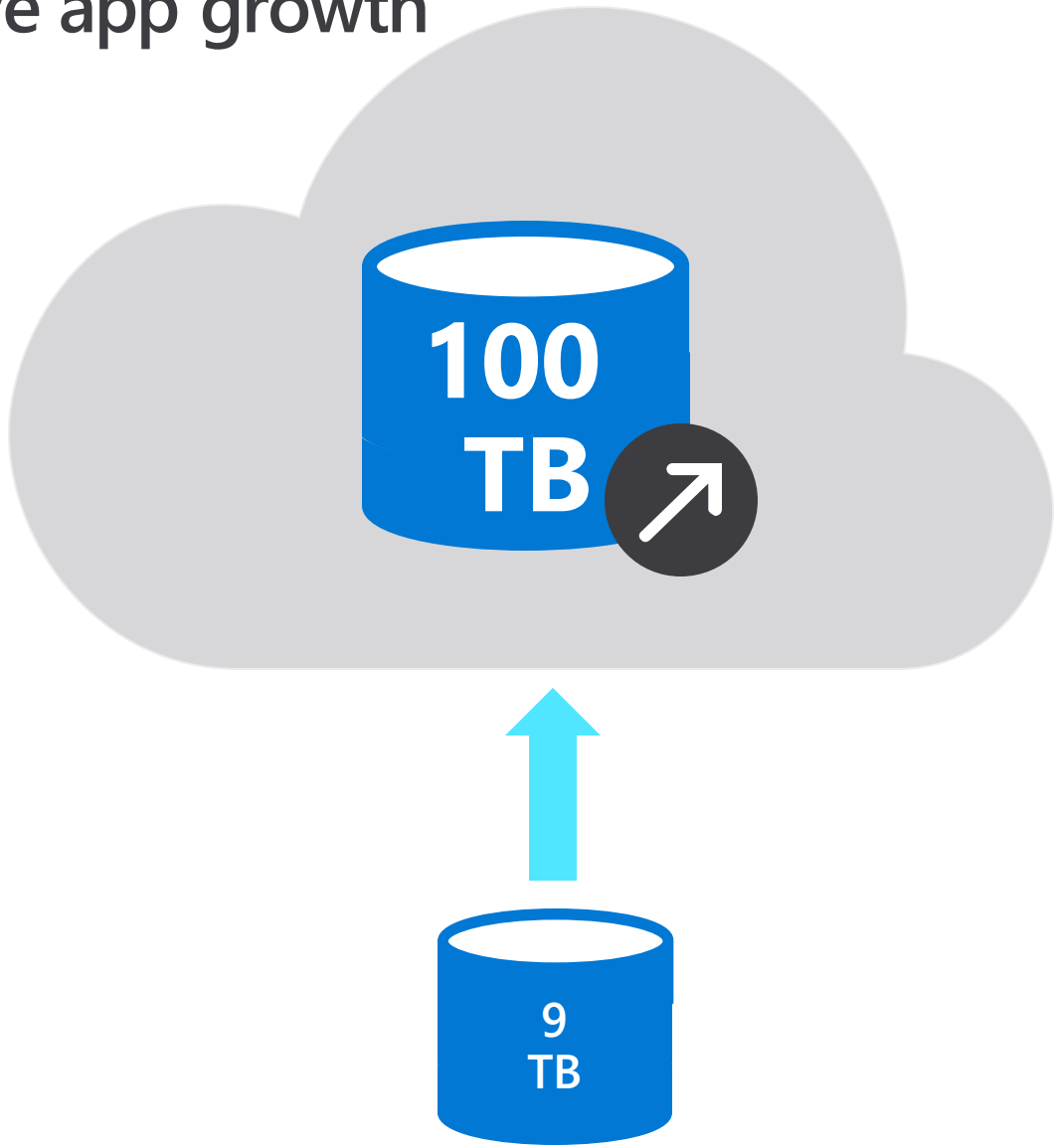
Hyperscale is a new, highly scalable service tier that adapts on-demand to your workload's needs, auto-scaling up to 100TB per database.

Storage dynamically adapts to your workloads' needs, auto-scaling up to 100TB.

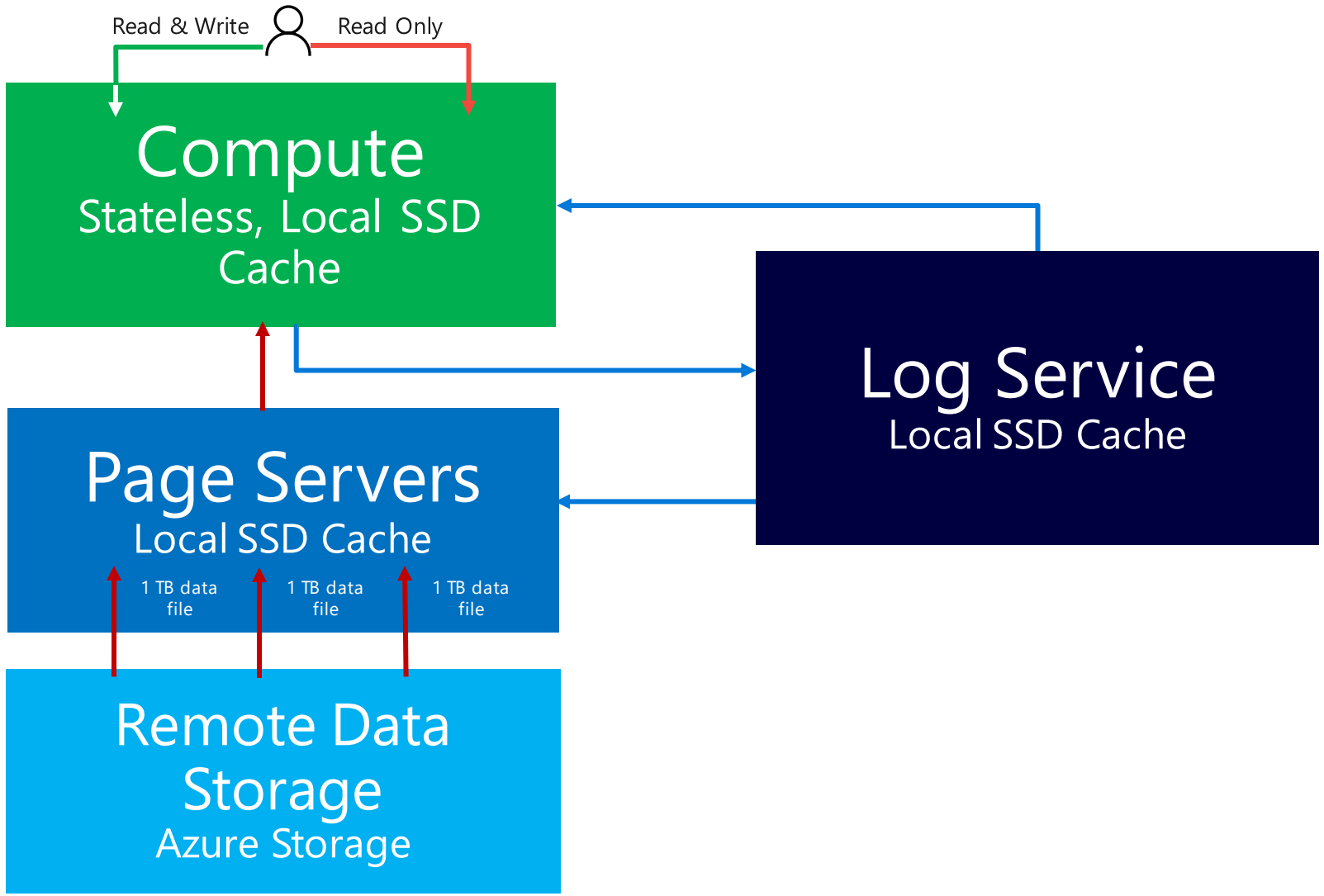
Provision one or more additional compute nodes that can serve your read-only workload and use them as a hot-standby, in case of failover.

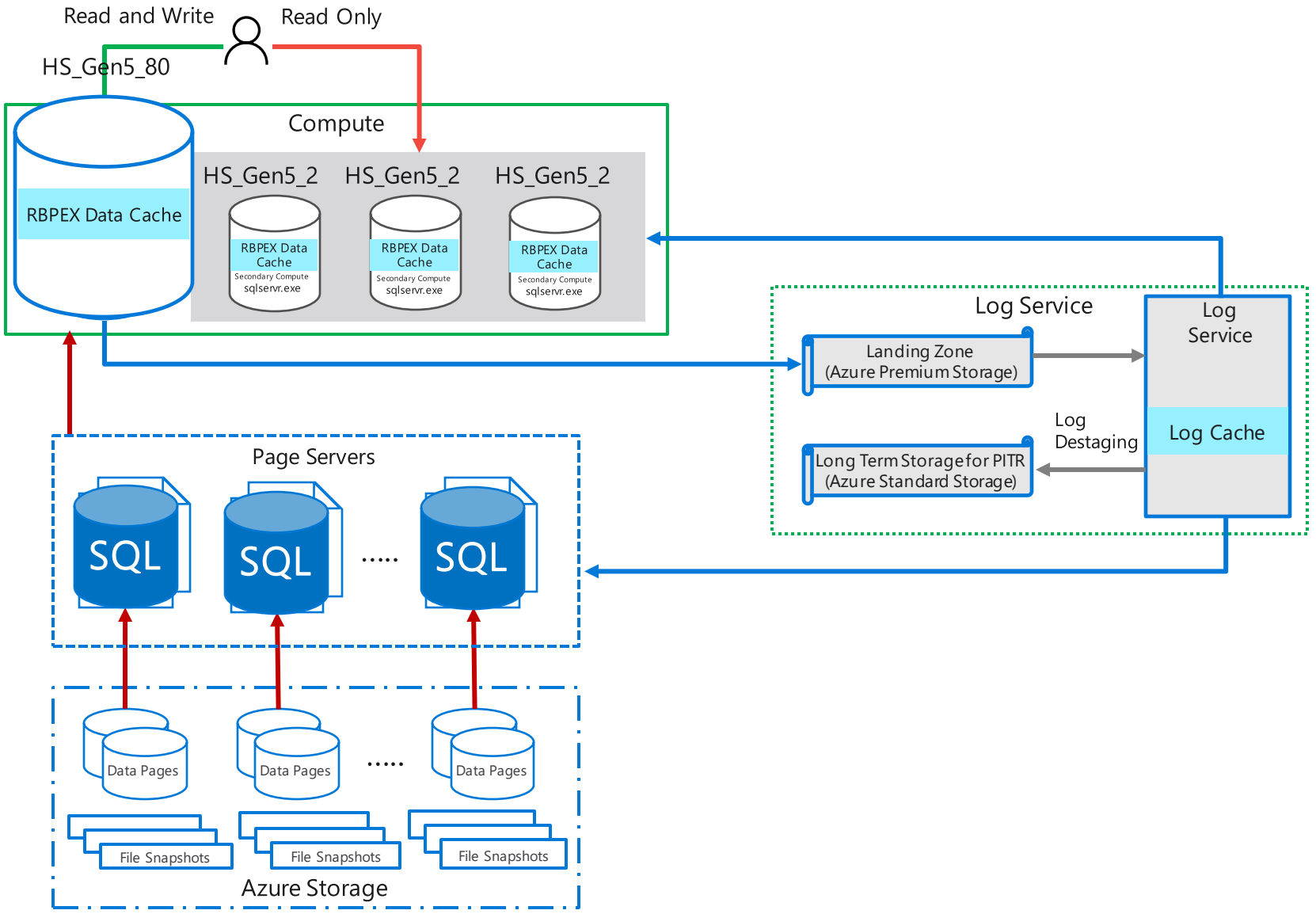
Perform operations in constant time, regardless of the size of the data operation.

Compute and storage resources scale rapidly and independently without sacrificing performance.



Hyperscale components





Constant time scale up and down

Offload read-only workload by adding read-scale replicas without data copy – constant time as well

Low log commit latency - <2.5ms with Premium Storage; < 0.5ms with Ultra SSD (future improvement)

High log generation rate and fast data loading

Page server instances work independently – infinite scale out

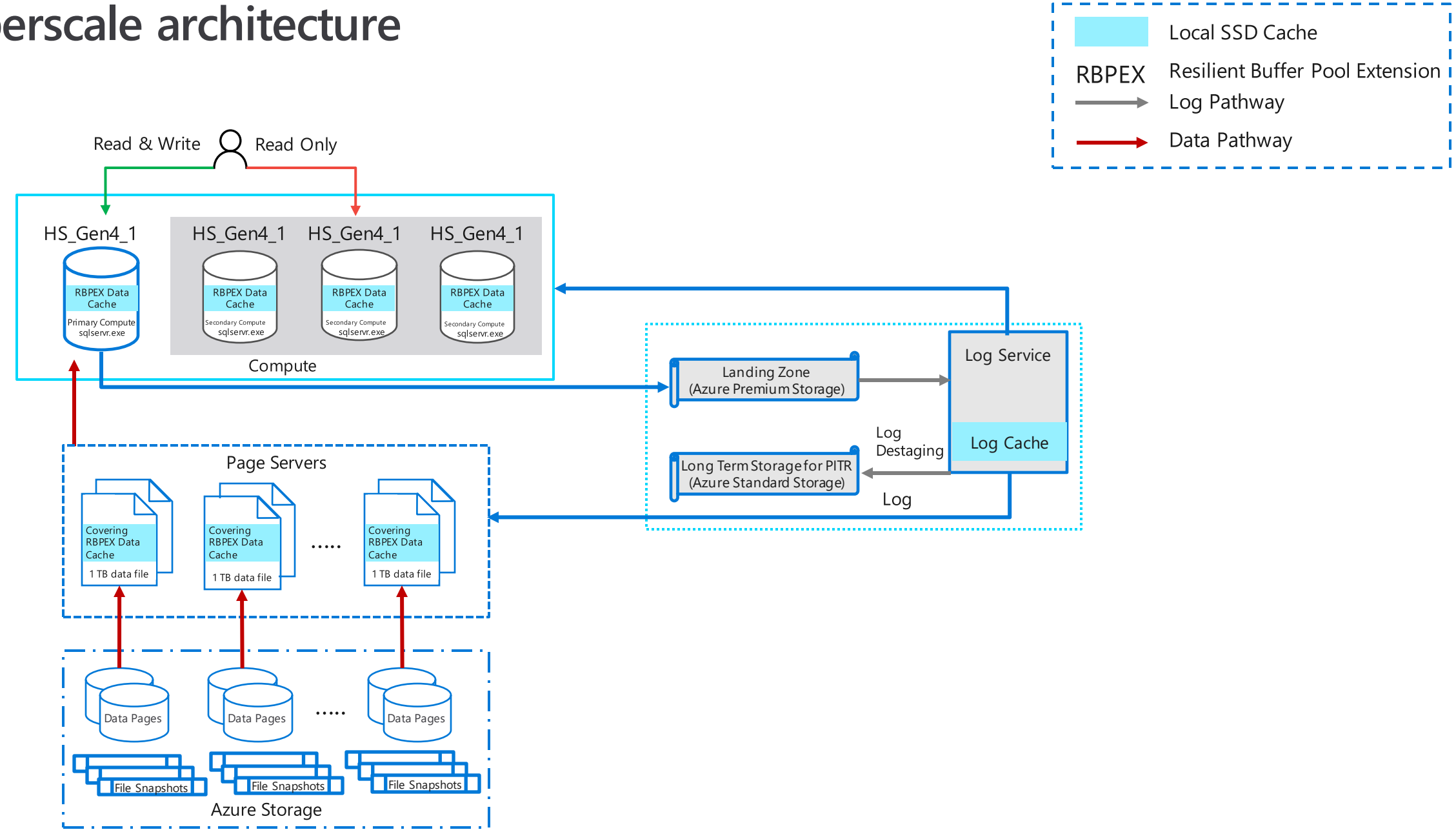
Adding more page servers as your database grows – pay by usage (start with 5GB with 1GB increments)

Snapshot backup + log offloading – zero impact to compute resource

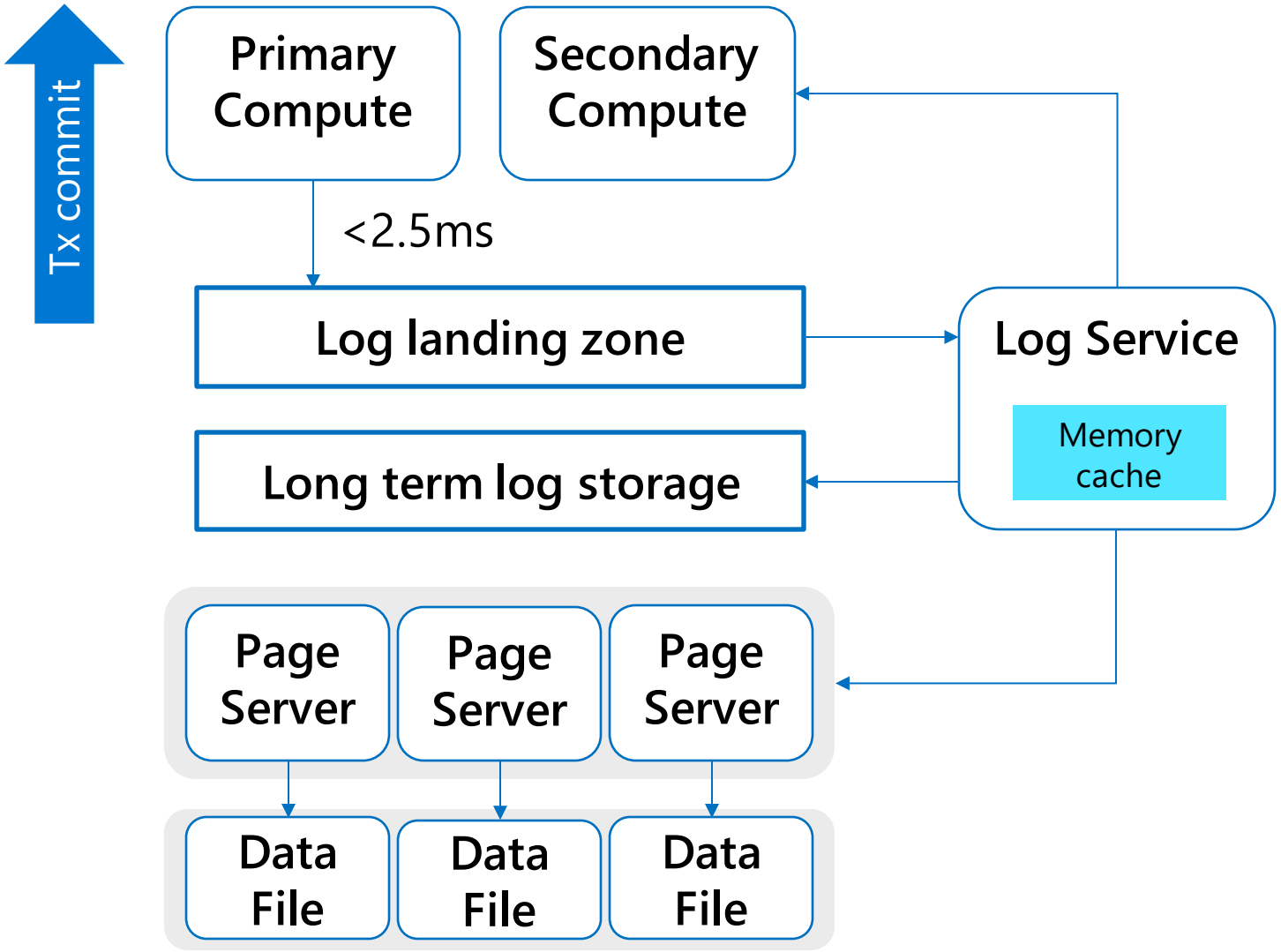
Restore database by copying snapshots and log records – constant time point in time restore

Checkpoints also offloaded to page servers

Hyperscale architecture



Write IO



Primary compute write log to the log landing zone - <2.5ms latency

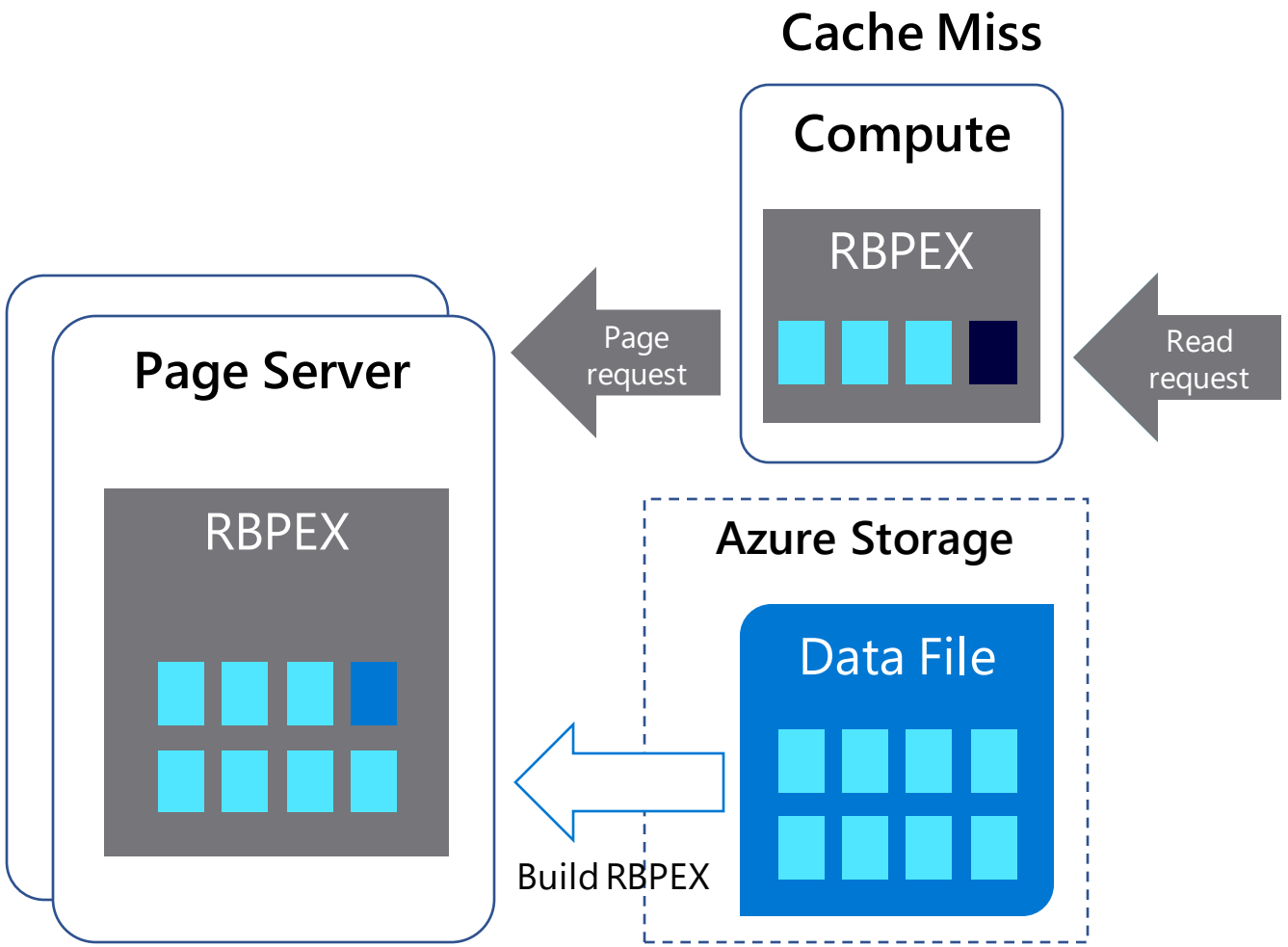
Commit transactions after hardening the log

Async log apply to the secondary compute

Async log apply to page servers

Page server writes data to data files at checkpoints

Read IO



Pre-build RBPEX when page server instance started

Two page-server replicas guarantee IO latency

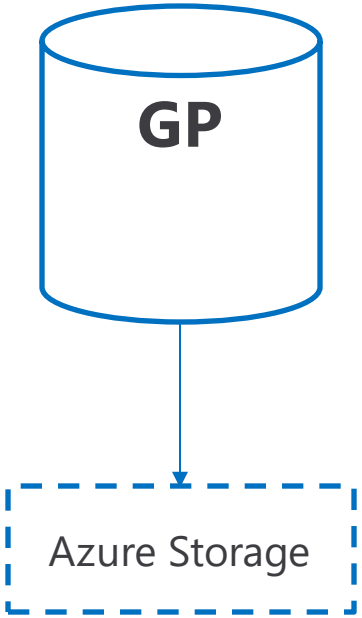
RBPEX on compute nodes is proportional to # of vCores

Hit local RBPEX - < 0.5ms
Hit page server RBPEX - < 2ms

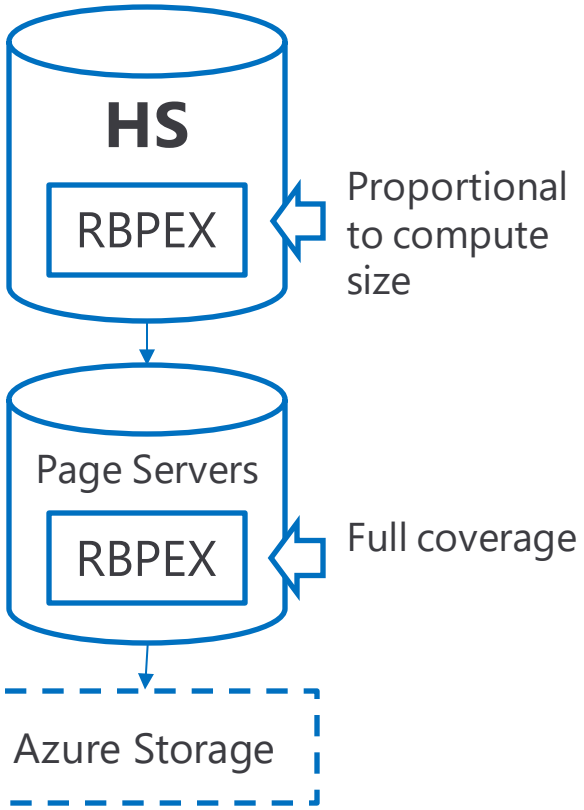
Optimized for OLTP workload – operating on hot data

Use Column Store index to optimize HTAP/OLAP workload

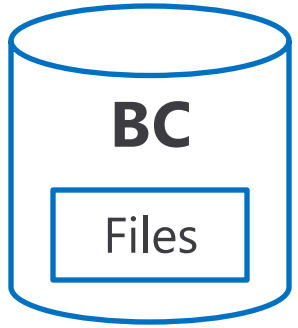
Read IO



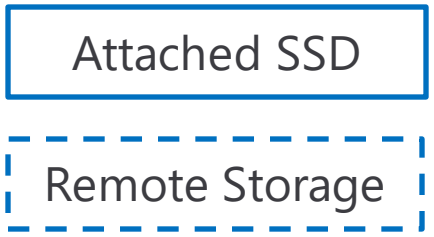
~2ms for all data access



<0.5ms for hot data access
~2ms otherwise



<0.5ms for all data access



Scaling multiple databases across shared resources with elastic pools

Elastic database model

Elastic databases in elastic database pools

Pooled resources are used by many databases

Standard elastic database pools provide 50-3000 database throughput units (DTUs) for up to 500 databases

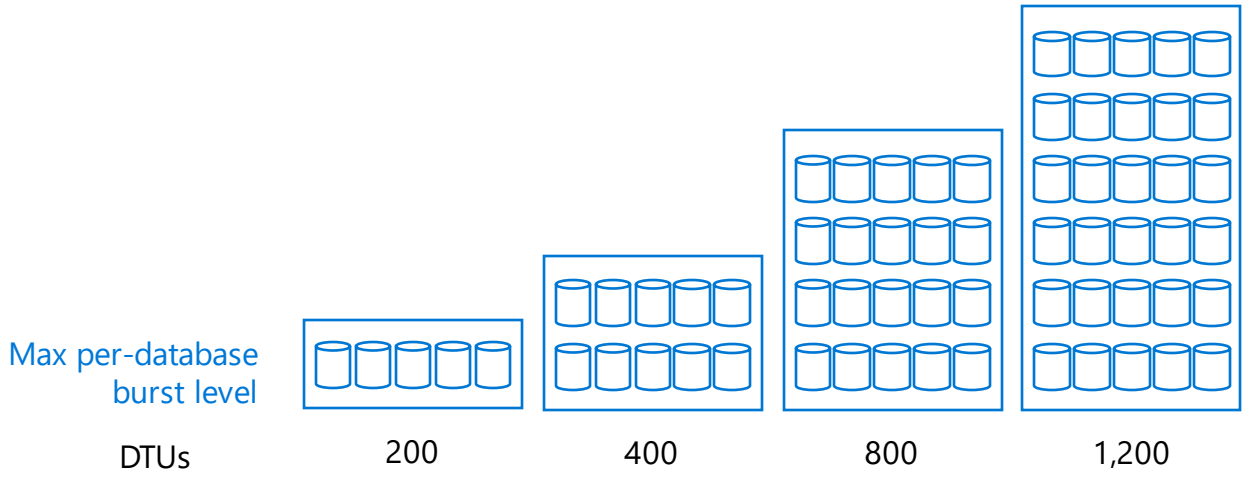
Max eDTUs per database can be set if available based on utilization by other database in the pool

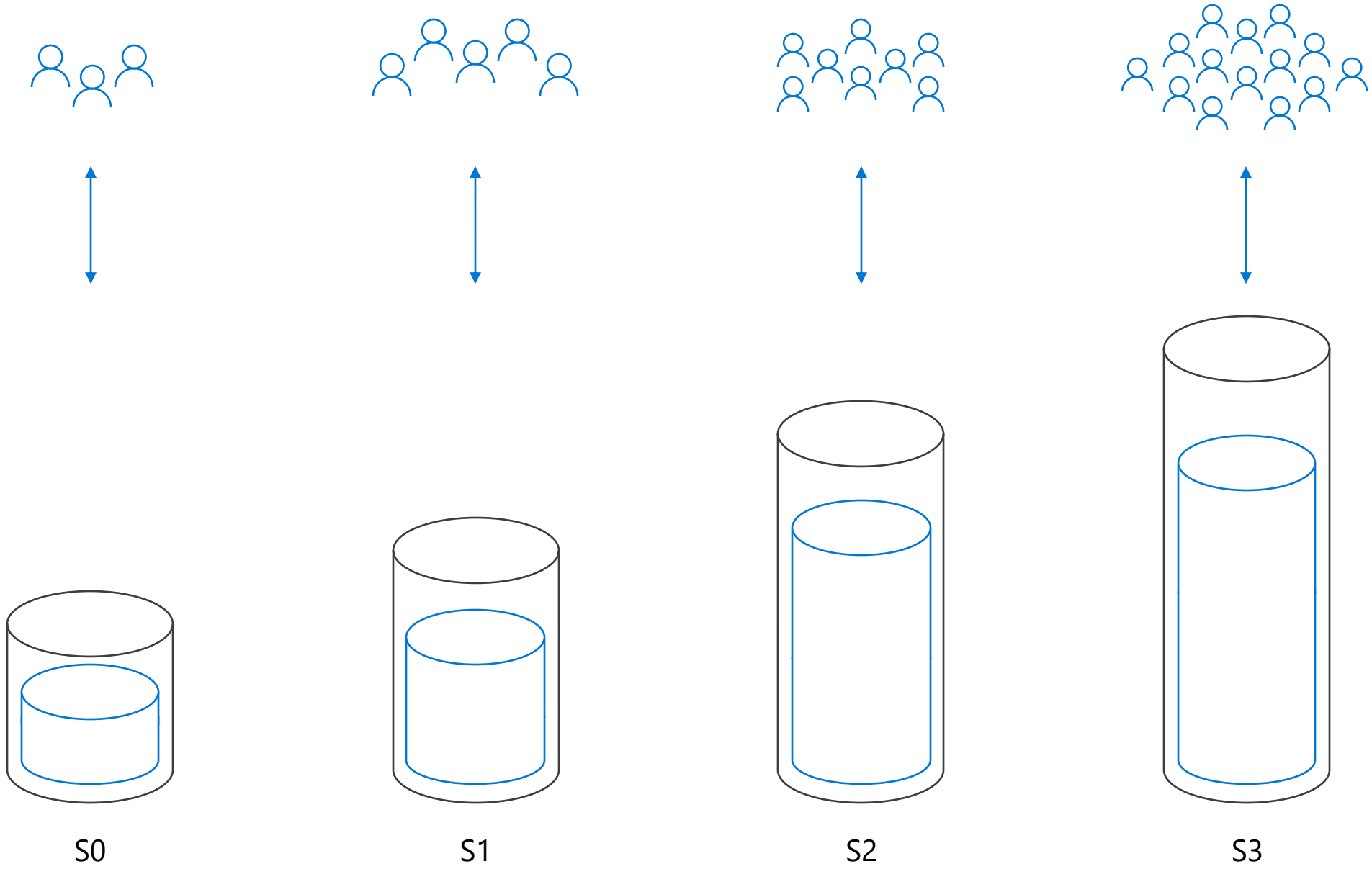
Create/configure pools using portal, Azure PowerShell, REST APIs

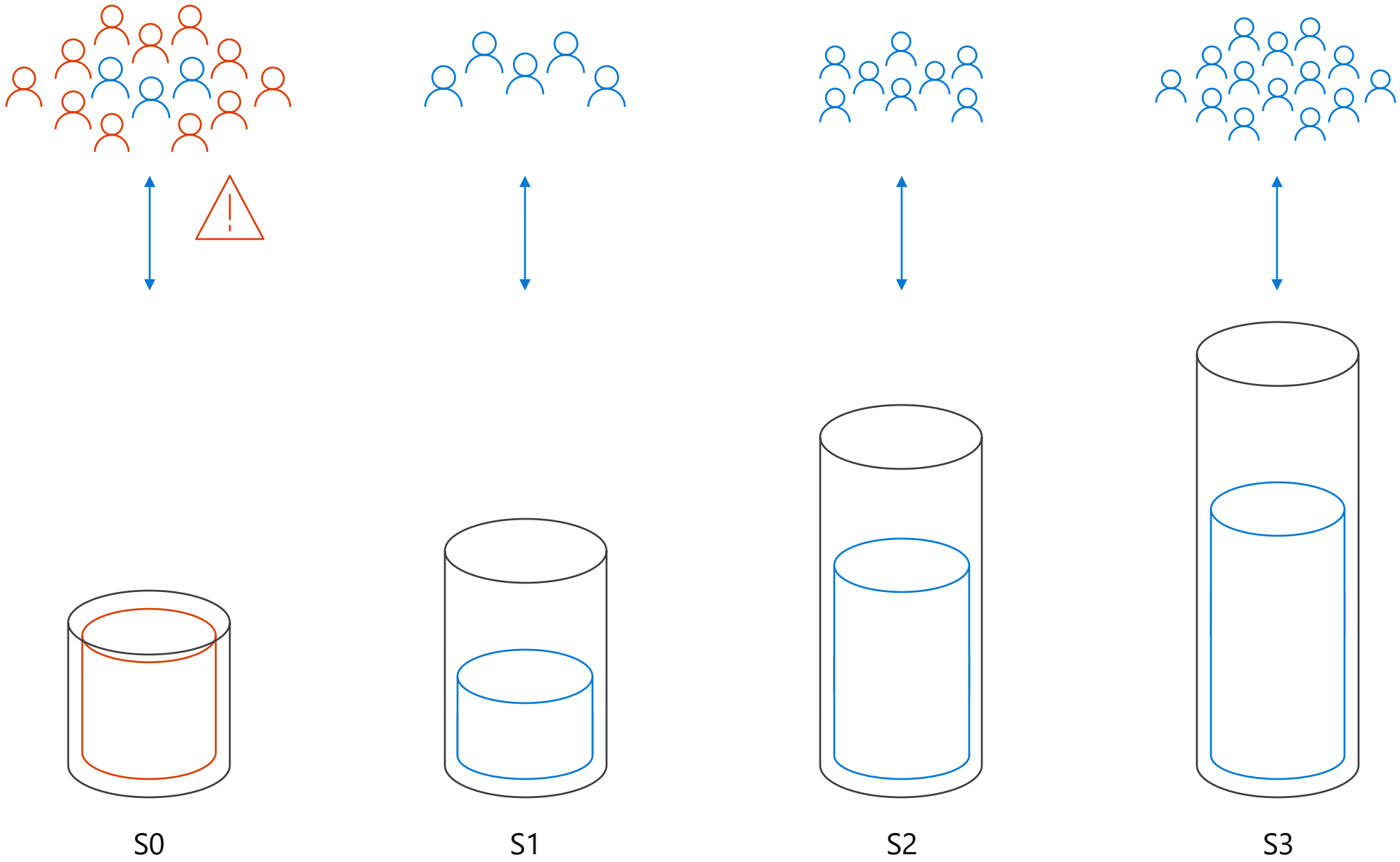
Move databases in/out using portal, Azure PowerShell, REST APIs, and T-SQL

Databases remain online throughout

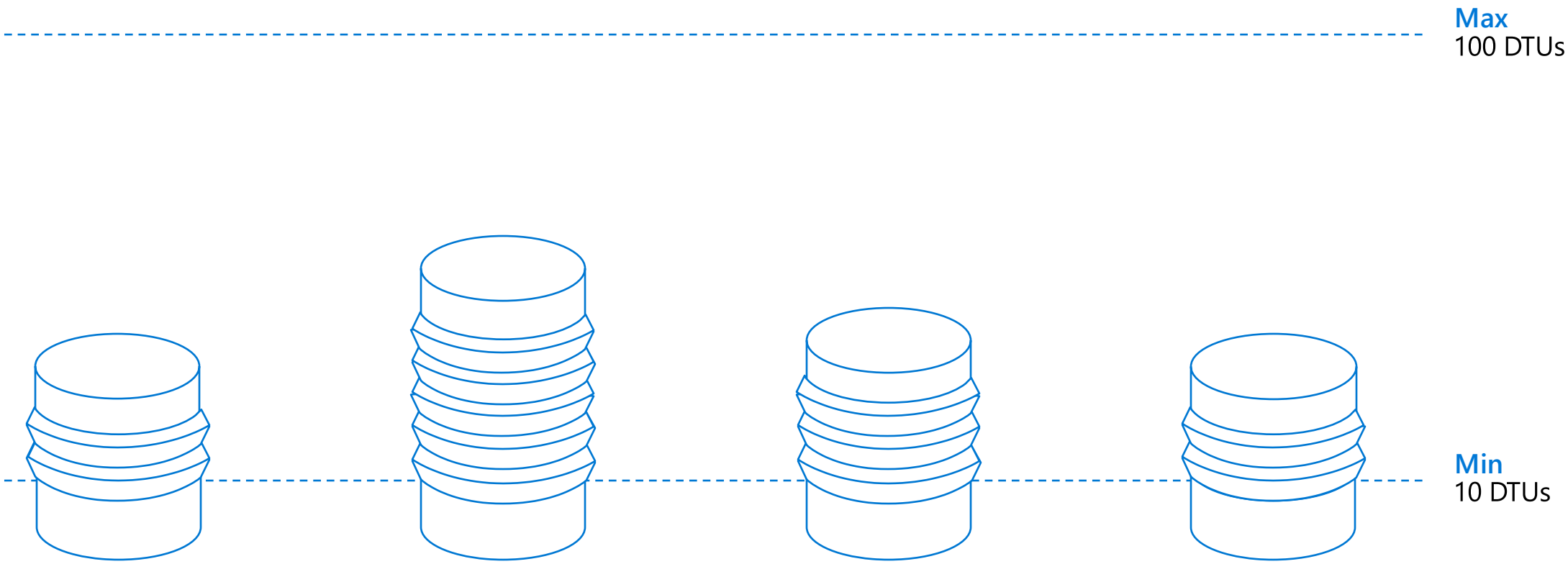
Monitoring and alerting available on both pools and databases




S0
S1
S2
S3


S0
S1
S2
S3

Elastic database pool

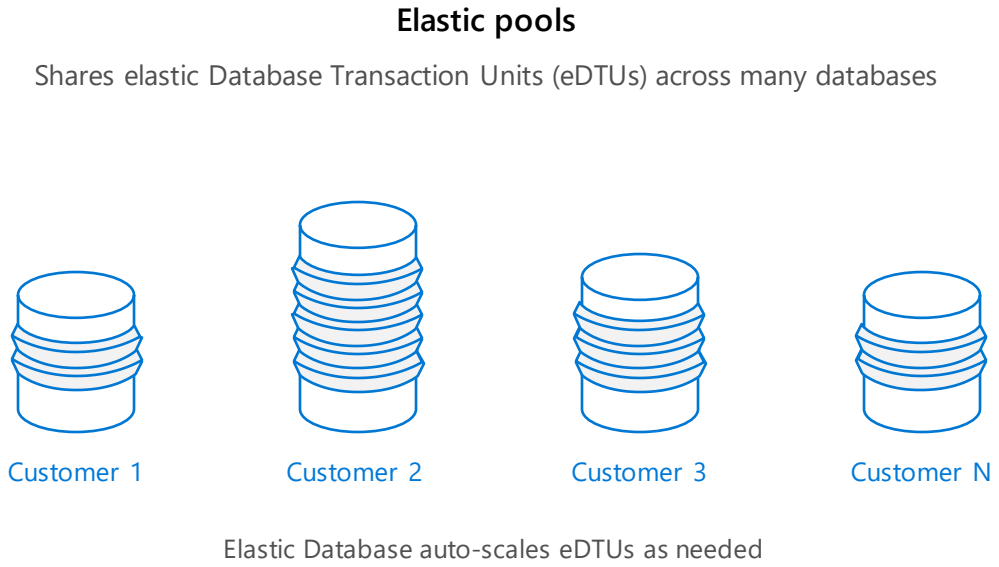


Auto-scaling you control with Elastic Database

Pools automatically scale performance and storage capacity for elastic databases—anytime, anywhere

Control the performance assigned to a pool, add or remove elastic databases on demand, and define performance of elastic databases without effecting overall pool cost

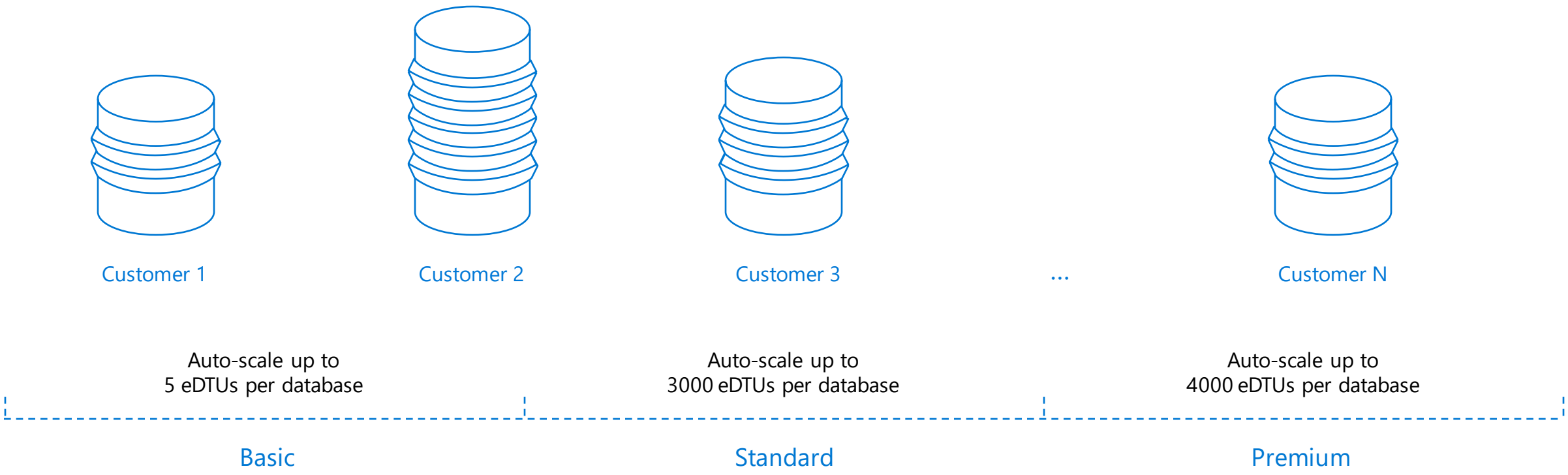
Don't worry about managing usage needs of individual databases



Elastic database pool service tiers

Buy a fixed number of eDTUs, share compute across many databases

ELASTIC DATABASE POOLS



Manage operational activities across multiple databases

Elastic database tools

- Elastic database jobs
- Elastic database queries
- Elastic database transactions

Support management and increased efficiency for multi-database environments

Elastic database pools

Elastic database jobs overview

Elastic database jobs enables you to run T-SQL scripts (jobs) against all databases in an elastic database pool

Define, maintain, and persist T-SQL scripts to be executed across an elastic database pool

Execute T-SQL scripts reliably with automatic retry and at scale

Track job execution state

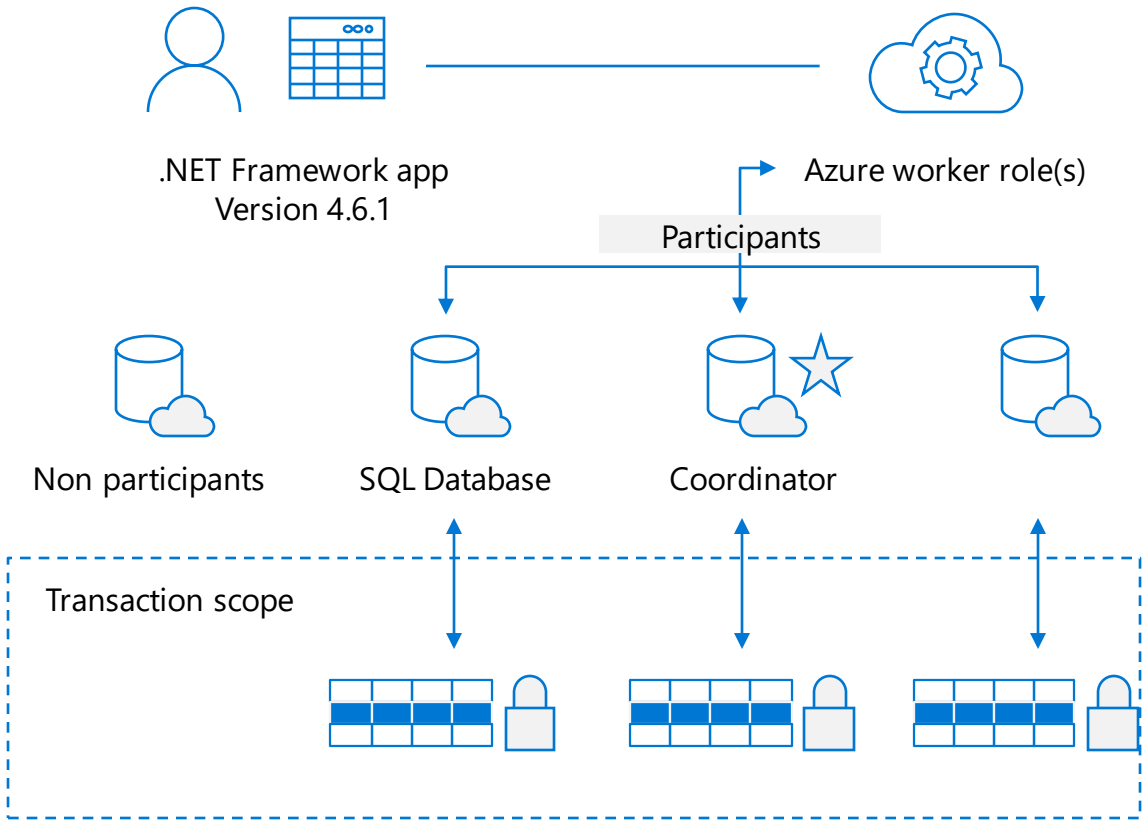
Elastic database transactions

Distributed transactions: perform operations across several databases with transactional properties in Azure SQL Database

Ensure that changes are made to all databases or not at all

Use the same .NET APIs that are used on-premises today

Distributed transactions on Azure SQL Database



Querying across many databases

Connect to a single Azure SQL Database instance using familiar Azure SQL Database connection strings

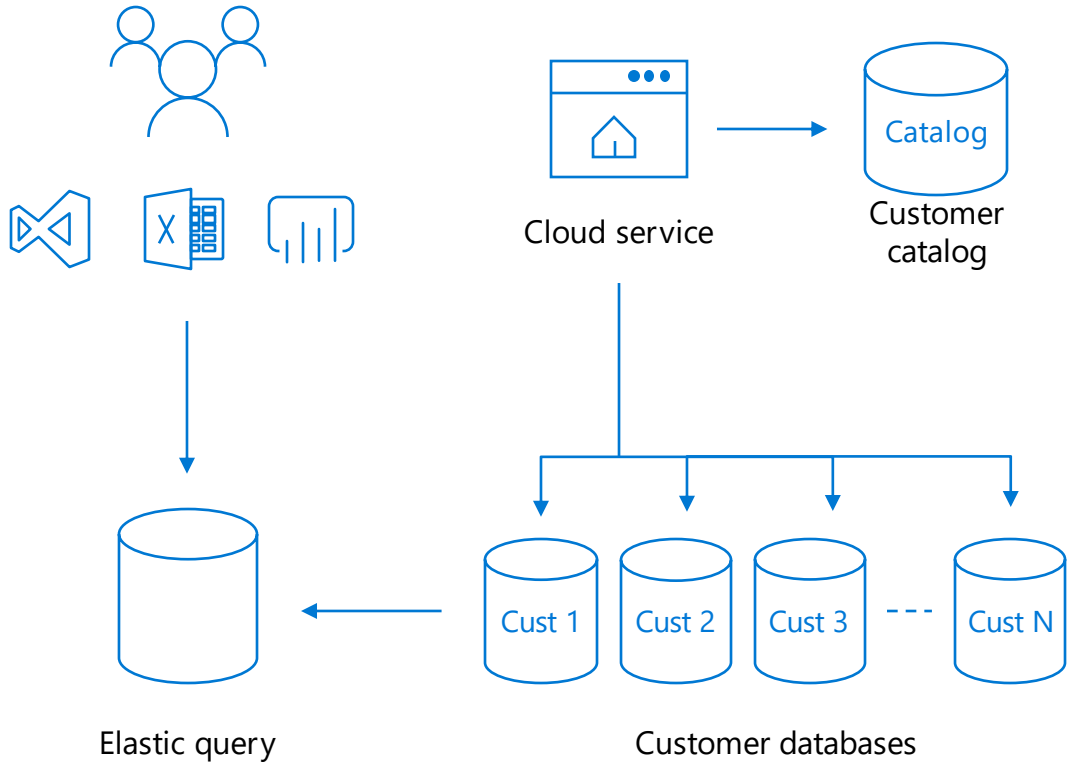
Simplify setup with Transact-SQL Data Definition Language (DDL)

Transparently query many databases from a single database

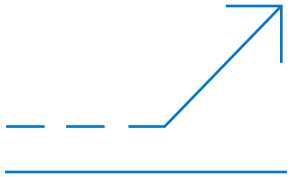
Familiar programming experience with Transact-SQL, ADO .NET LINQ, Entity Framework (EF), and others

Use familiar development and business-intelligence (BI) tools to query across many databases

Designed for interactive querying

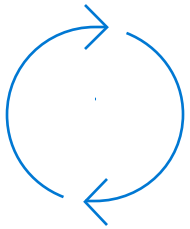


Multiply capacity and density for scalability



Adding more capacity

Identifying and breaking contention and choke points
How to add additional capacity to a solution?
Subtle constraints to consider…



Using capacity more efficiently

Traditional performance tuning
Maximizing application throughput (for example, leveraging batching)
Improving network performance

Elastic database client library overview

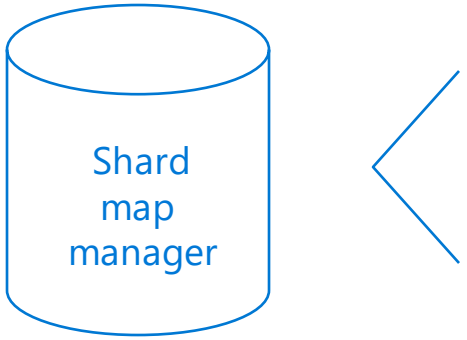
Two types of shard maps

Range: contiguous values

List: explicit values

Four types of sharding keys

INT, BIGINT, GUID, VARBINARY



[shardmaps_global]

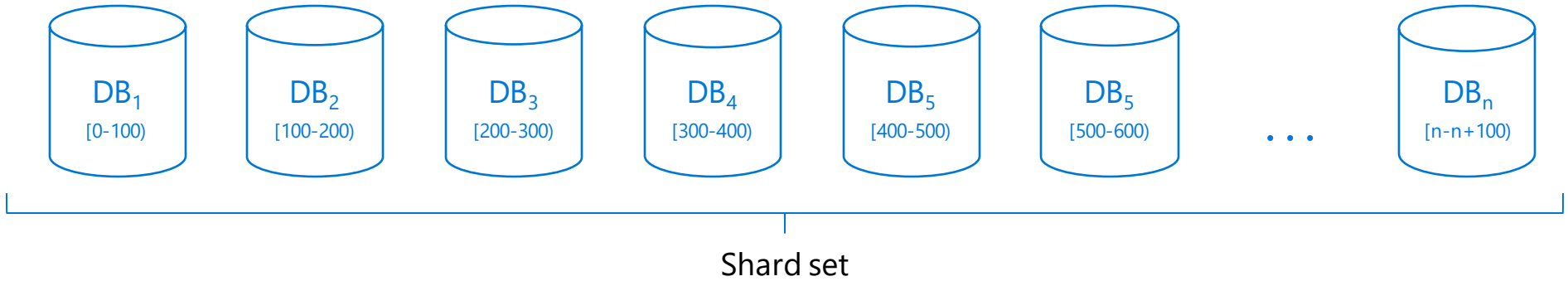
smid	name
1	RangeShardMap

[shards_global]

sid	smid	Datasource	Databasename
1	1	serverName	DB2
2	1	serverName	DB2

[shard_mappings_global]

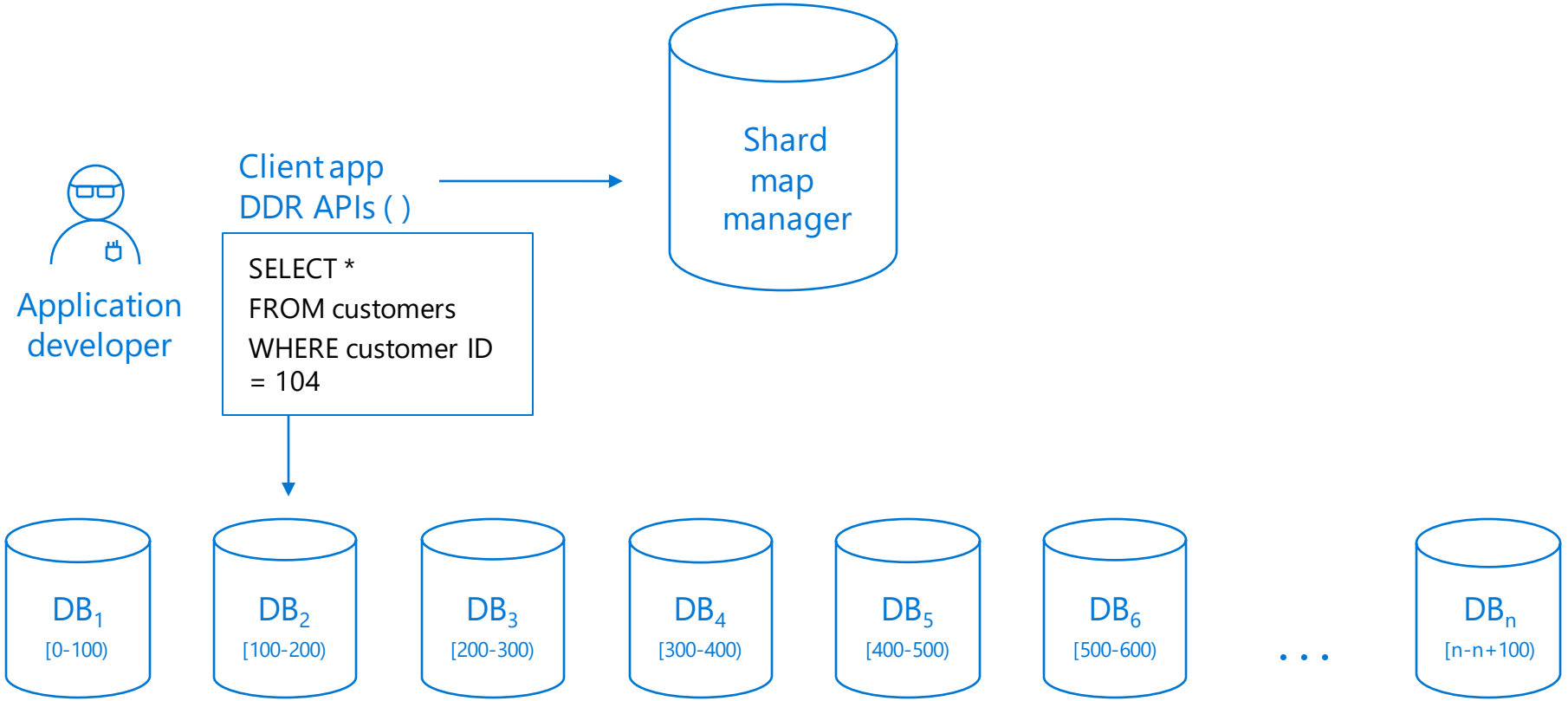
mid	smid	min	max	Sid
1	1	0	100	1
2	1	100	200	2



Data Dependent Routing (DDR)

Scenario:

Query a shard with a specific shardlet key



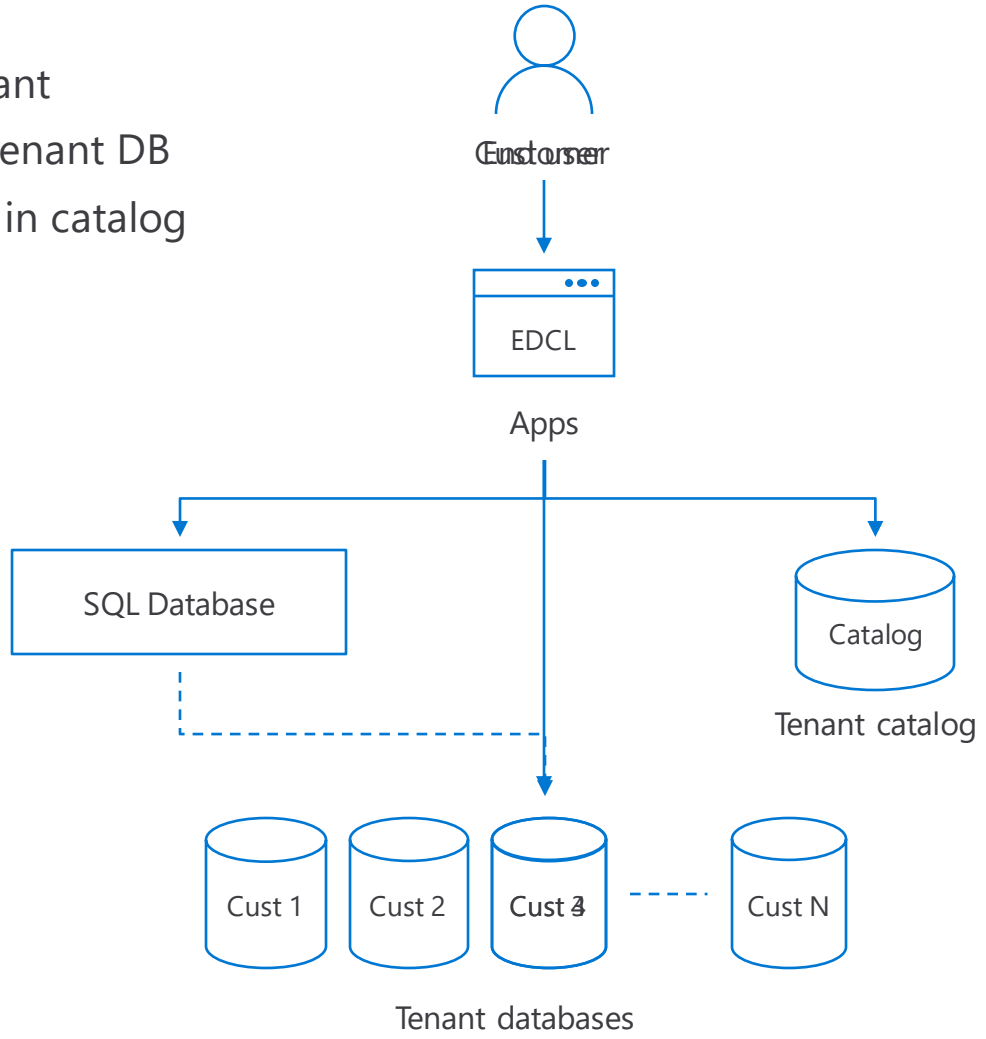
Data Dependent Routing (DDR)

```
// Get a routed connection for a given shardingKey
using (SqlConnection conn = ShardMap.OpenConnectionForKey(
                    shardingKey,
                    connectionString /* Credentials Only */ ,
                    ConnectionOptions.Validate   /* Validate */ ));
{
     using (SqlCommand cmd = new SqlCommand()
     {
          cmd.Connection = conn;
          cmd.CommandText = "SELECT dbNameField, TestIntField, TestBigIntField FROM
ShardedTable";

          SqlDataReader sdr = cmd.ExecuteReader();

          // Now consume results from the data reader…
```

Mapping tenants to databases

Tenant onboarding

A. Customer signs up as new tenant
B. Cloud service provisions new tenant DB
C. …registers tenant id, DB name in catalog



Application use

1. End user connects via a front end to the cloud service
2. Cloud service looks up tenant in catalog
3. …connects to correct tenant database
4. …on subsequent requests, uses cached database location

Mapping tenants to databases

Elastic Database Client Library plus catalog schema

Define and manage tenant-to-database mapping

Supports database-per-tenant and sharded data models

Supports split/merge of shards

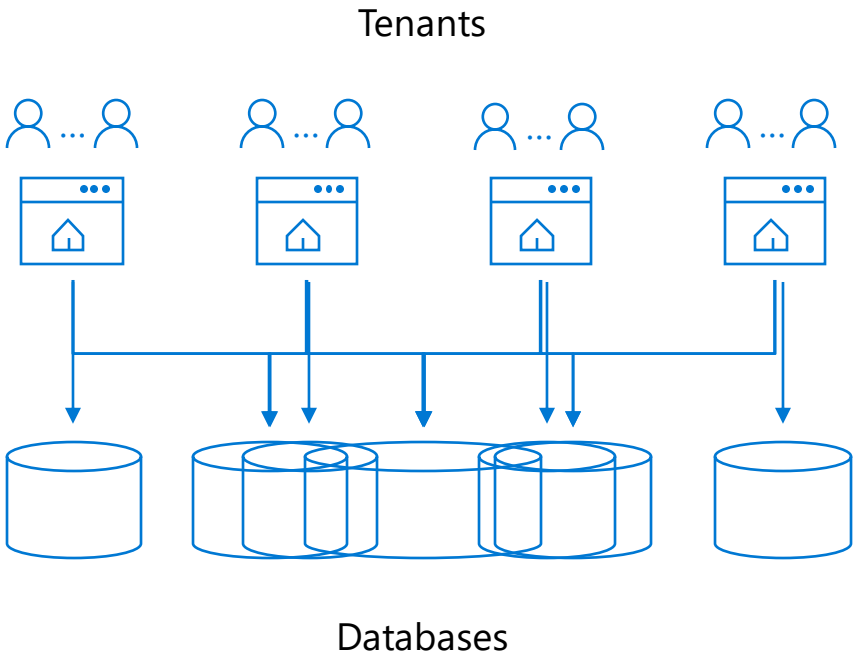
Route database requests (data-dependent routing)

Routes incoming requests to the correct database

Ensures correct routing if databases move or renamed

Caches server and database names to optimize performance

Can be used with native SQL access, EF



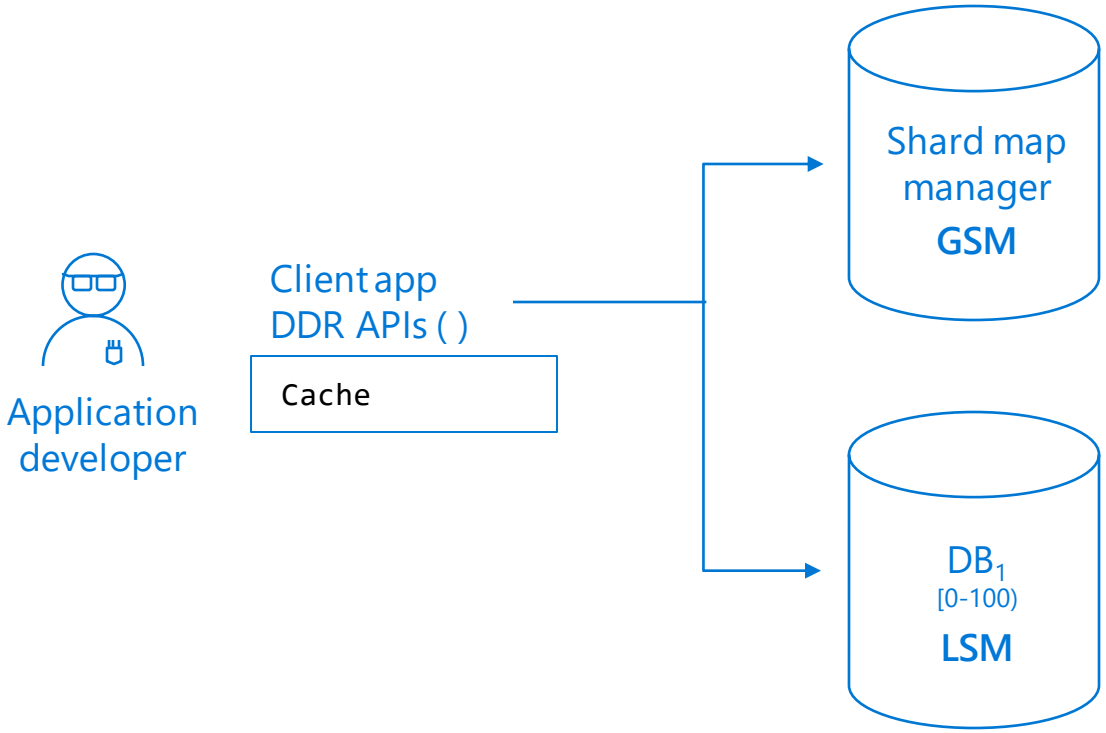
Shard map manager

Caching: Improve performance of shard operations

Global Shard Map (GSM) – state of all shards in the Shard Map

Local Shard Map (LSM) – state of all shards on a particular shard

Client Cache (eager/lazy) – state of all shards in the Shard Map/known shards



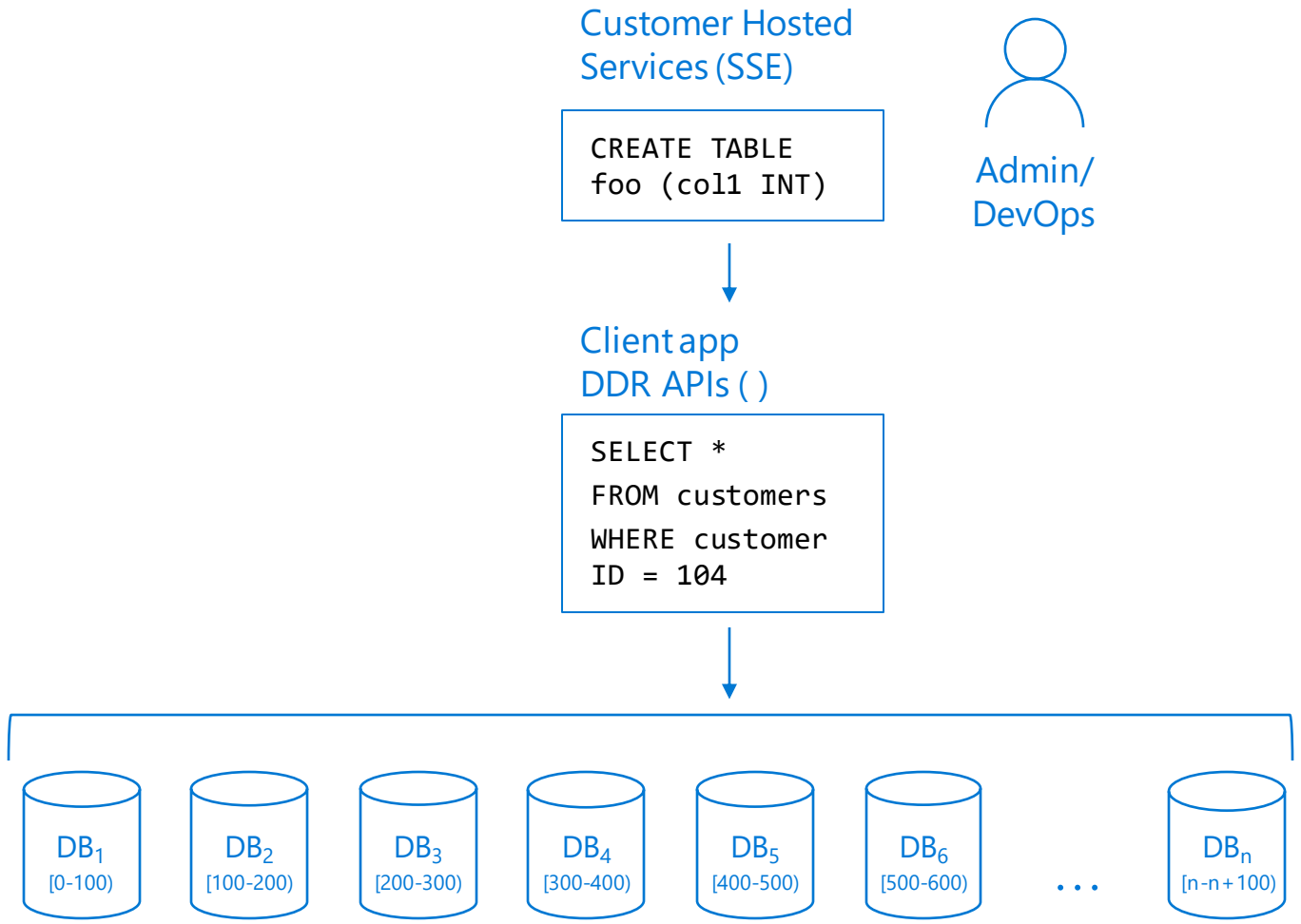
Multi-shard queries (MSQ)

```
using (MultiShardConnection conn = new MultiShardConnection(m_shardMap.GetShards(),
MultiShardTestUtils.GetTestSqlCredential()))
{
    using (MultiShardCommand cmd = conn.CreateCommand())
    {
        cmd.CommandText = "SELECT dbNameField, TestIntField, TestBigIntField FROM ShardedTable";
        cmd.CommandType = CommandType.Text;
        cmd.ExecutionOptions = MultiShardExecutionOptions.IncludeShardNameColumn;
        cmd.ExecutionPolicy = MultiShardExecutionPolicy.PartialResults;

        using (MultiShardDataReader sdr = cmd.ExecuteReader())
        {
            while (sdr.Read())
            {
                var dbNameField = sdr.GetString(0);
                var testIntField = sdr.GetFieldValue<int>(1);
                var testBigIntField = sdr.GetFieldValue<Int64>(2);
                string shardIdPseudoColumn = sdr.GetFieldValue<string>(3);
            }
        }
    }
}
```

Shard Set Executer (SSE)

Scenario:

Perform an admin action across set of shards



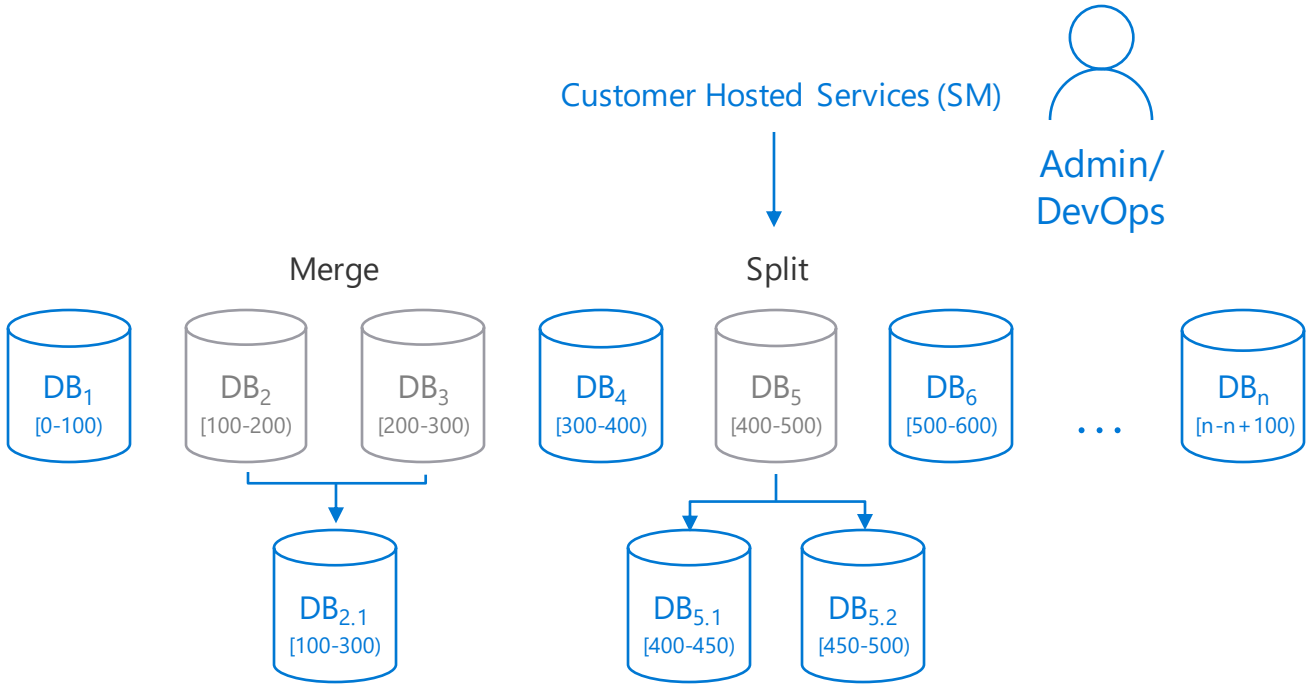
Split/Merge (SM)

Scenario:

Perform a split or merge action

Split: create two distinct shards from one

Merge: create one shard from two distinct shards



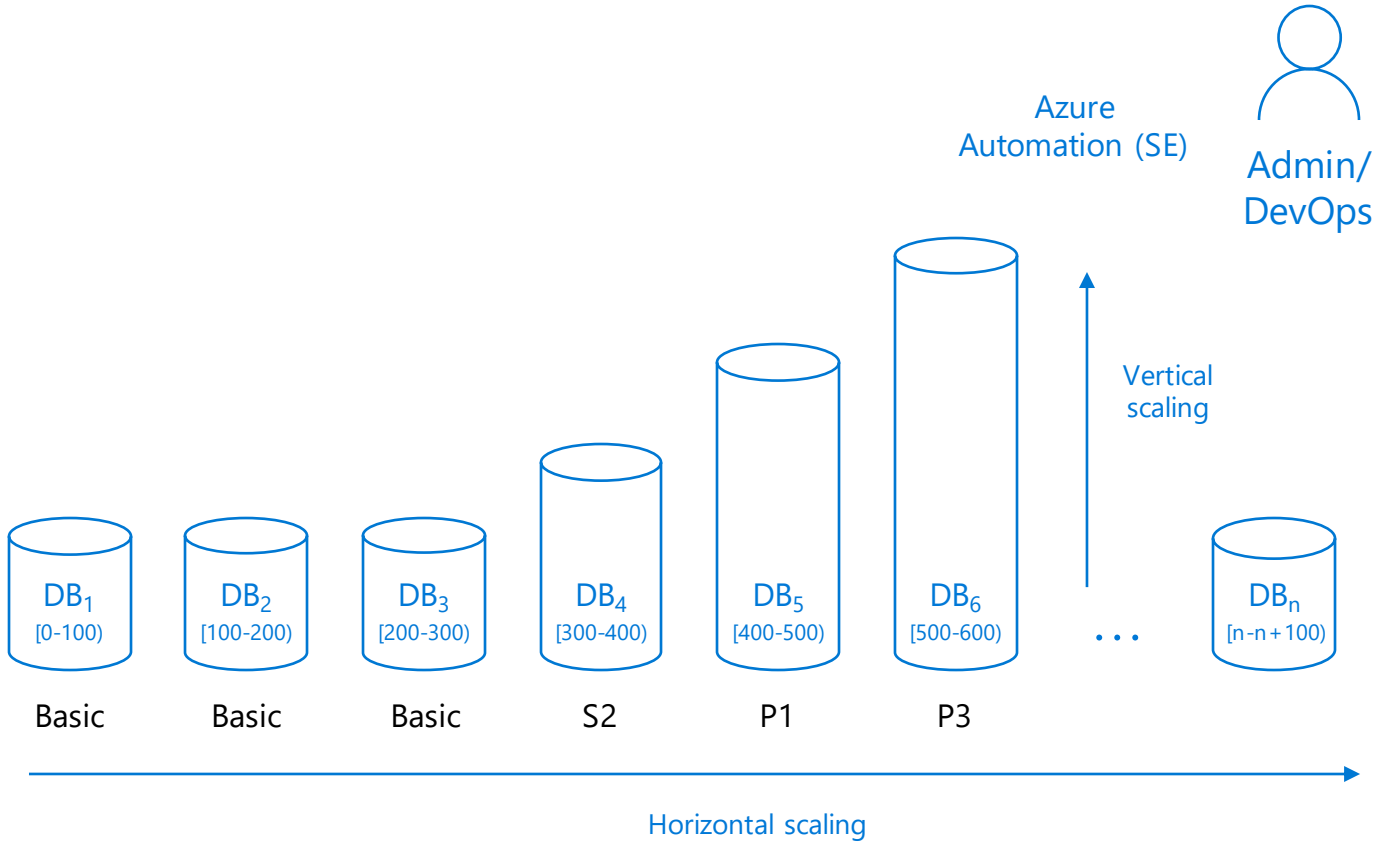
Shard Elasticity (SE)

Scenario:

Automation to vertically scale a shard or horizontally scale a shard set

Vertical scale: increase/decrease the performance level of the shard

Horizontal scale: add/remove a shard to the shard set



The growing need for serverless databases

Why serverless

Compute requirements for new apps may be unknown

Developers struggle to provide sufficient capacity and resources to support apps

Managing unpredictable and intermittent workloads is costly and time-consuming

Businesses struggle to ensure that database provisioning consistently aligns with workload requirements

Existing offerings cannot solve the problem

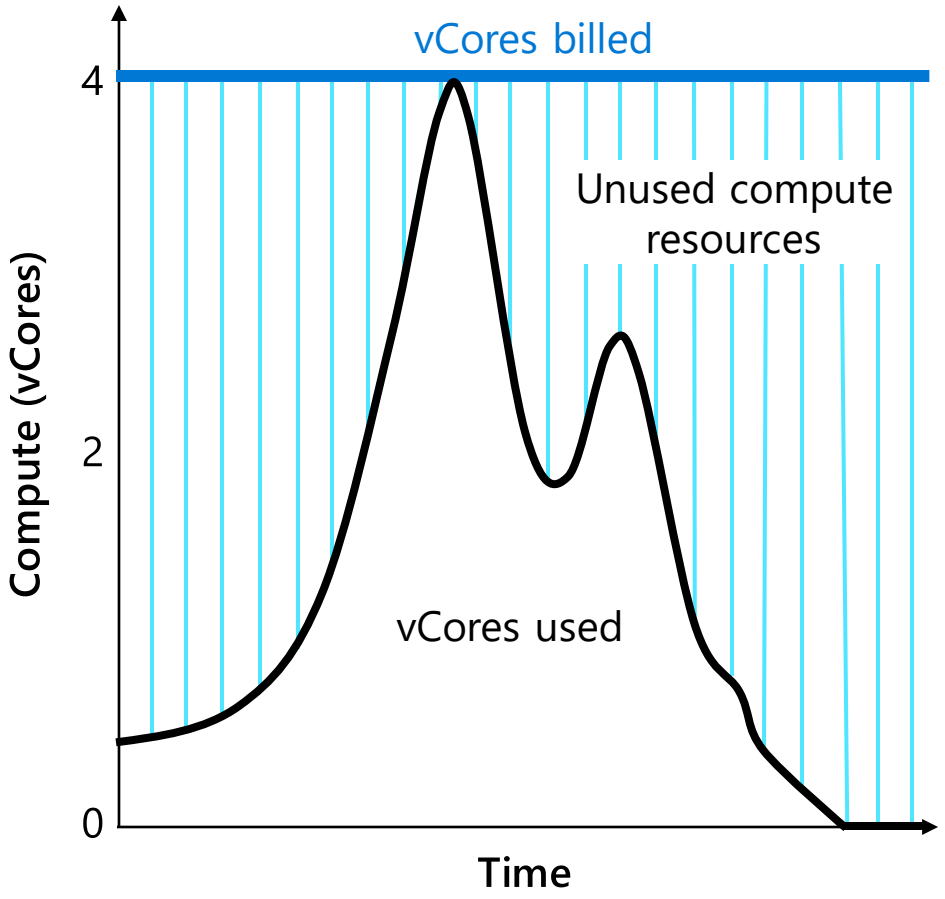
Provisioned compute databases are designed for predictable patterns and higher compute utilization

They struggle to meet high peaks in demand

They contribute to over-allocation of resources and costs during periods of inactivity or low usage

Lead to precious resources spent managing, not building

Provisioned compute with unpredictable and intermittent workloads



SQL Database serverless

On-demand flexible scale
Operate at the true rhythm of your business

Adapts compute resources to the workload without sacrificing performance

Automatically pauses and resumes

Cost-effective
Pay for performance. Period.

Pay only for compute resources you consume, on a per-second basis

Further optimize costs with configurable compute thresholds

Fully managed & intelligent
Focus on your applications, not your infrastructure

Fully-managed and intelligent database service

Built-in 99.99% availability

Best for unpredictable and intermittent workloads on single databases, such as:

Dev/test

Line of Business

E-commerce

Serverless supports common industry scenarios of sporadic or unpredictable usage

Line of business apps

Expense reporting and employee tracking apps

Procurement systems

E-commerce

Opening new marketplaces, marketing campaigns, sales promotions

Content management systems

Updating and publishing web content

Content clearinghouses that pull select content by third parties

Dev/test workloads

Handling unpredictable workload needs

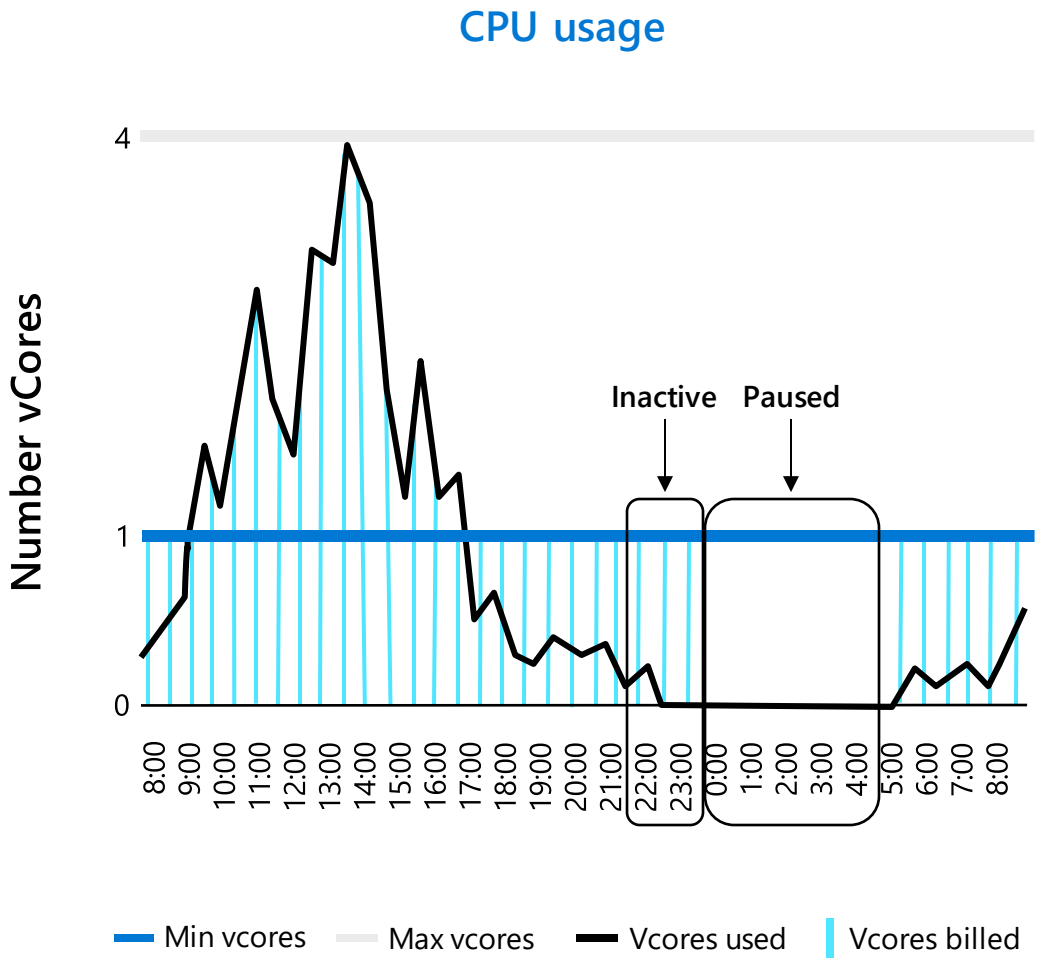
Optimize price to performance with per-second billing

Compute resources scale dynamically up or down based on workload requirements

Configure minimum and maximum vCores to define the range of available compute capacity

Use auto-pause delay to define the time period the dataset must be inactive before pausing

Pay for compute based on the vCores and memory used per second, with lowest billing based on configured vCore minimum



Provisioned compute and serverless meet different needs

Optimize compute provisioning and billing for your workload

Serverless databases...

Scale up or down to meet workload requirements, instead of pre-provisioning

Bill on a per-second basis

Common scenarios

Workloads with unpredictable and intermittent usage patterns or performance requirements

Workloads where the requirements are unknown and you can delegate compute sizing to the service

Databases with provisioned compute...

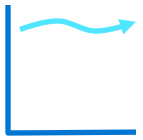
Provision compute resources upfront

Bill on an hourly basis

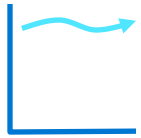
Common scenarios

Workloads with regular and substantial compute utilization

Multiple databases with bursty usage patterns that can be consolidated into a single server and use *elastic pools* for better price optimization



Choosing provisioned or serverless compute



Characteristics for provisioned compute

- More uniform resource utilization
- Need for higher compute responsiveness
- Scenarios where hourly billing granularity is ideal
- Desire to maintain resource allocation
- Interested in reserved capacity, Azure Hybrid Benefit, or elastic pools

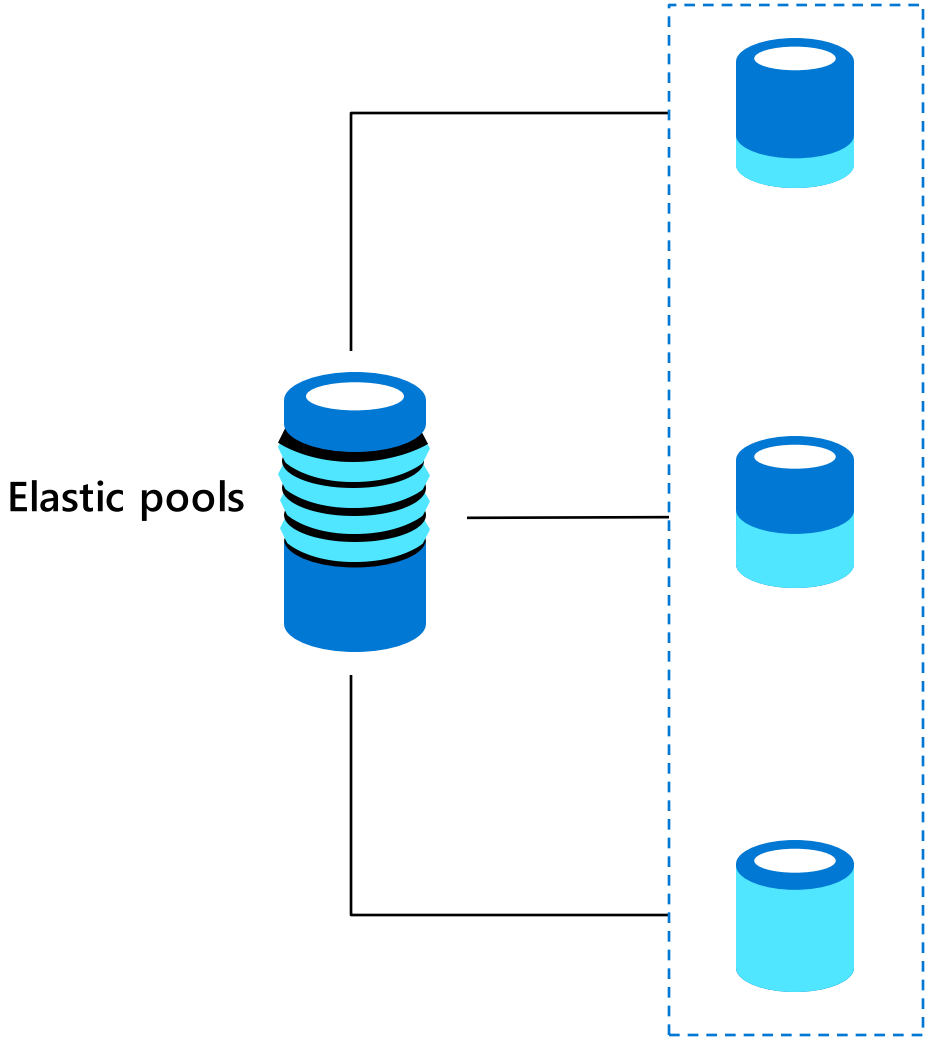
Characteristics for serverless compute

- Large shifts in usage and periods of inactivity
- Comfort with resume delay and memory reclamation
- Scenarios where per second billing granularity is ideal
- Desire to delegate resource allocation
- Currently using single databases on General Purpose service tier

Price optimization will help drive the decision between provisioned and serverless compute

When is elastic pools the right choice?

Multiple databases with unpredictable and intermittent usage patterns can be consolidated into a single server and use elastic pools for better price optimization



Intelligent performance that learns and adapts with your workloads

Learning Objectives

Single SQL code base
In-Memory OLTP
Query Store
Extended events
Query Performance Insight
Index Advisor
Automatic tuning
Monitoring at scale
Adaptive Query Processing

Single SQL Code Base

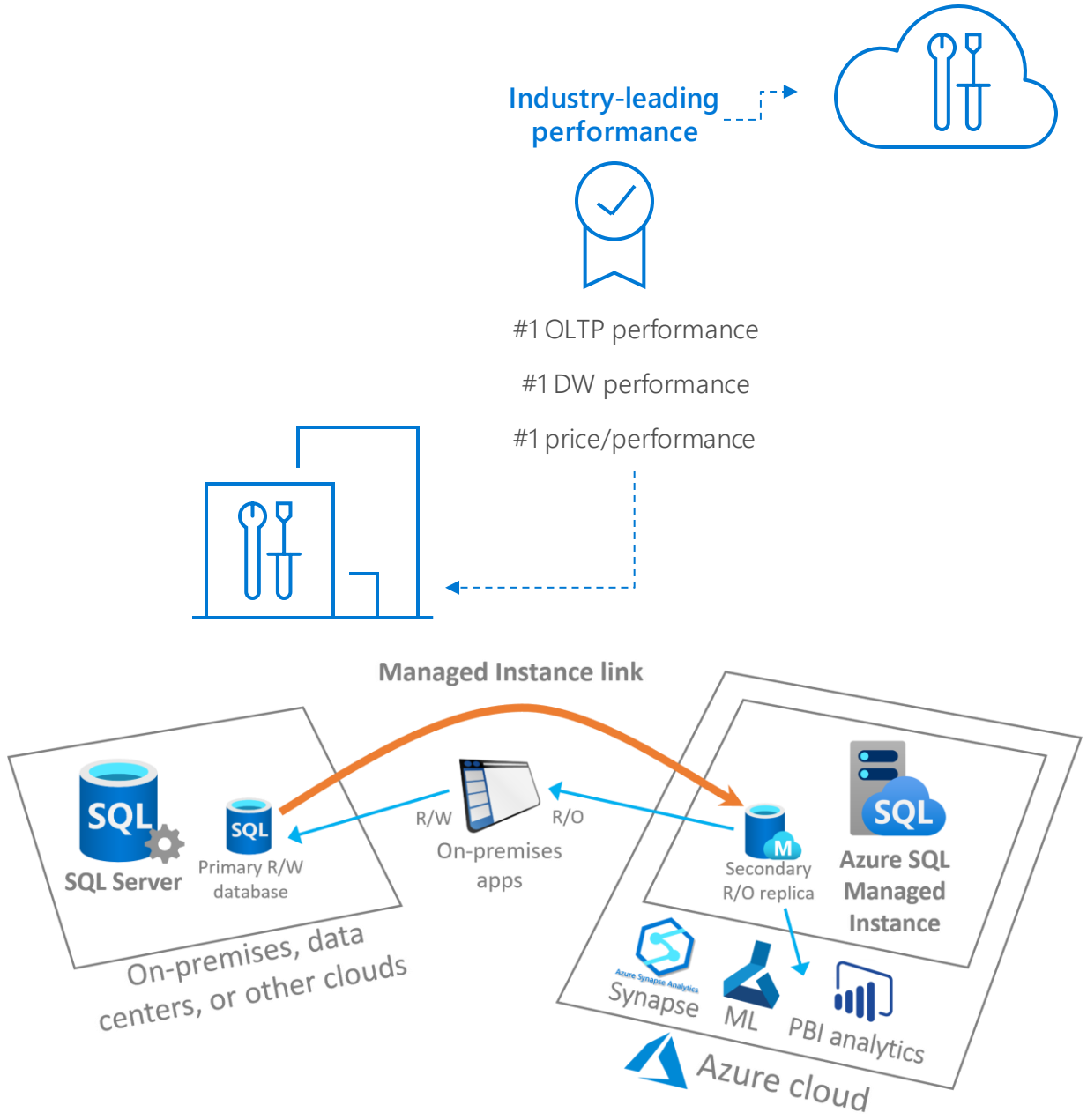
Eliminate app changes with full SQL Server programming surface

Use familiar SQL Server features in Azure SQL Database

Rapid development cycles with built-in testing across millions of databases

Innovation deployed to Azure first

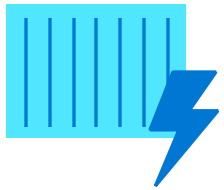
Industry-leading database engine



Breakthrough productivity and performance

Realize the benefits of real-time operational analytics

Enable scale-up with near zero downtime through cloud-born innovation



30x
faster transactions with In-Memory OLTP

100x
performance gains with in-memory analytics

Near
100% uptime with dynamic scalability

In-Memory OLTP

Customer benefits	**High-performance data operations**	**Efficient business-logic processing**	**Frictionless scale up**	**Hybrid engine and integrated experience**
Architectural pillars	**Main-memory optimized** • Optimized for in-memory data • Indexes (hash and range) exist only in memory • No buffer pool or B-trees • Stream-based storage	**Transact-SQL compiled to native machine code** • Transact-SQL compiled to machine code by using C code generator • Invoking a procedure is just a DLL entry-point • Aggressive compile-time optimizations	**High concurrency** • Multi-version optimistic concurrency control with full ACID support • Core engine uses lock-free algorithms • No lock manager, latches, or spinlocks	**SQL Server integration** • Same manageability, administration, and development experience • Integrated queries and transactions • Integrated high availability and backup/restore
Drivers	**Hardware trends** • Steadily declining memory price for non-volatile, random-access memory (NVRAM)	• Stalling CPU clock rate	• Processors with many cores	**Business** • Total cost of ownership

Real-time operational analytics

Capabilities

In-memory columnar index over in-memory/disk-based OLTP tables

Enhanced OLTP Transact-SQL surface area

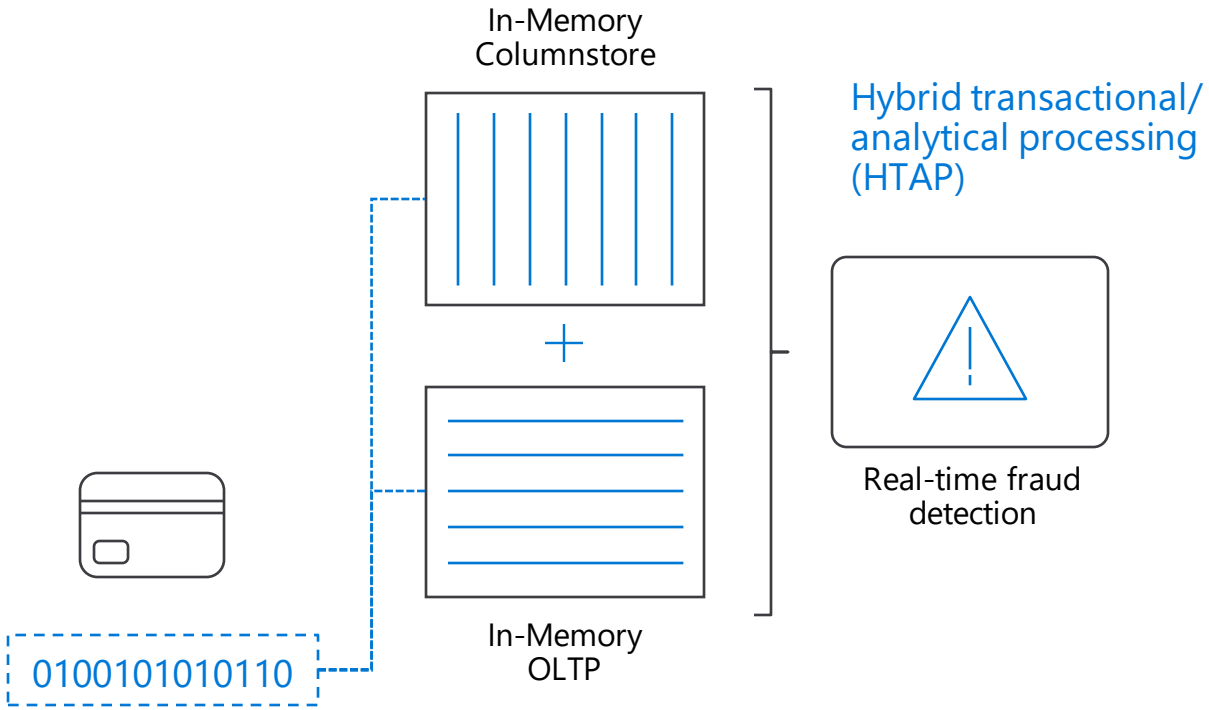
Scale to higher compute and memory

Benefits

Eliminate the need for ETL and a data warehouse

30x faster transactions and 100x better query performance

Run analytics in real time on up-to-date data



Query Store for comprehensive performance

Flight data recorder for your database

Captures history of queries, plans, and runtime statistics

Quickly finds performance differences caused by query plan changes

Separates data by time window

Query Store use

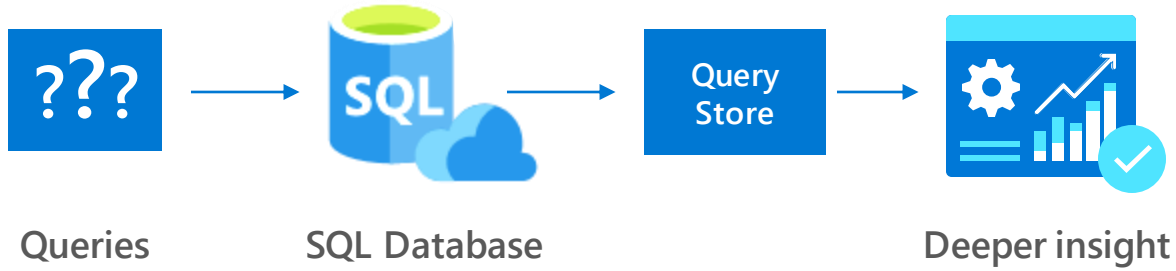
Enabled by default

Find regressed queries

Identify top resource-consuming queries

Optimize ad-hoc workloads

Streamline application upgrades



Working with Query Store

DB-level feature exposed through T-SQL extensions

ALTER DATABASE

Catalog views (settings, compile, and runtime stats)

Stored procs (plan forcing, query/plan/stats cleanup)

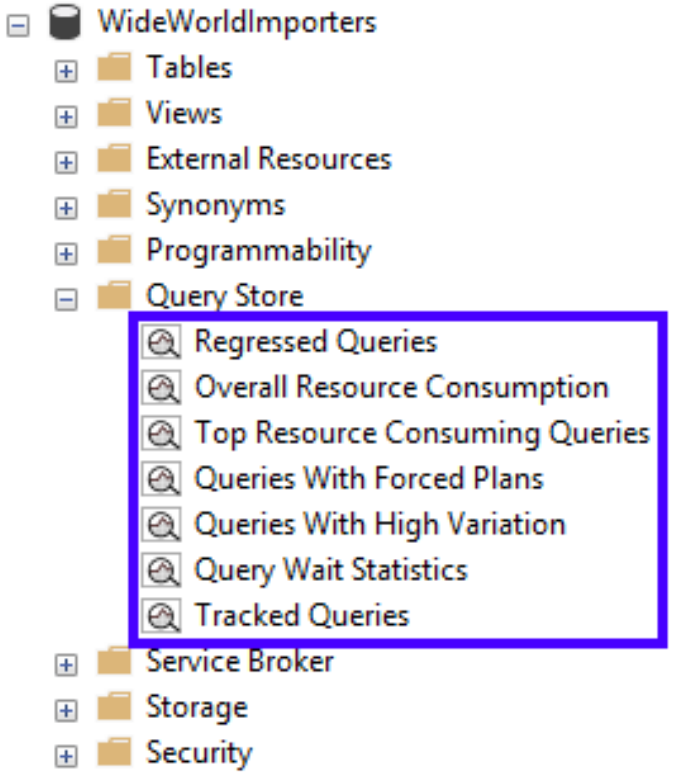
/*The following query returns information about queries and plans in the Query Store. */

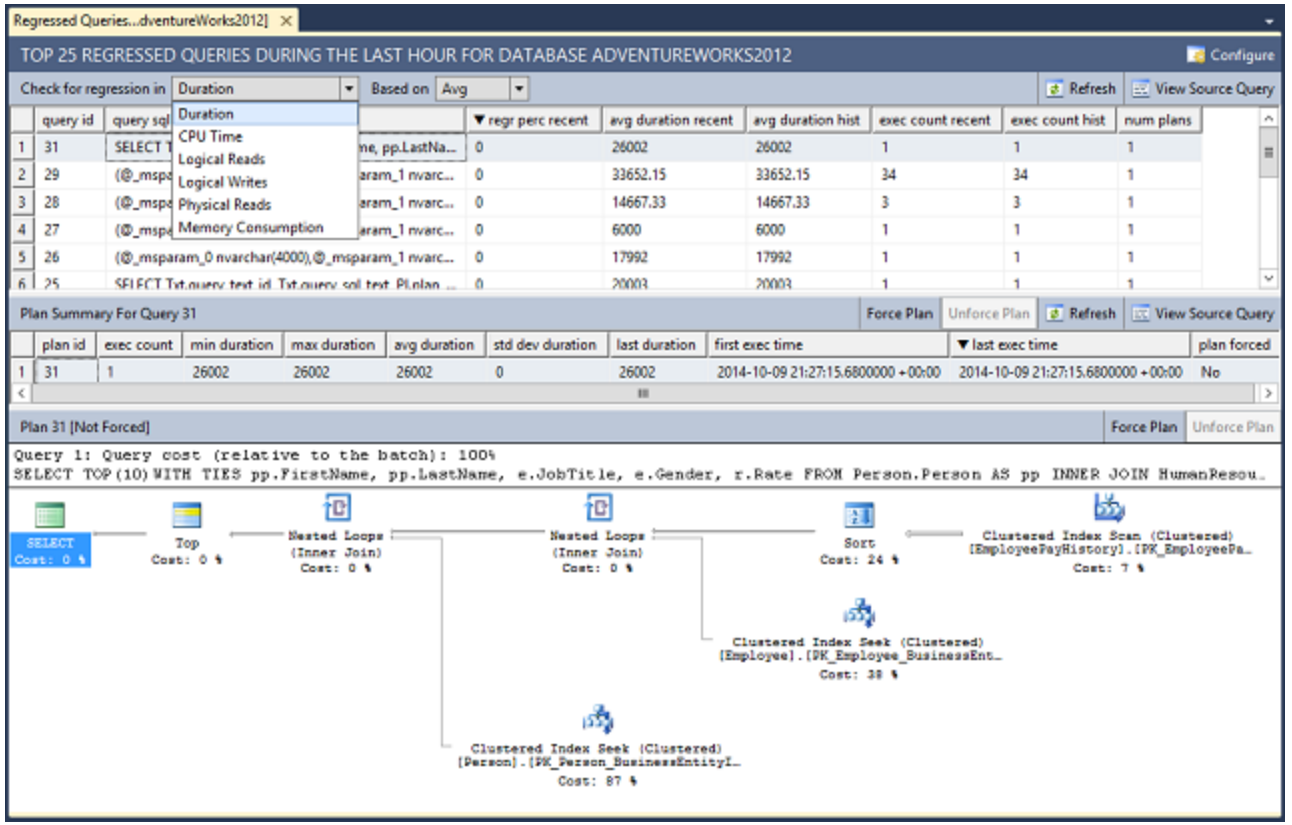
```
SELECT
Txt.query_text_id, Txt.query_sql_text, Pl.plan_id, Qry.*
FROM sys.query_store_plan AS Pl
INNER JOIN sys.query_store_query AS Qry
   ON Pl.query_id = Qry.query_id
INNER JOIN sys.query_store_query_text AS Txt
   ON Qry.query_text_id = Txt.query_text_id;
```

```
/* (1) Turn ON Query Store */

ALTER DATABASE MyDB SET QUERY_STORE = ON;

/* (2) Review current Query Store parameters */
SELECT * FROM sys.database_query_store_options

/* (3) Set new parameter values */
ALTER DATABASE MyDB
SET QUERY_STORE (
  OPERATION_MODE = READ_WRITE,
  CLEANUP_POLICY = (
    STALE_QUERY_THRESHOLD_DAYS = 30
  ),
  DATA_FLUSH_INTERVAL_SECONDS = 3000,
  MAX_STORAGE_SIZE_MB = 500,
  INTERVAL_LENGTH_MINUTES = 15
);

/* (4) Clear all Query Store data */
ALTER DATABASE MyDB SET QUERY_STORE CLEAR;

/* (5) Turn OFF Query Store */
ALTER DATABASE MyDB SET QUERY_STORE = OFF;
```

The following query returns information about queries and plans in the Query Store.

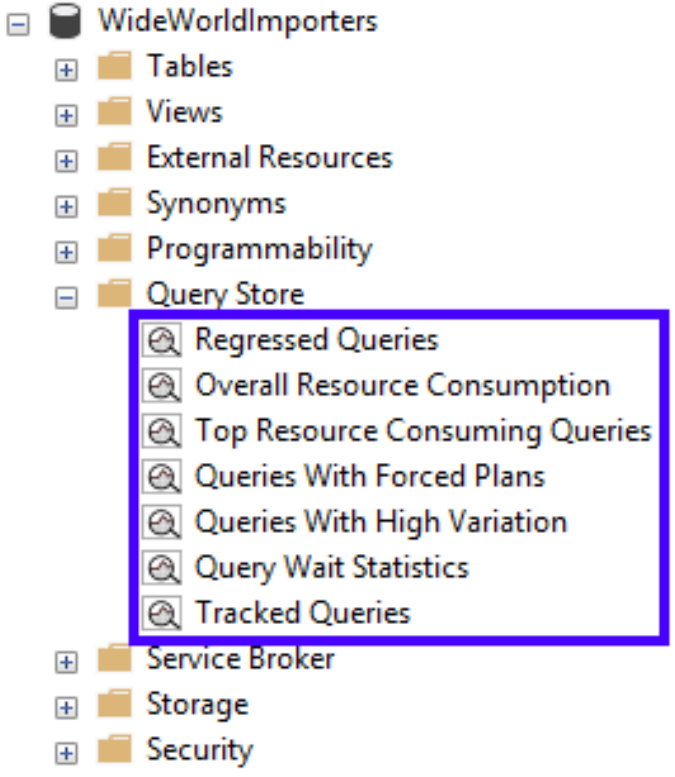
open the **Regressed Queries** pane in SQL Server Management Studio

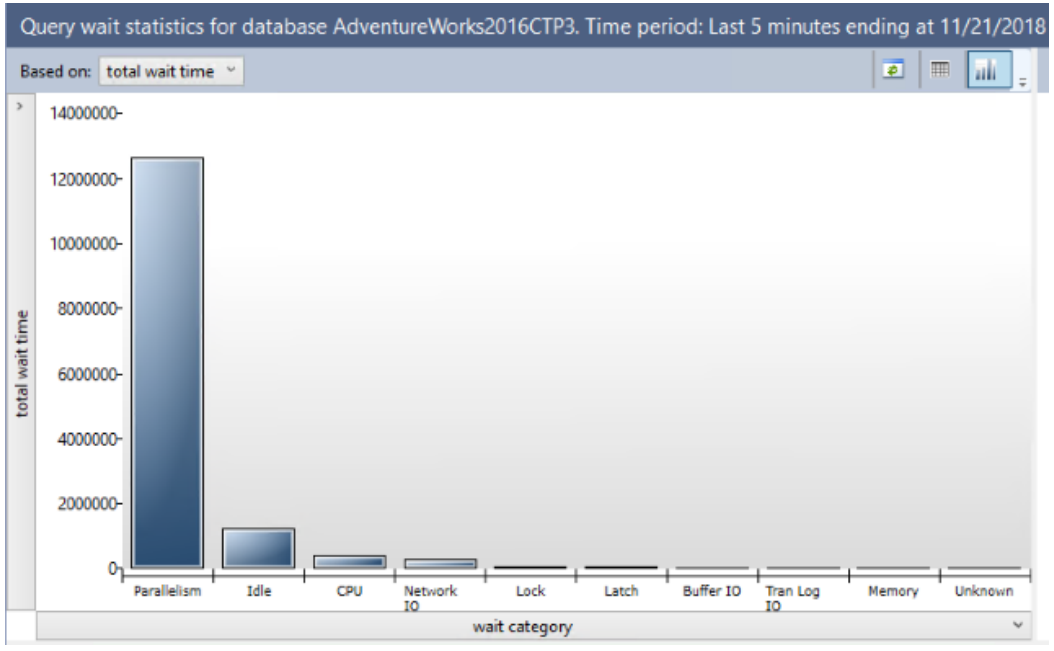




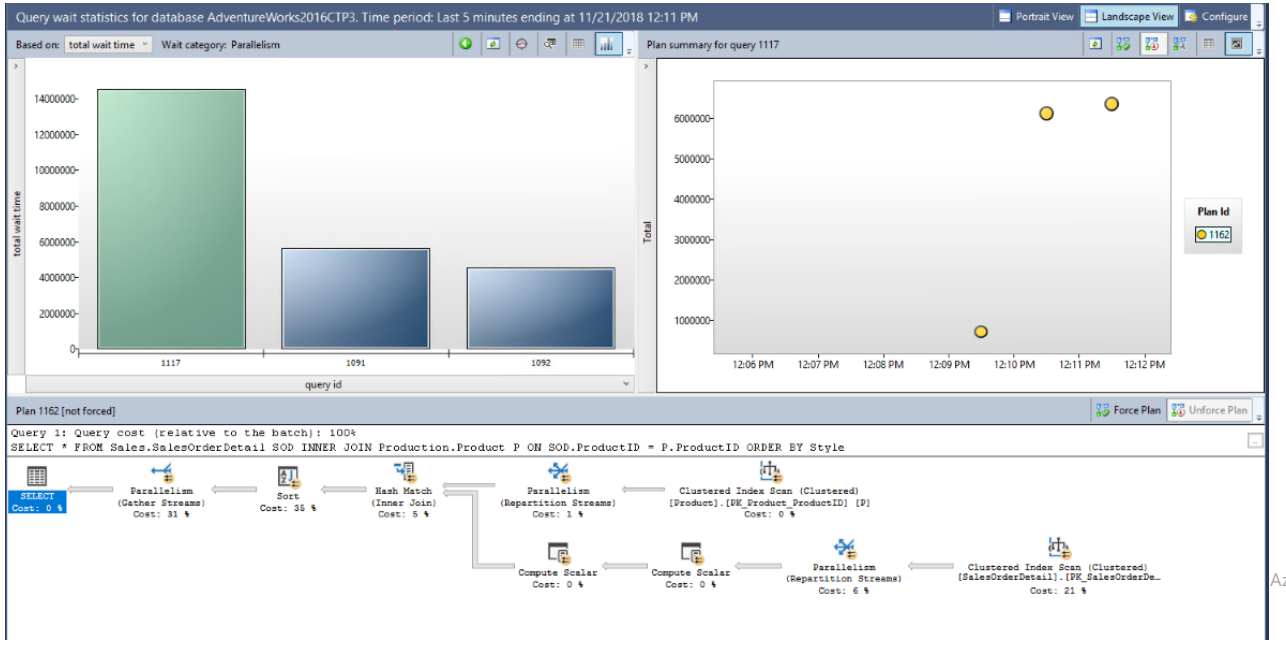
Finding waiting queries

open the **Query Wait Statistics** pane in SQL Server Management Studio





Select a wait category by clicking on the bar and a detail view on the selected wait category displays



How you can get more insights into your workload before and after introducing wait categories in Query Store

Previous experience	New experience	Action
High RESOURCE_SEMAPHORE waits per database	High Memory waits in Query Store for specific queries	Find the top memory consuming queries in Query Store. These queries are probably delaying further progress of the affected queries. Consider using MAX_GRANT_PERCENT query hint for these queries, or for the affected queries.
High LCK_M_X waits per database	High Lock waits in Query Store for specific queries	Check the query texts for the affected queries and identify the target entities. Look in Query Store for other queries modifying the same entity, which are executed frequently and/or have high duration. After identifying these queries, consider changing the application logic to improve concurrency, or use a less restrictive isolation level.
High PAGEIOLATCH_SH waits per database	High Buffer IO waits in Query Store for specific queries	Find the queries with a high number of physical reads in Query Store. If they match the queries with high IO waits, consider introducing an index on the underlying entity, in order to do seeks instead of scans, and thus minimize the IO overhead of the queries.
High SOS_SCHEDULER_YIELD waits per database	High CPU waits in Query Store for specific queries	Find the top CPU consuming queries in Query Store. Among them, identify the queries for which high CPU trend correlates with high CPU waits for the affected queries. Focus on optimizing those queries - there could be a plan regression, or perhaps a missing index.

Extended Events

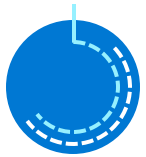
Enhanced monitoring and troubleshooting for Azure SQL Database

Performance issues

SQL statement executions

Full-text related errors

Targets that can capture results from your event sessions



Ring buffer target

Briefly holds event data in memory

Event counter target

Counts all events that occur during an extended events session

Event file target

Writes complete buffers to an Azure Storage container

Analyze resources with Query Performance Insight

Review top CPU consuming queries

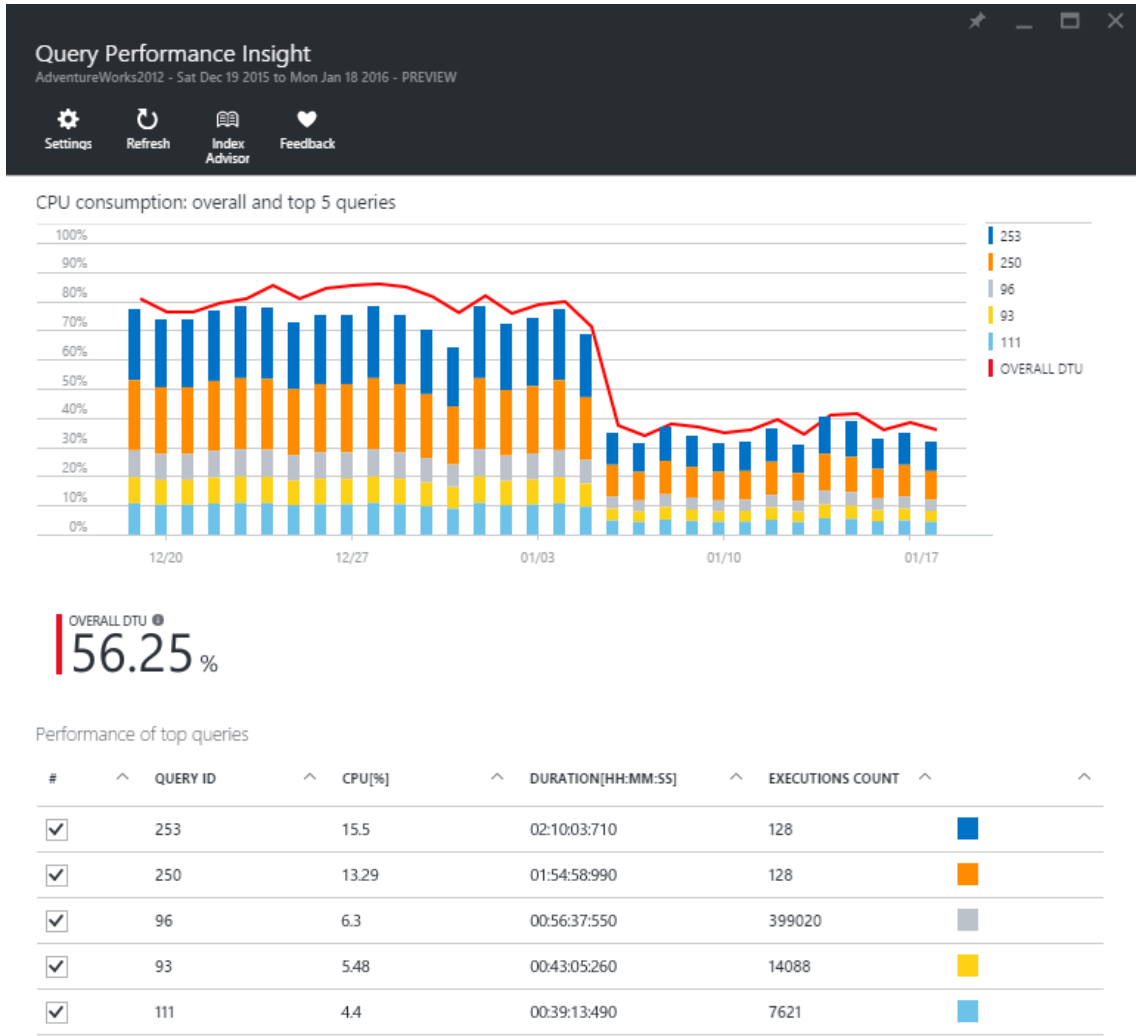
Customize your view by selecting observation interval, number of queries, and aggregation type

View aggregated statistics about your workload including total duration and number of executions

View individual query details

Get granular view on query execution intervals

View query text



Understand and tune your database with Query Performance Insight

Insights into resource consumption

Query Performance Insights shows resource consumption of top resource-consuming queries over time, and helps pinpoint the potential issues with additional details for each query

Hints for optimization

Query Performance Insights gives tuning hints for top resource consumers

Query Performance Insights can help users with the following:

Answer the question "Where are my resources spent?" and understand the impact of top queries on the resource consumption of the database over time

Identify the queries to fix, before (or after) they become a problem

Azure SQL Database - performance recommendations

Index tuning recommendations tailored to each DB

Recommendations are based on the observed usage, and evolve as the DB workload changes

Support for CREATE and DROP index, more types of recommendations underway

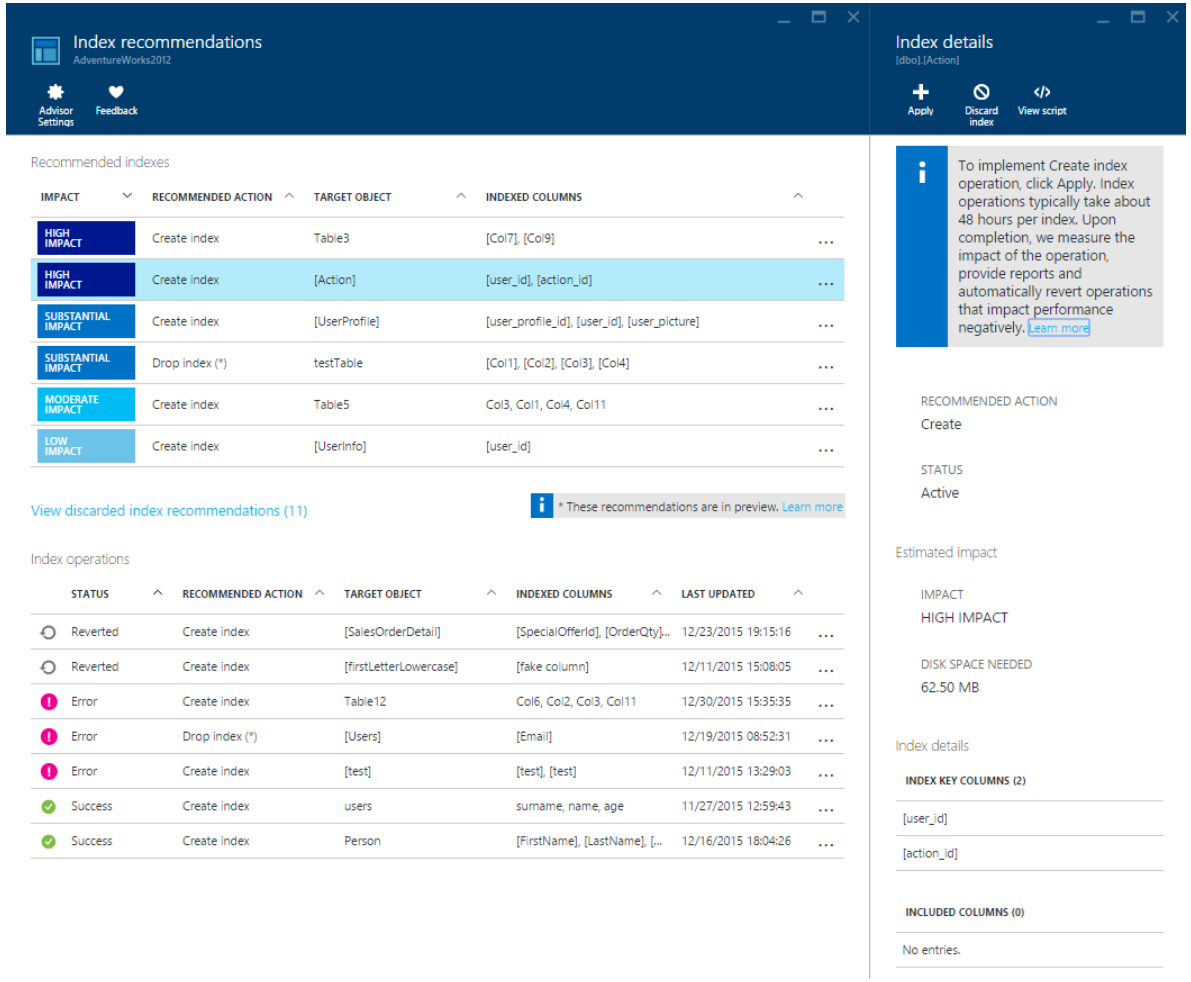
Drop index recommendations

Recommendations are based on the observed usage of index not used

Intelligent service for implementing and validating index recommendations

Full-auto mode takes care of indexes for your DB

Manual "review and apply" mode for full control



Continuously optimized by the platform | Automatic tuning

One-click to enable

Prevent and mitigate issues

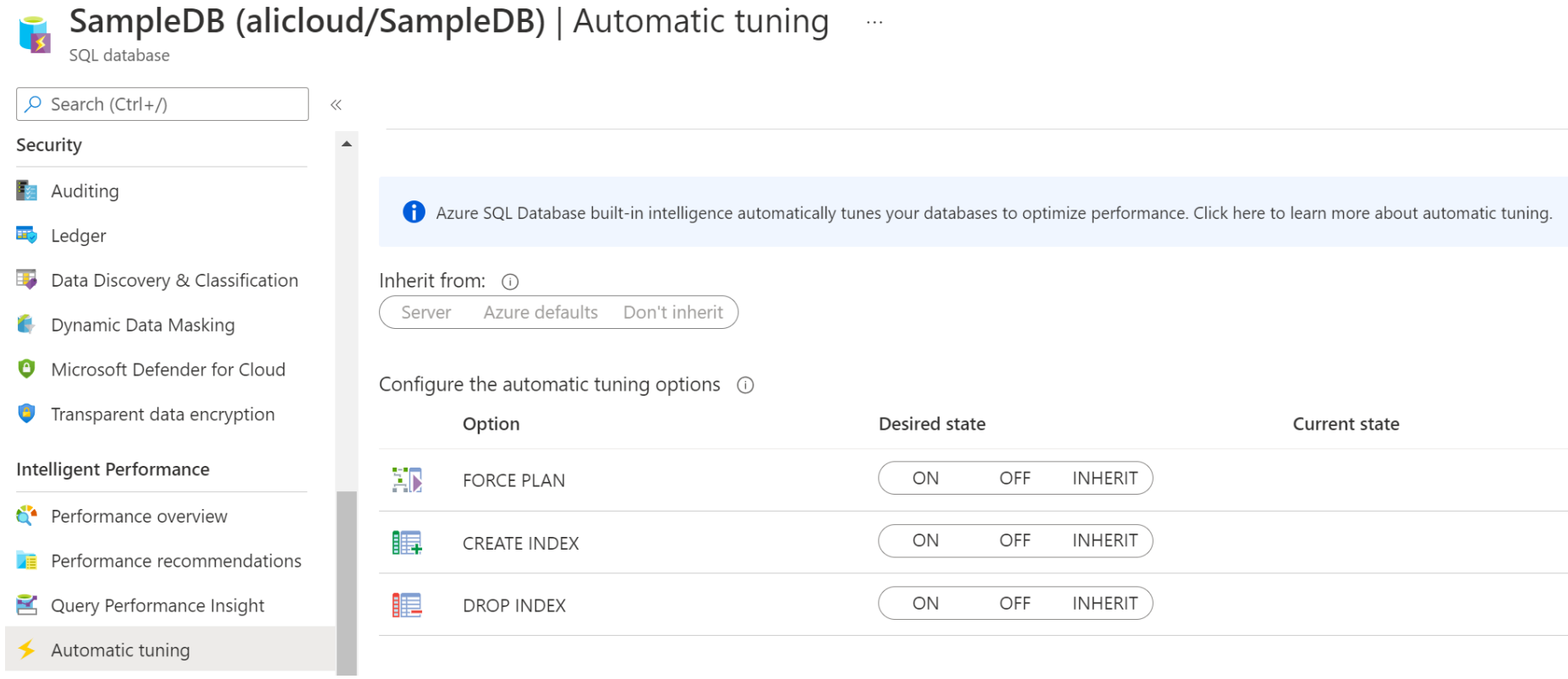
No app changes needed

Tuning actions

Create missing indexes

Drop unused/duplicate indexes

Force last good plan



Azure Monitor - SQL Analytics

Monitoring Azure SQL Database at scale

Integrated with Operations Management Suite

Monitor entire Azure SQL Database estate across multiple subscriptions

Provides a view into raw telemetry

Monitored activities

Resource usage

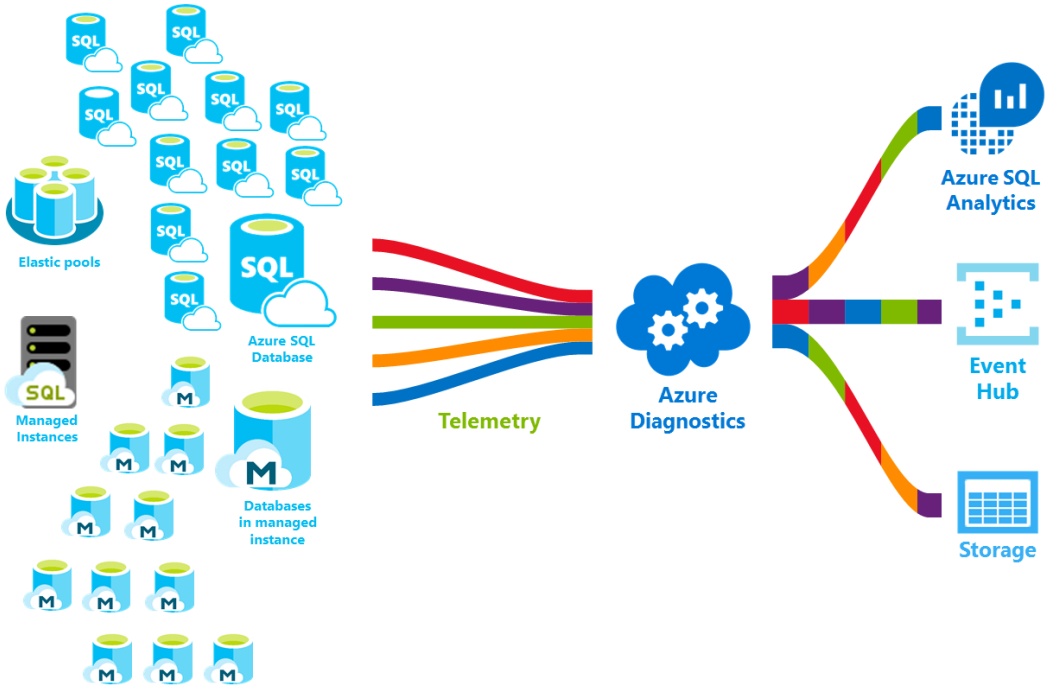
Query performance

SQL errors

Timeouts

Blocking

Intelligent insights



Adaptive Query Processing

Interleaved execution

Materialize estimates for multi-statement table valued functions (MSTVFs)

Downstream operations will benefit from the corrected MSTVF cardinality estimate

Batch mode memory grant feedback

Adjust memory grants based on execution feedback

Remove spills and improve concurrency for repeating queries

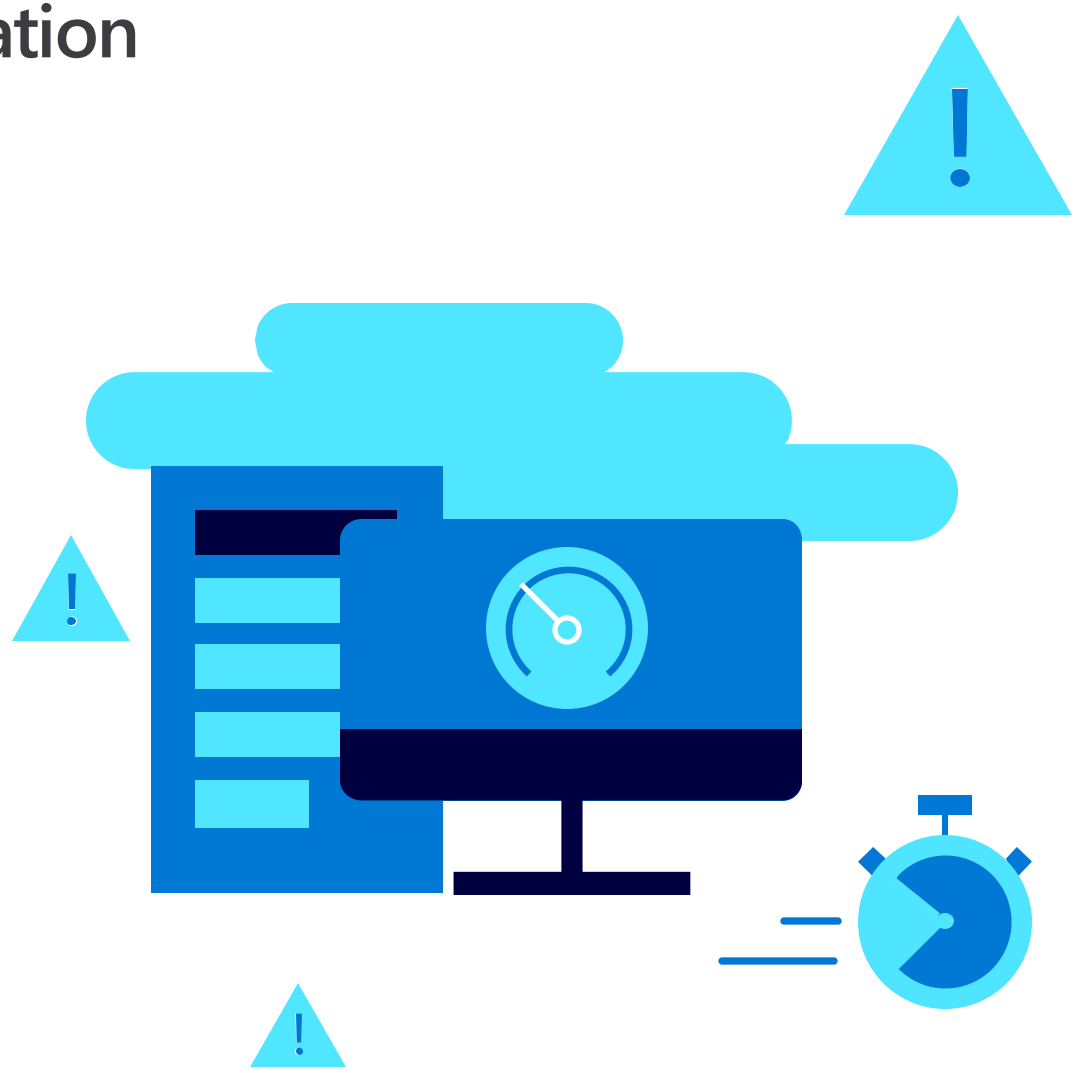
Batch mode adaptive join

Defer the choice of hash join or nested loop until after the first join input has been scanned

Uses Nested Loop for small inputs, Hash Joins for large inputs

Challenges associated with mis-estimation

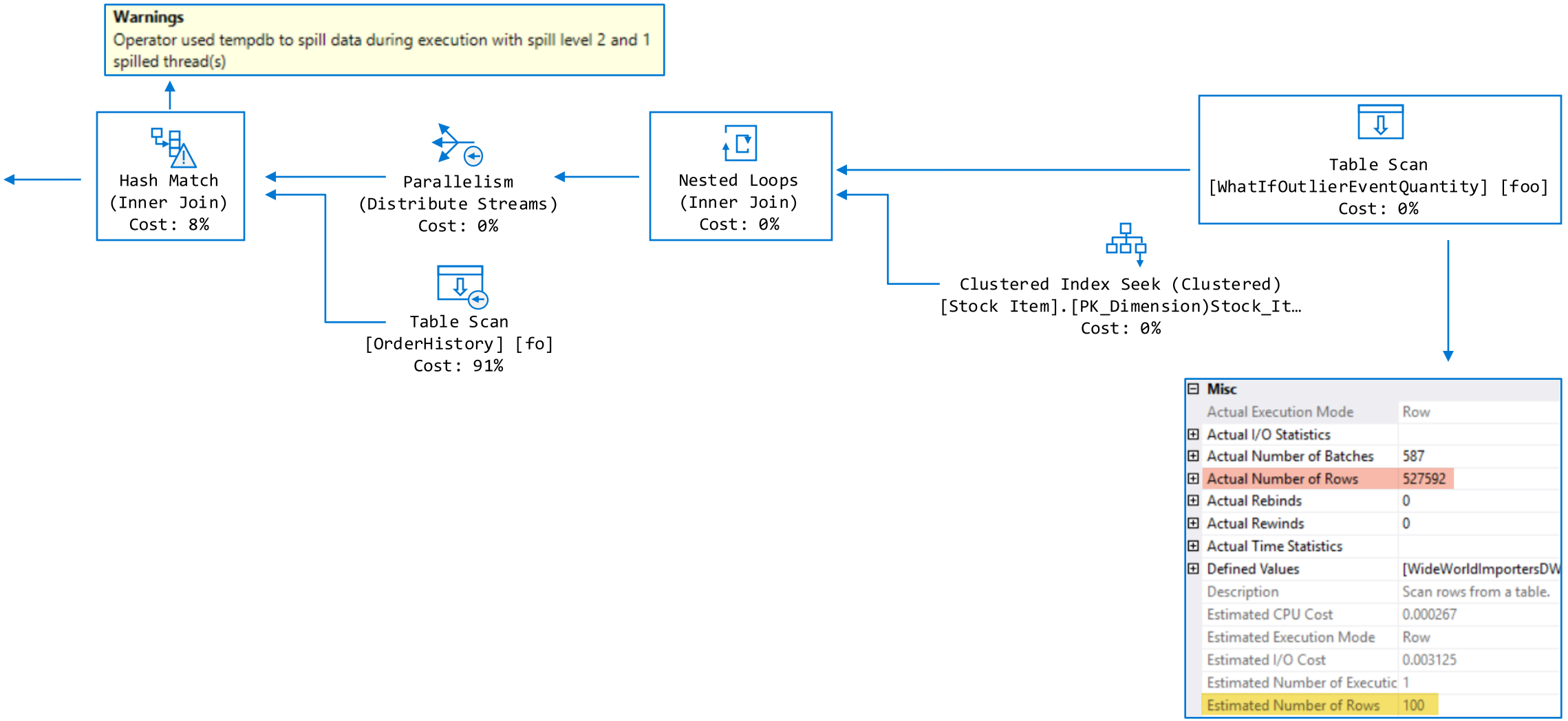
- Slow query response time due to bad plans
- Excessive resource utilization (CPU, Memory, IO)
- Reduced throughput and concurrency
- T-SQL refactoring for off-model statements



Cardinality estimation and plan quality

```
SELECT  [fo].[Order Key], [fo].[Description], [fo].[Package],
        [fo].[Quantity], [foo].[OutlierEventQuantity]
FROM    [Fact].[OrderHistory] AS [fo]
INNER JOIN [Fact].[WhatIfOutlierEventQuantity]('Mild Recession',
                        '1-01-2013',
                        '10-15-2014') AS [foo] ON [fo].[Order Key] = [foo].[Order Key]
                       AND [fo].[City Key] = [foo].[City Key]
                       AND [fo].[Customer Key] = [foo].[Customer Key]
                       AND [fo].[Stock Item Key] = [foo].[Stock Item Key]
                       AND [fo].[Order Date Key] = [foo].[Order Date Key]
                       AND [fo].[Picked Date Key] = [foo].[Picked Date Key]
                       AND [fo].[Salesperson Key] = [foo].[Salesperson Key]
                       AND [fo].[Picker Key] = [foo].[Picker Key]
INNER JOIN [Dimension].[Stock Item] AS [si]
    ON [fo].[Stock Item Key] = [si].[Stock Item Key]
WHERE   [si].[Lead Time Days] > 0
        AND [fo].[Quantity] > 50;
```

Cardinality estimation and plan quality



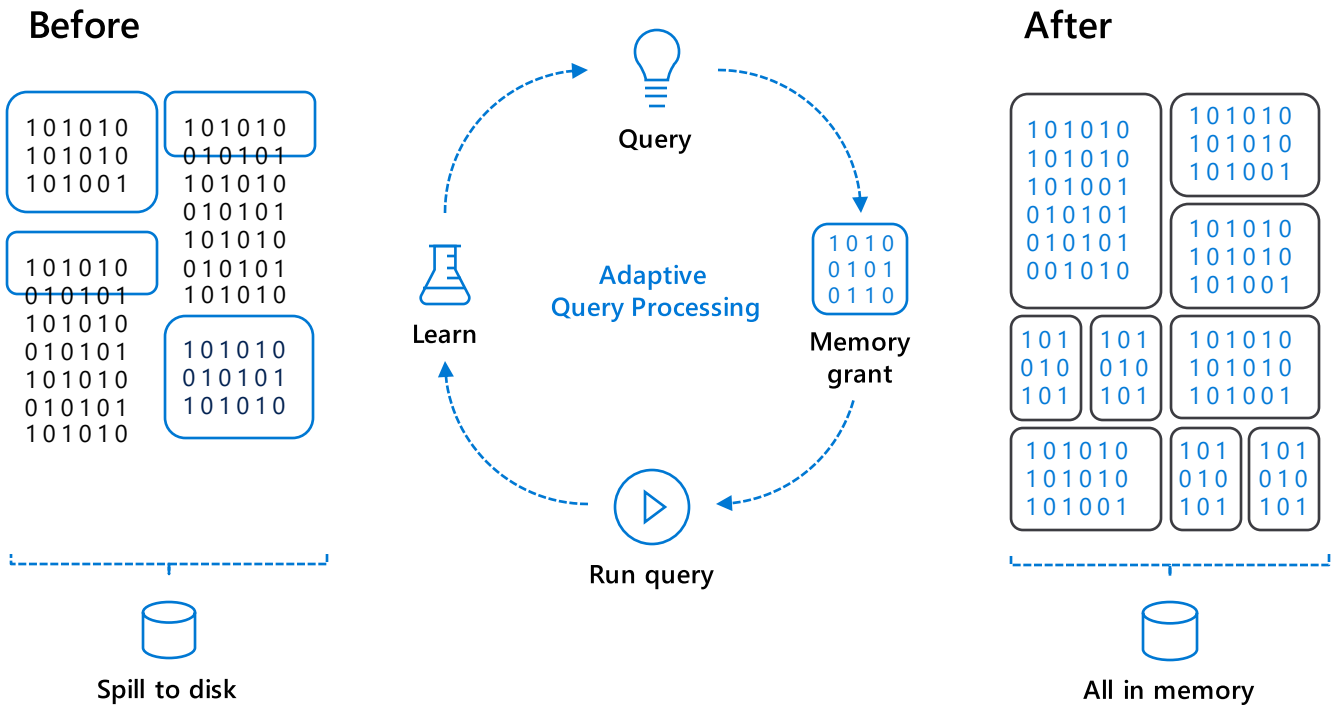
Optimized query processing

Improved efficiency with Adaptive Query Processing

Optimize memory grants for repeatable queries to avoid over or under allocating

Adjust data join strategy for small or large tables to speed joins

Batch mode for memory grants feedback and adaptive joins



Scale on the fly
with no application downtime

Learning Objectives

Scalable performance

Predictable performance

Pay for what you need Real-time analytics

Steps to optimize your service tier

Scalable performance with LITTLE to no downtime

Predictable performance

Guaranteed resources allow for a predictable performance experience

In-Memory OLTP

Up to 30x performance gains with In-Memory OLTP

Pay for what you need, when you need it

Easily scale up app resources to accommodate growth periods or peak workload demand

Real-time analytics

Get real-time insights and 100x performance gains with real-time operational analytics

Service tier selection overview

Choosing the right service tier/performance level is dependent on:

Feature usage and features available in different service tiers

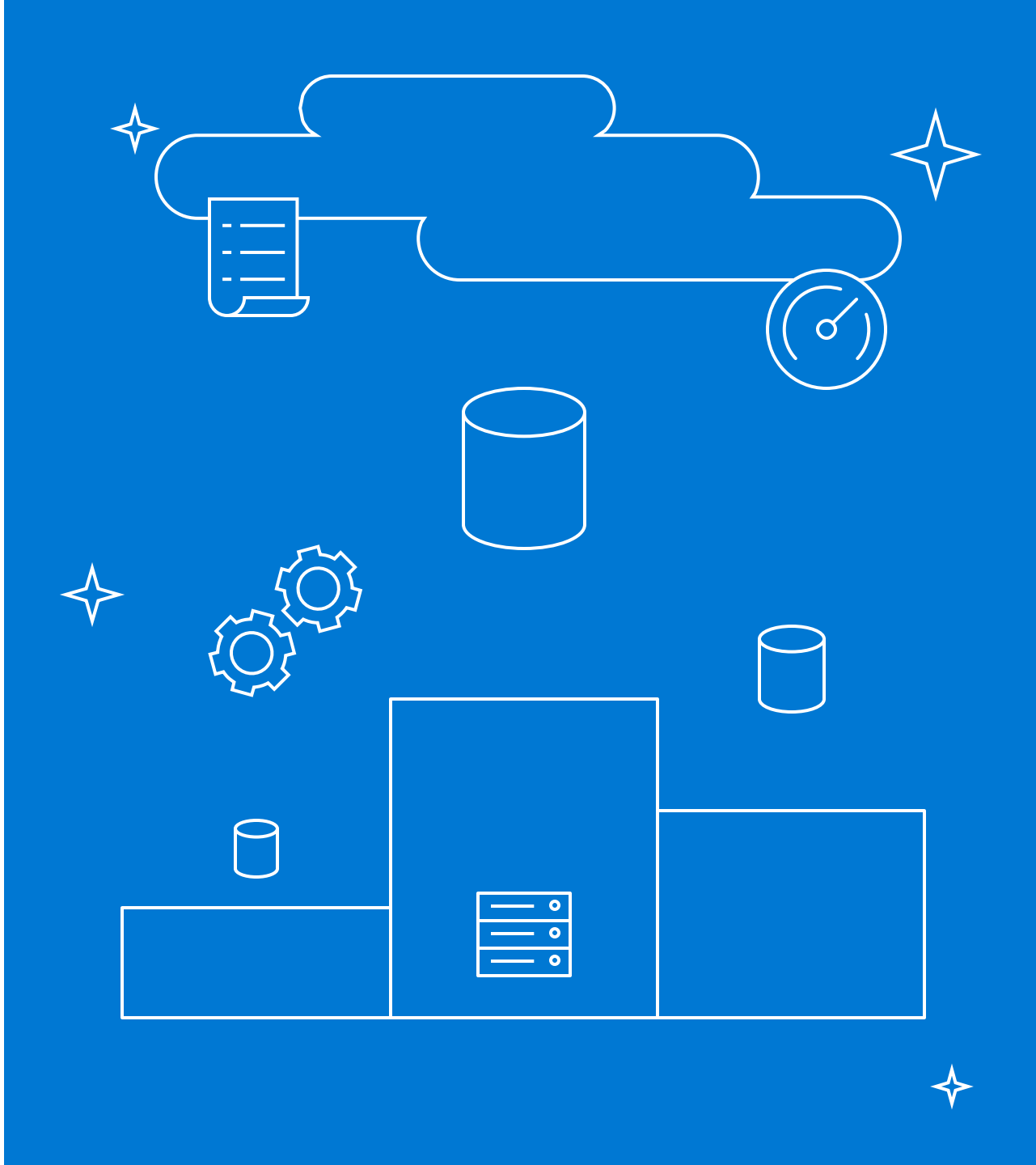
Resource usage and bounding boxes of different performance levels

Selection should take into account:

Minimum database features required

Resource consumption

Database size

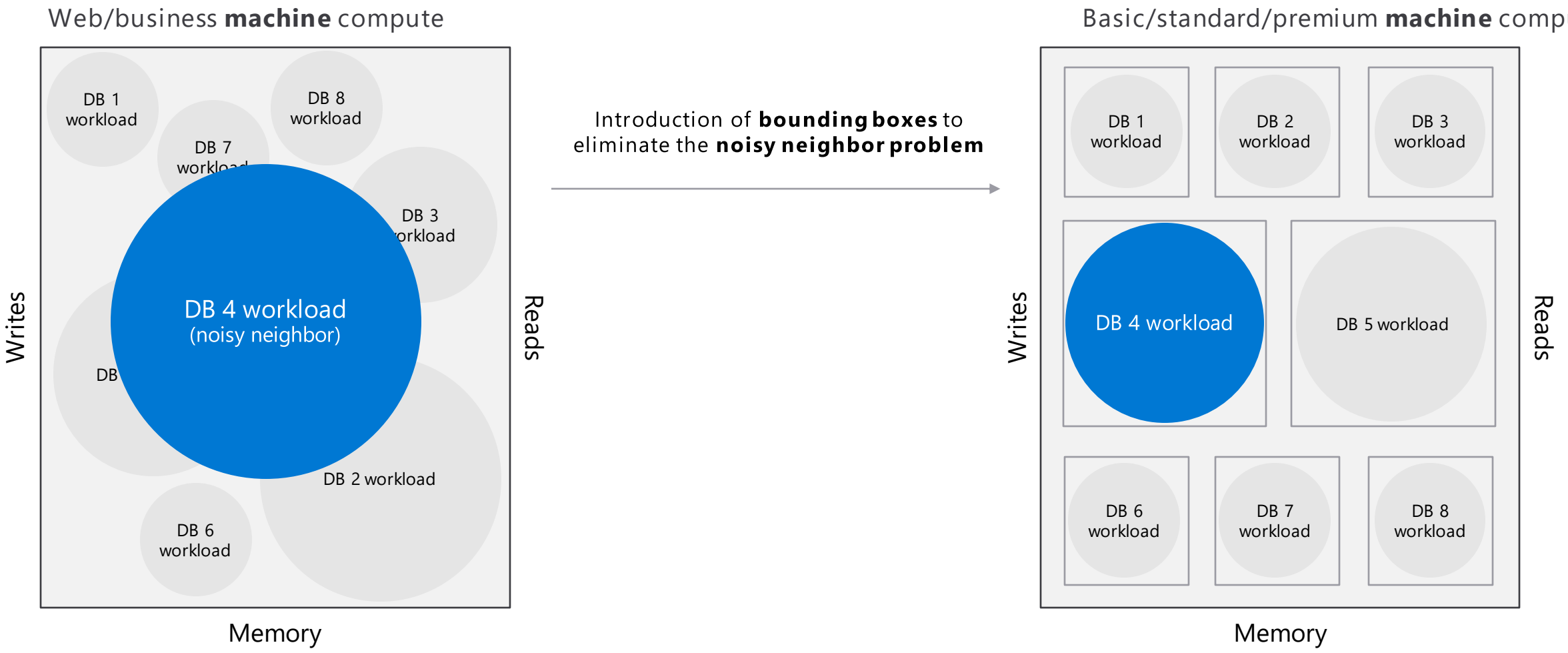


Upgrade to new service tier/performance level

After you determine the appropriate service tier and performance level for your web or business database, you can choose from multiple ways to upgrade your database to the new tier.

Azure Management Portal	On your database dashboard page, click the Pricing tier tab
Azure PowerShell	Use the Set-AzureSqlDatabase cmdlet
Service Management REST API	Use the Update Database command
Transact-SQL	Use the ALTER DATABASE (Transact-SQL) statement

Improved performance predictability



Managing large numbers of databases

Predictable workloads

Single databases or partitioned data across multiple databases

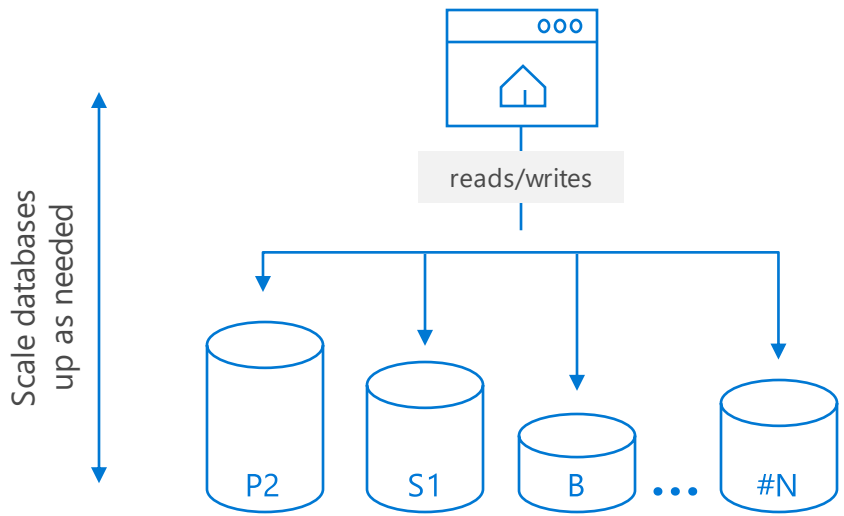
Scale between service tiers and performance levels as capacity needs fluctuate

Unpredictable workloads

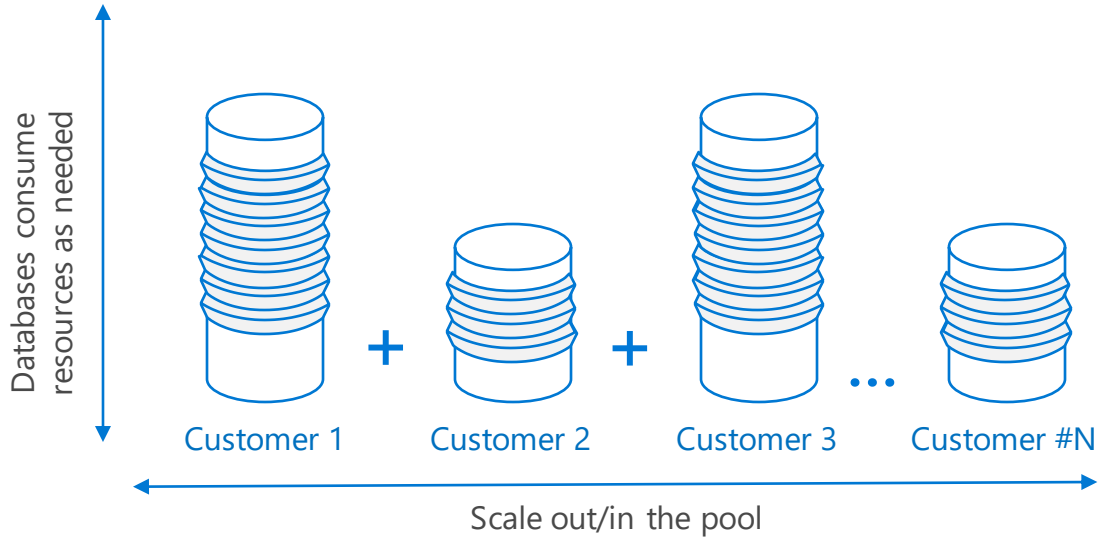
For large numbers of databases with unpredictable performance demands

Pool resources are shared between these databases

Single database or partitioned databases



Elastic Database Pool



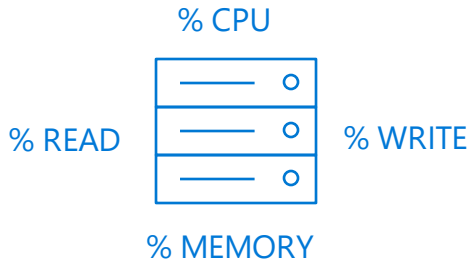
Designed for predictable performance

Redefined

Across the service tiers, each performance level is assigned a defined level of throughput for a streamlined experience

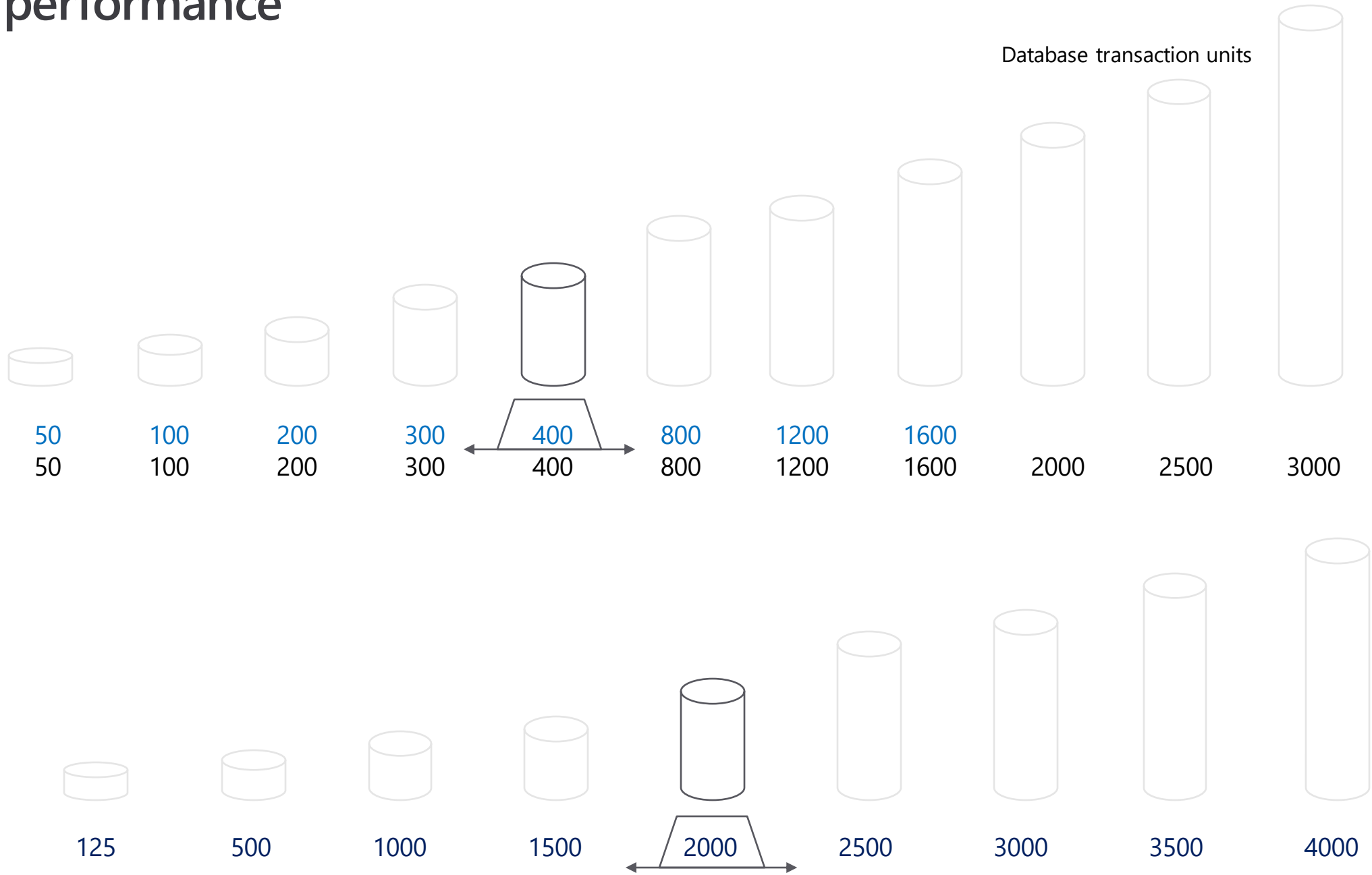
Measure of power

Introducing the Database Transaction Unit (DTU), which represents the relative power of databases based on a real-world measure: **the database transaction**



DTU represents a set of operations that are typical for an online transaction processing (OLTP) request, and then measured by how many transactions could be completed per second under fully loaded conditions

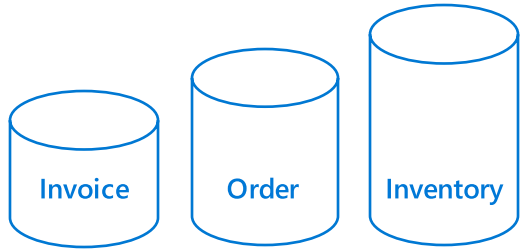
Scale with performance



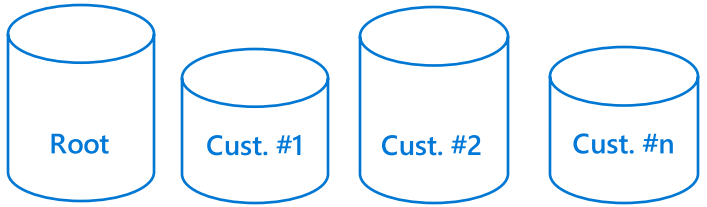
Common database scalability patterns

Single large database

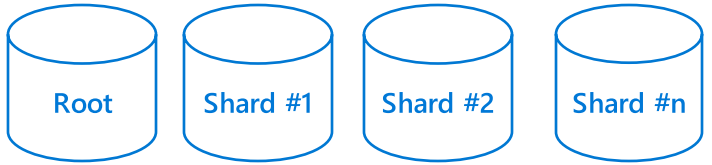
Vertically partitioned



1 tenant: 1 database (SaaS ISV)



Other partitioning scheme



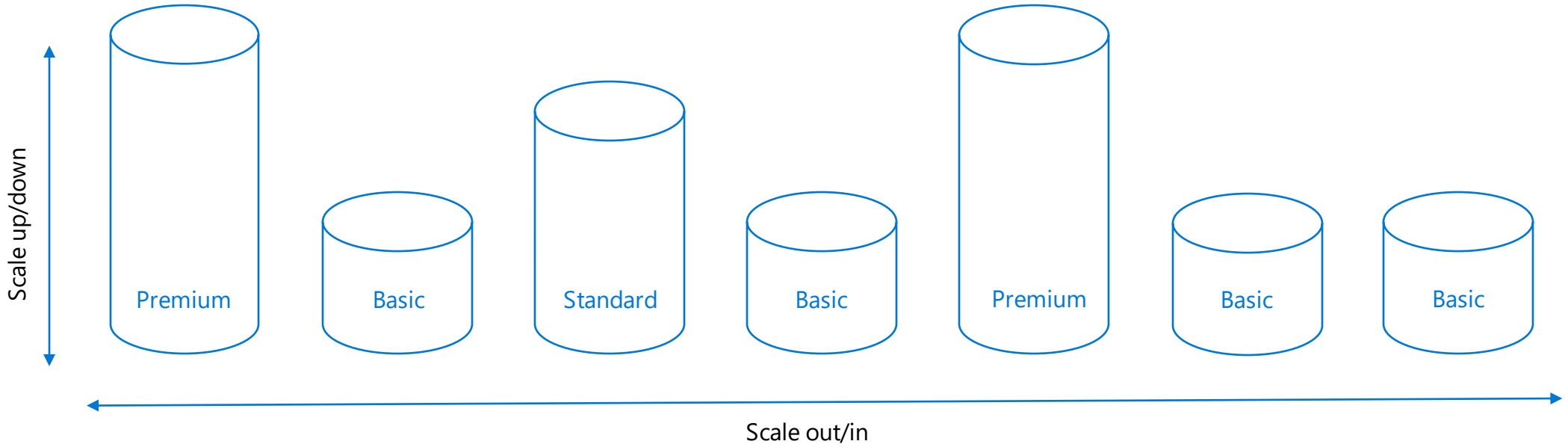
Scalability options in Azure SQL Database

Vertical: scale up or scale down

Change service tiers for a given database as capacity needs fluctuate

Horizontal: scale out or scale in

Add or remove databases (sharded and/or in a pool) as more or less capacity is needed



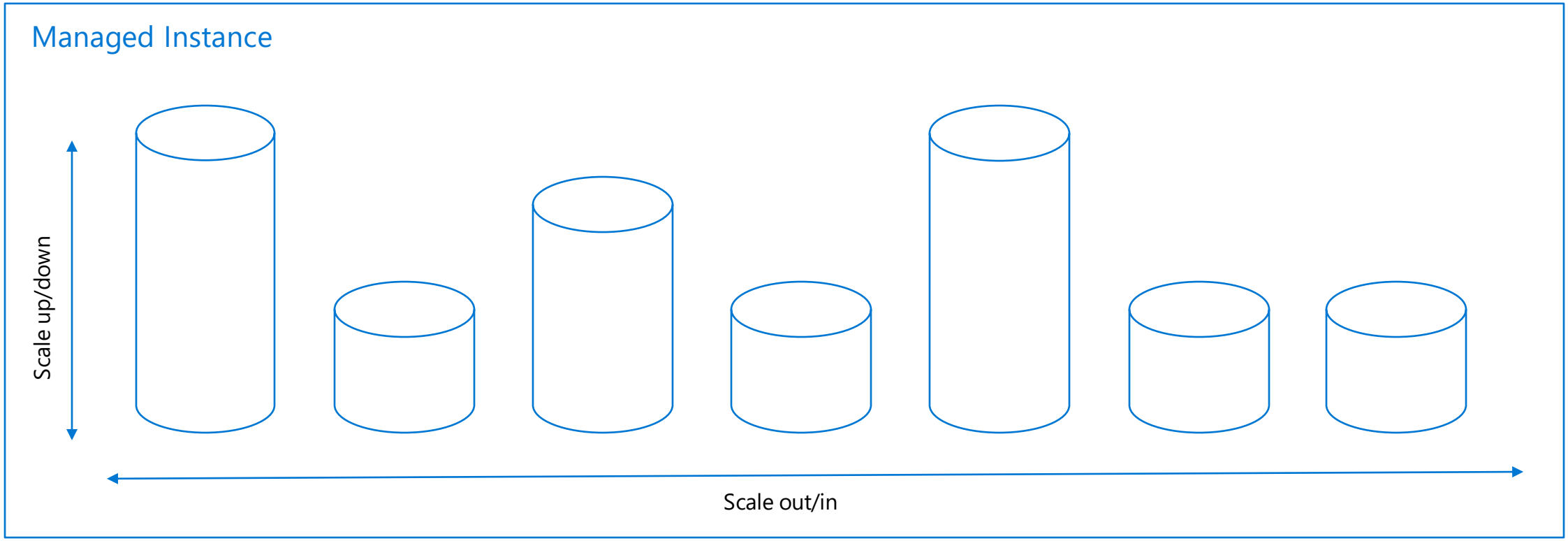
Scalability options for Azure SQL Database Managed Instance

Vertical: scale up or scale down

Change service tiers to provide a larger resource pool for the entire managed instance

Horizontal: scale out or scale in

Add or remove databases and manage performance using resource governor



Resource monitoring

master.sys.resource_stats

Based on 5 minute averages

userdb.sys.dm_db_resource_stats

Based on 15 second averages

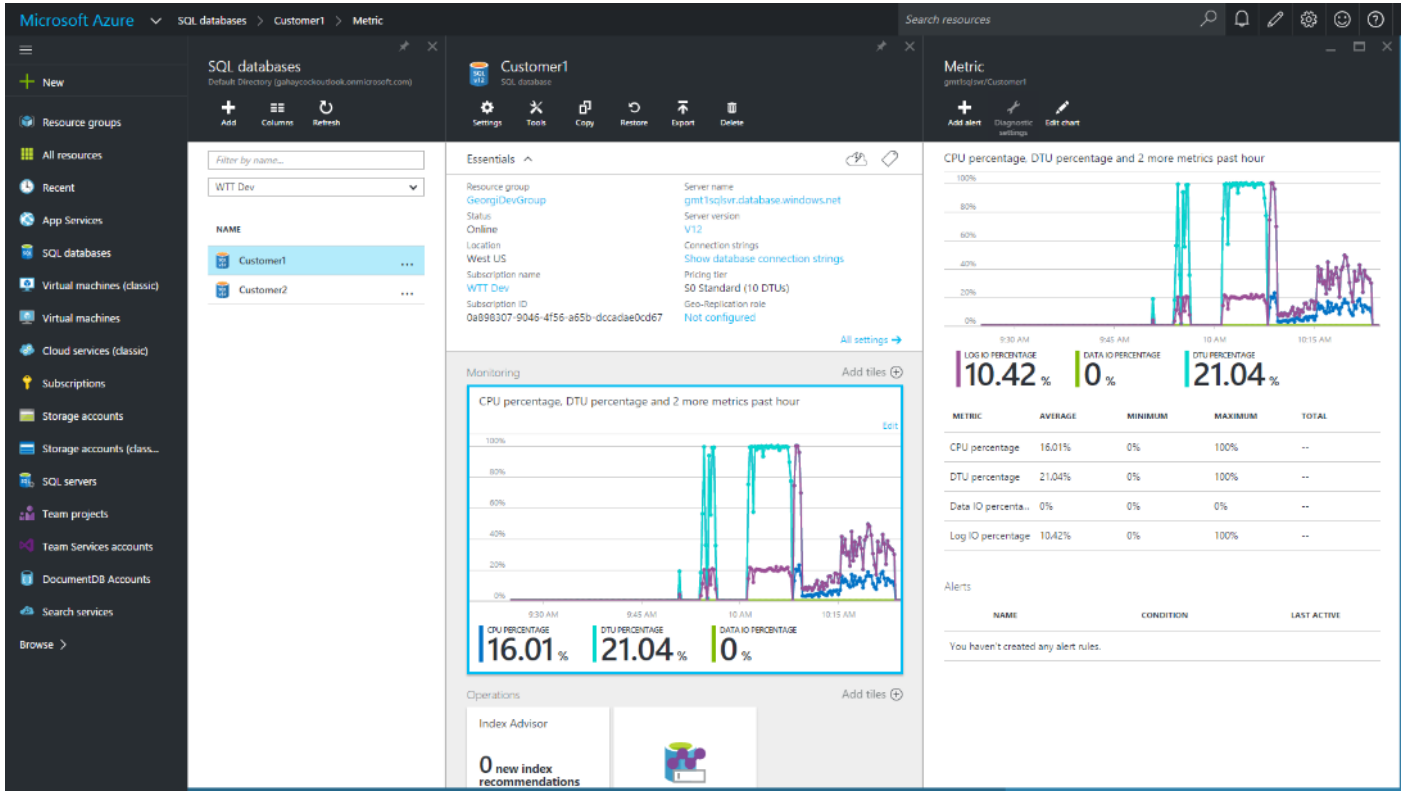
Percentages relative to performance level

Accessible though Azure Portal

Enables configuration of alerting

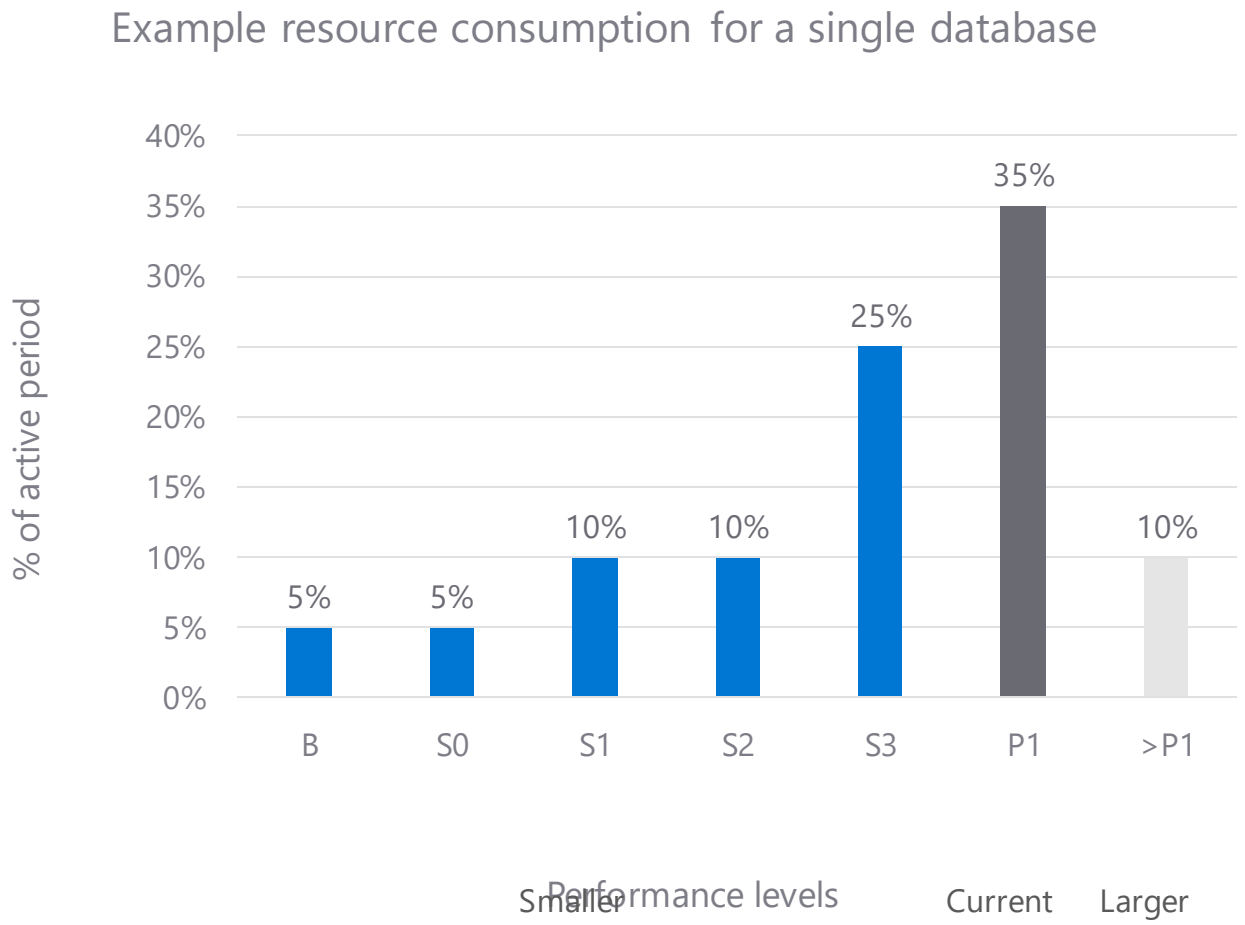
Intelligent Insights

Monitor performance across your entire Azure SQL Database estate



Resource consumption analysis

Resource consumption distribution shows what percentage of an active period the database was consuming resources within the boundaries of different performance levels.



Ensure Business Continuity for your mission critical workloads

Learning Objectives

Point-in-Time Restore
Geo-Replication
Azure Data Sync
Built-in High Availability
Zone Redundancy
Software as a service
Elastic database models
SaaS Patterns

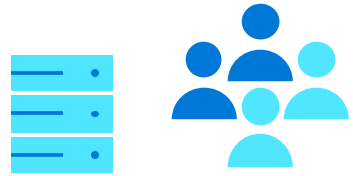
Roles and responsibilities

Azure SQL Database

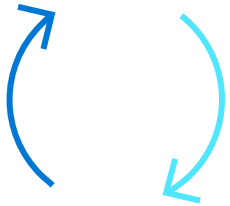
Geo-distributed service
Customer metadata protection and recovery
Transparent high availability and data protection from local platform failures
Automatic geo-distributed backups
Automatic data synchronization of geo-replicated databases
Platform compliance testing and certification
Alert to impacted customers about server degradation during regional failures

Customer (subscription owner)

Detecting user errors and initiating point-in-time restore
Planning, database prioritization, and region selection for disaster recovery
Initiating geo-restore to selected region
Initiating failover of geo-replicated databases
Application disaster recovery drills



Microsoft



You

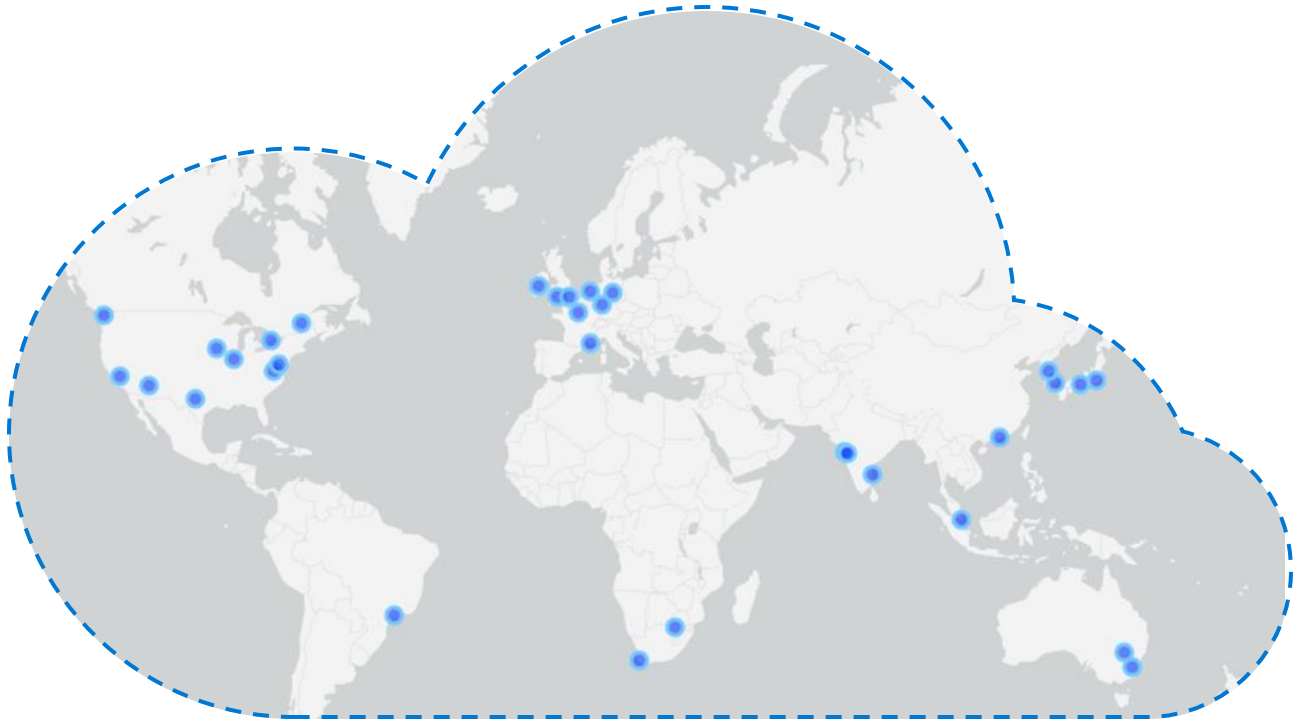
Microsoft-backed for your peace of mind

Peace of mind over your cloud investments

Built-in regional database replicas for additional protection

Uptime SLA of 99.995%*

Single support vendor across Azure cloud services



*Web & Business tiers remain backed by 99.9% uptime SLA.

Long-term data retention

Automatically created with LTR capability in Azure SQL Database

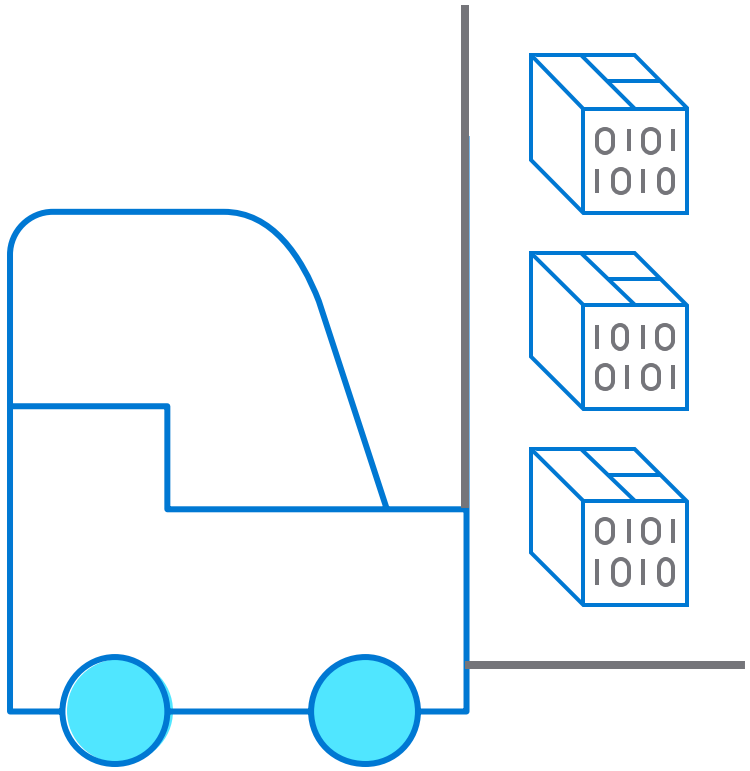
Full database backups

Store backups for up to for up to 10 Years

Read-access geo-redundant storage (RA-GRS)

Export a database

Generate a BACPAC in external storage and hydrate as needed



Point-in-time restore

Automatic backups

Full backups weekly, differential backup daily, log backups every 5 minutes

Daily and weekly backups automatically uploaded to geo-redundant Azure Storage

Self-service restore

Point-in-time up to a second granularity

REST API, PowerShell, or Azure portal

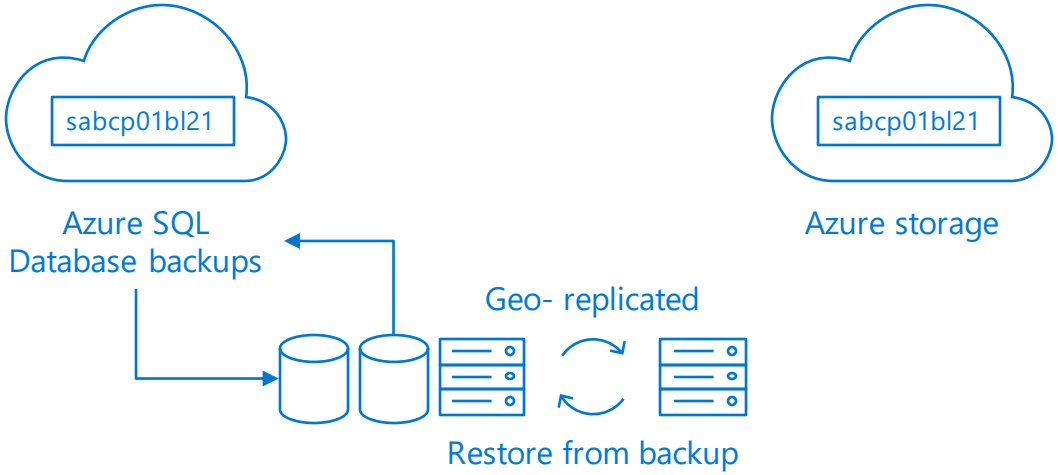
Creates a new database in the same logical server

User-controlled retention policy

7 days default retention in all service tiers

Up to 35 days of additional retention if required at additional cost

Choice of storage tier for data sovereignty



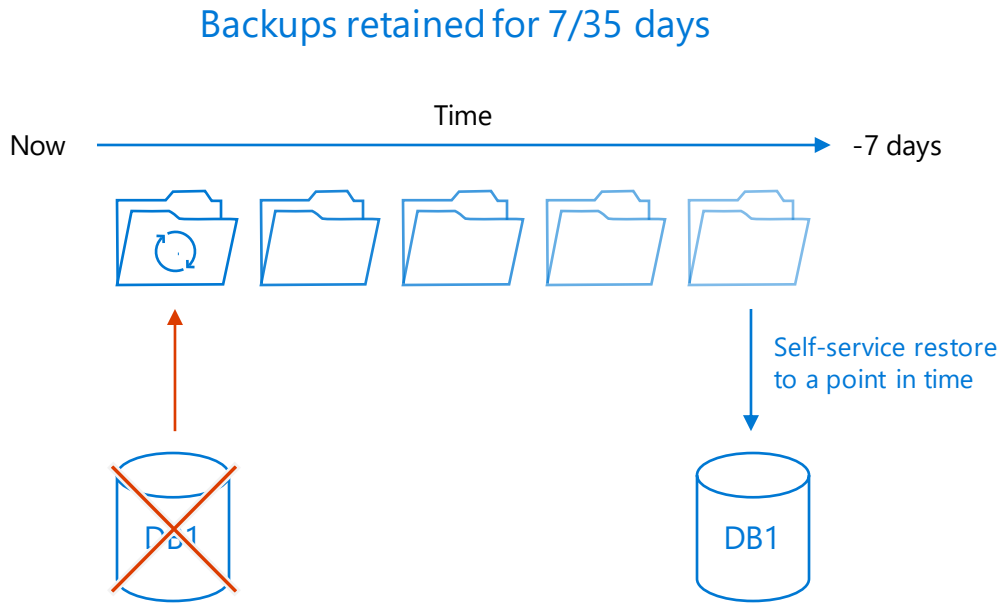
Database recovery

Restoring a deleted database

Restores the database to any point in time within the retention period

Creates a new database on the server used by the original database

You can choose to failover to the restored database or use scripts to recover data



Geo-restore protects from disaster

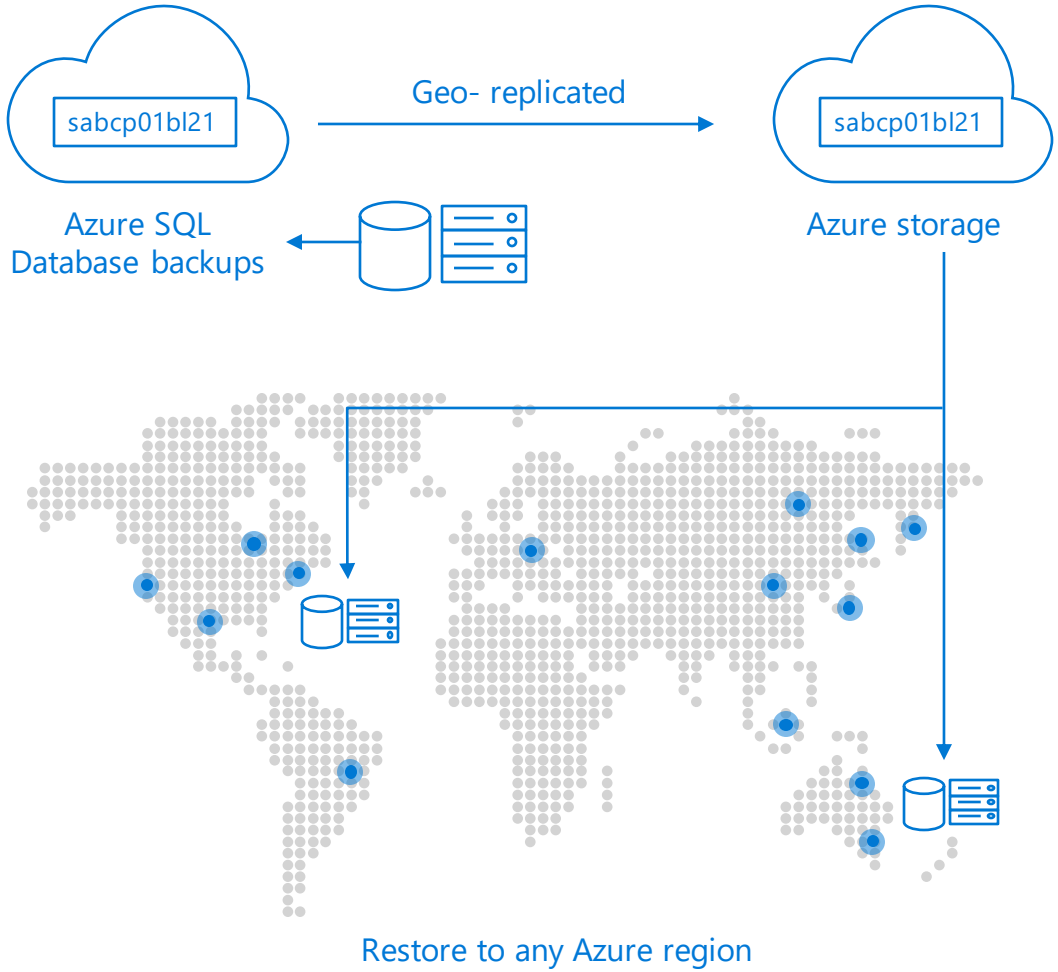
Self-service restore API

Built on geo-redundant Azure Storage

Restores last replicated backup to any Azure region as a new database

No extra cost, no capacity guarantee

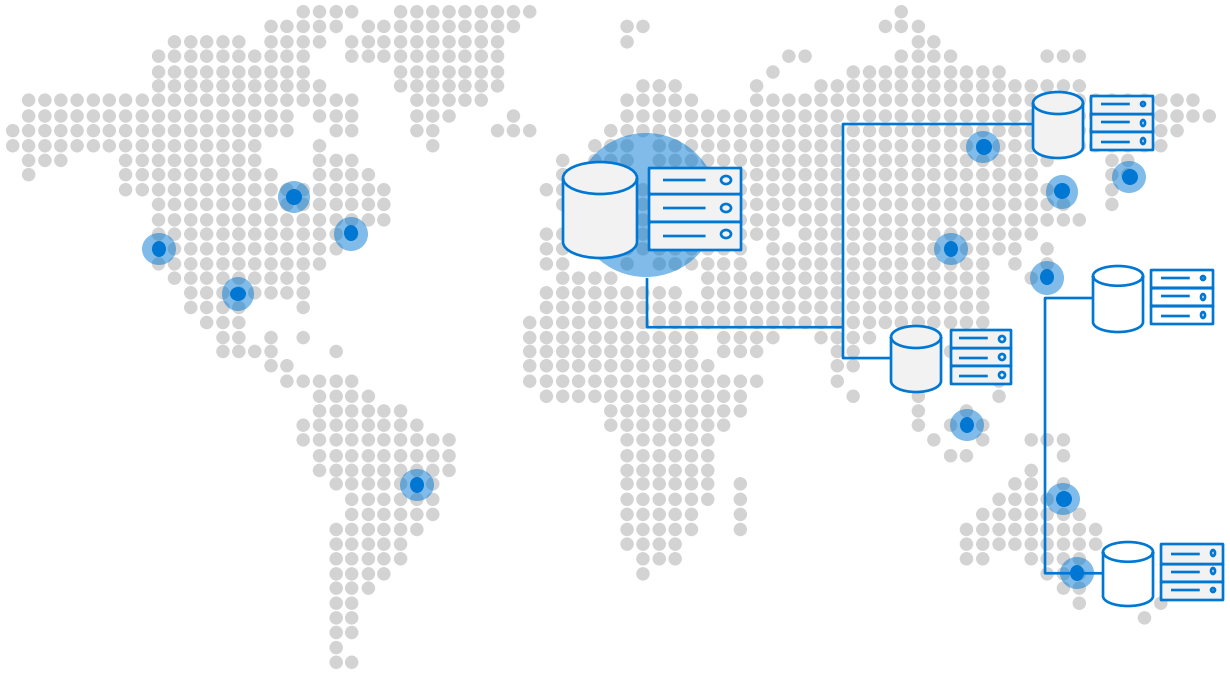
RTO≥24h, RPO=1h



Active geo-replication

Mission-critical business continuity on your terms, via programmatic APIs

Service levels	All
Readable secondaries	Up to 4
Regions available	Any Azure region
Replication	Automatic, asynchronous
Manageability tools	REST API, PowerShell, or Azure Portal
Recovery time objective (RTO)	<30 sec
Recovery point objective	<5sec
Failover	On demand



Up to 4 secondaries

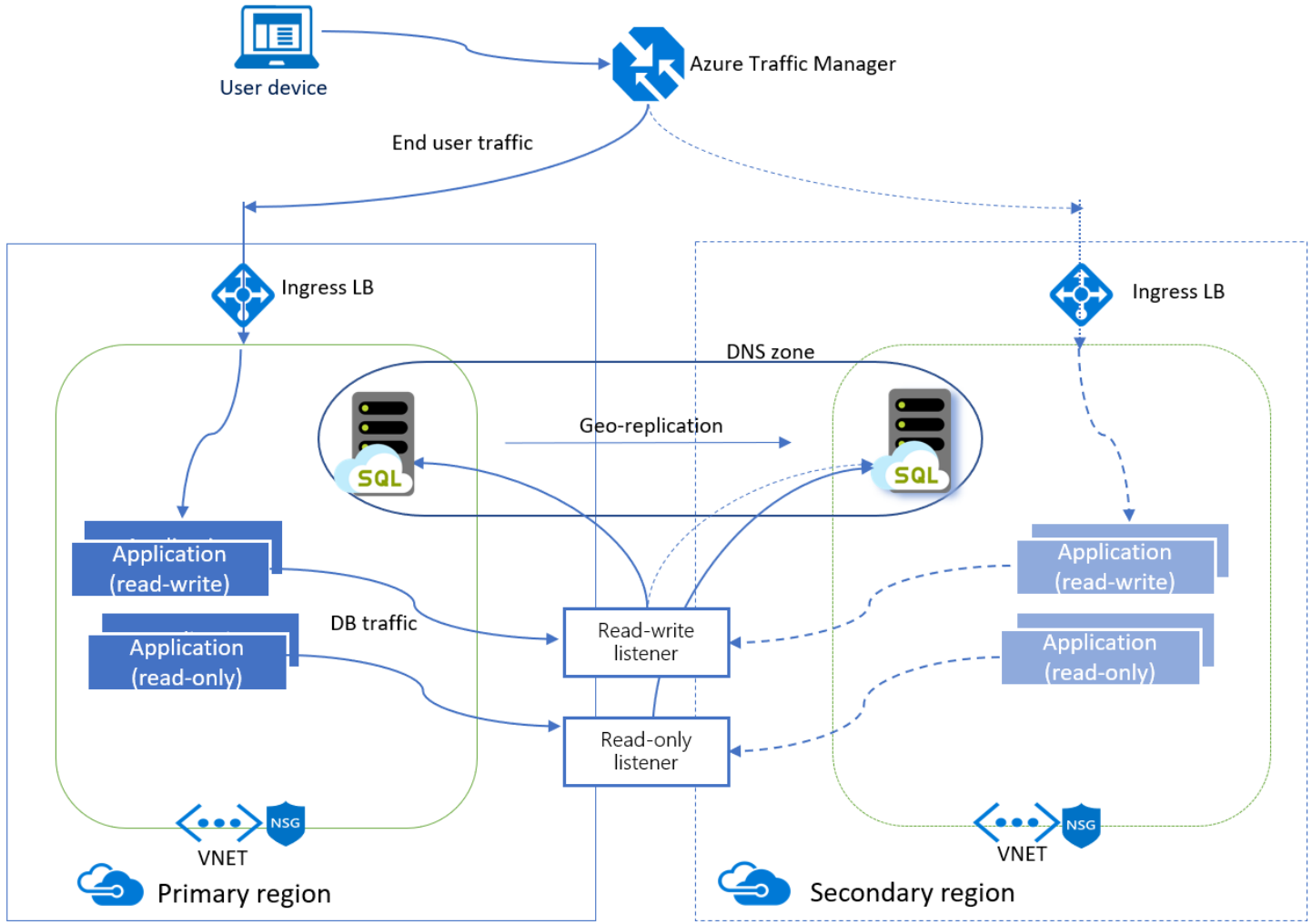
Failover groups with Managed Instance

Enable geo-replication for a group of databases or pools to another region

Automatic or manual failover policy

Read-only and read-write listener endpoints for transparent failover

Available for all service tiers



Automated administration allows you to do your job

Focus on building apps instead of management tasks

Active geo-replication provides the richest business continuity solution with the least risk of data loss and the most rapid recovery time

Extends standard geo-replication with up to four readable secondary databases in the same or different data center locations (regions)

Secondary databases can also be used for load balancing or to provide low-latency access to replicated data anywhere in the world

Automatically manage geo-replication relationship, connectivity, and failover at scale

Available in auto-failover policy or manual activation

SQL Data sync

Bi-directionally synchronizes data across multiple SQL databases and SQL Server instances

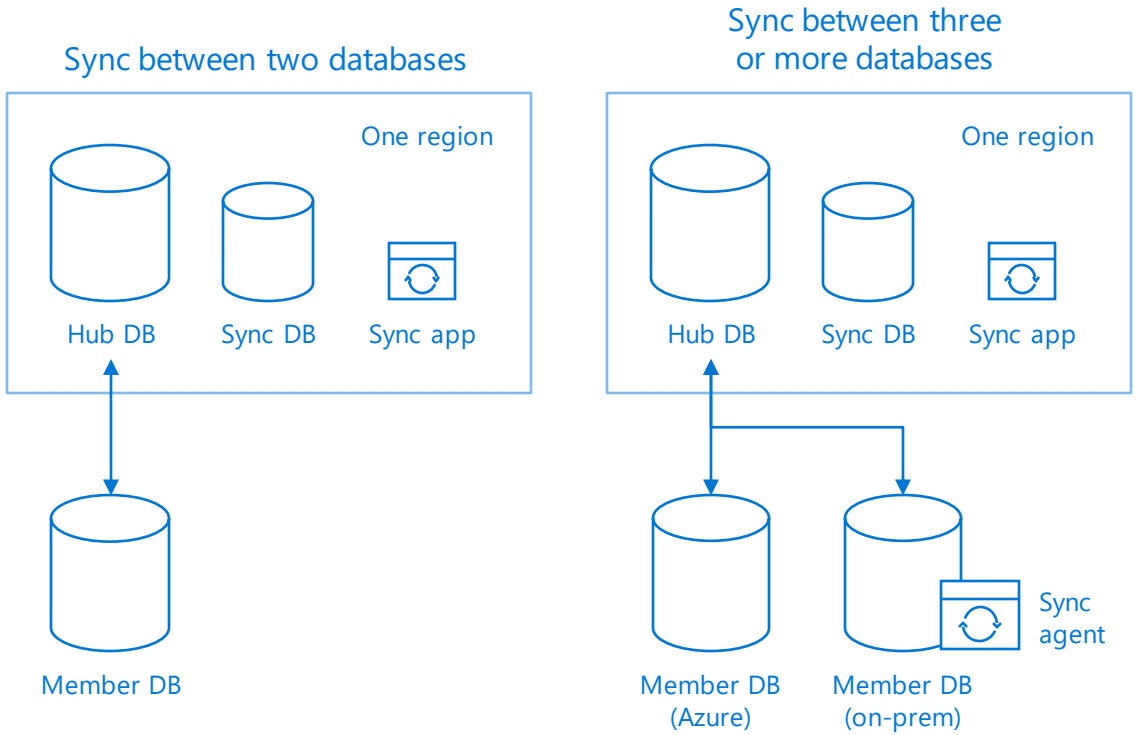
Sync occurs between the defined Hub database and individual member databases

Use cases:

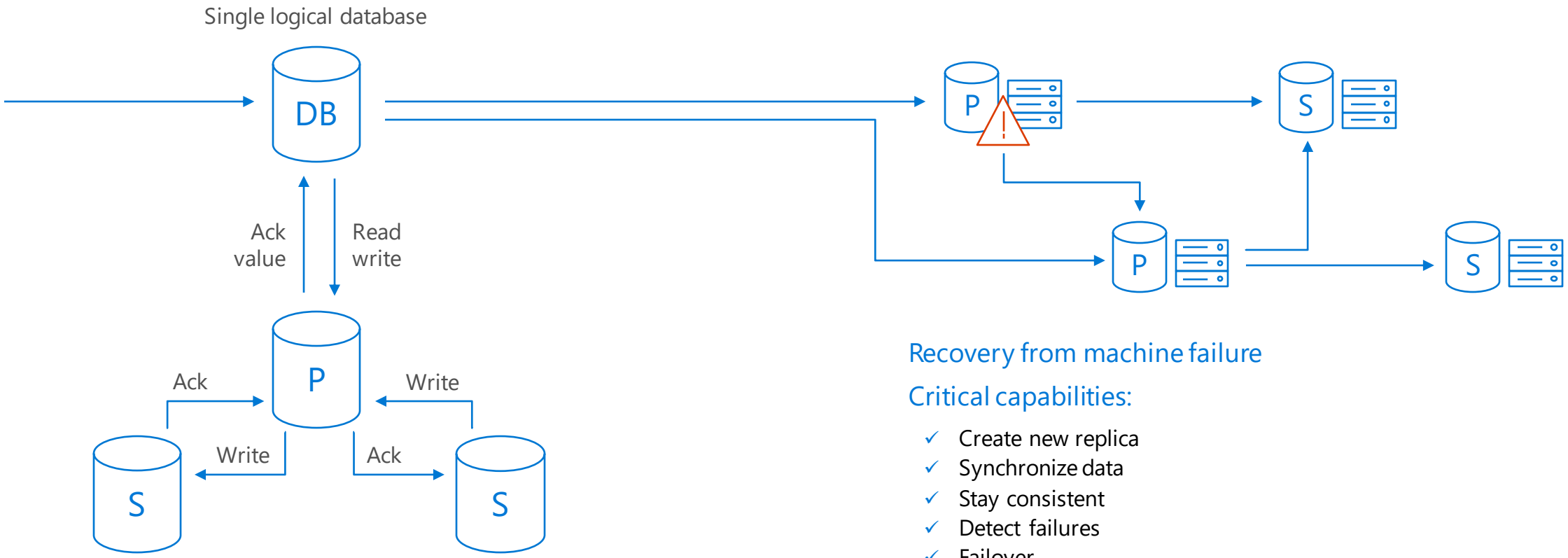
Distributed Applications

Globally Distributed Applications

Hybrid Data Synchronization



High-availability platform



Reads are completed at the primary

Writes are replicated to secondaries

Recovery from machine failure

Critical capabilities:

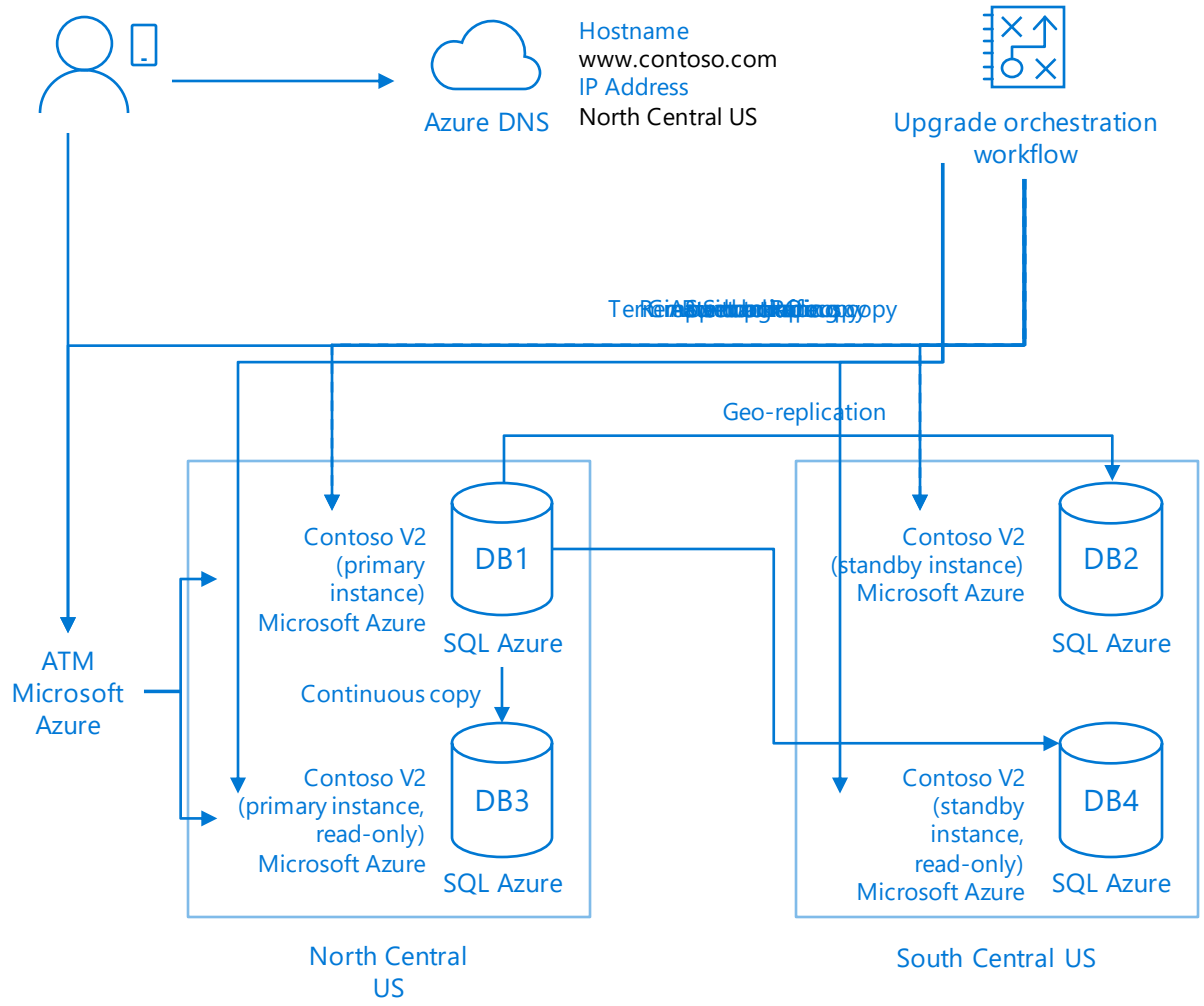
- ✓ Create new replica
- ✓ Synchronize data
- ✓ Stay consistent
- ✓ Detect failures
- ✓ Failover
- ✓ 99.99% availability

Online service upgrade

Both main copy and backup copy are protected at all times

No data loss during the upgrade process

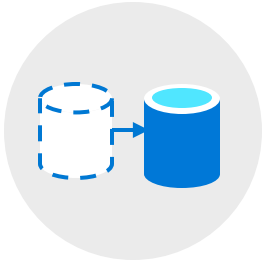
The read-only period depends on the duration of the database upgrade



Self-managed

Built-in maintenance

Remove virtually all infrastructure maintenance with Azure SQL Database, which provides automatic software patching as part of the service.

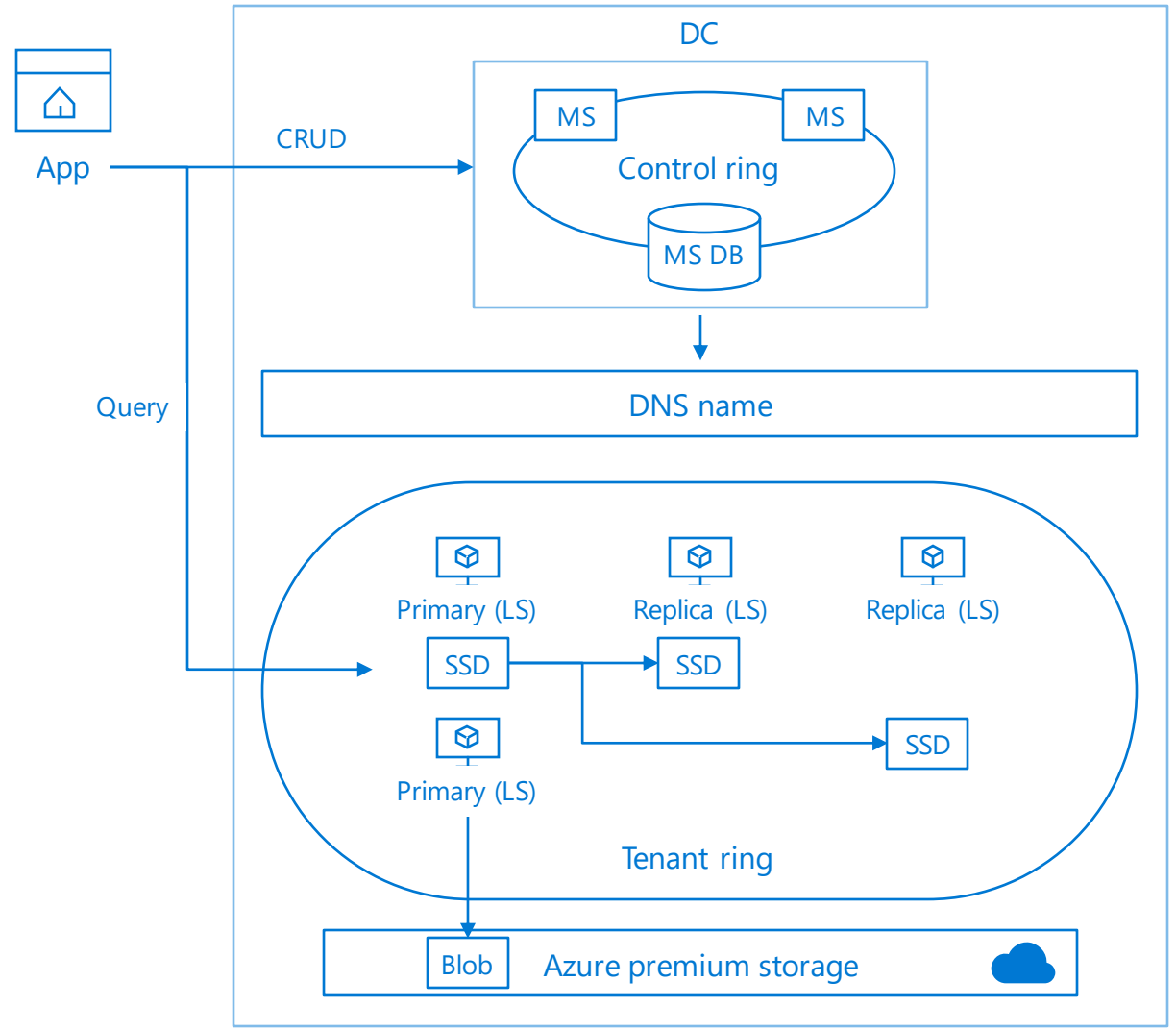


Fault tolerance

Built-in system replicas help deliver inherent data protection and database uptime. System replicas are automatically moved to new machines as old machines fail.

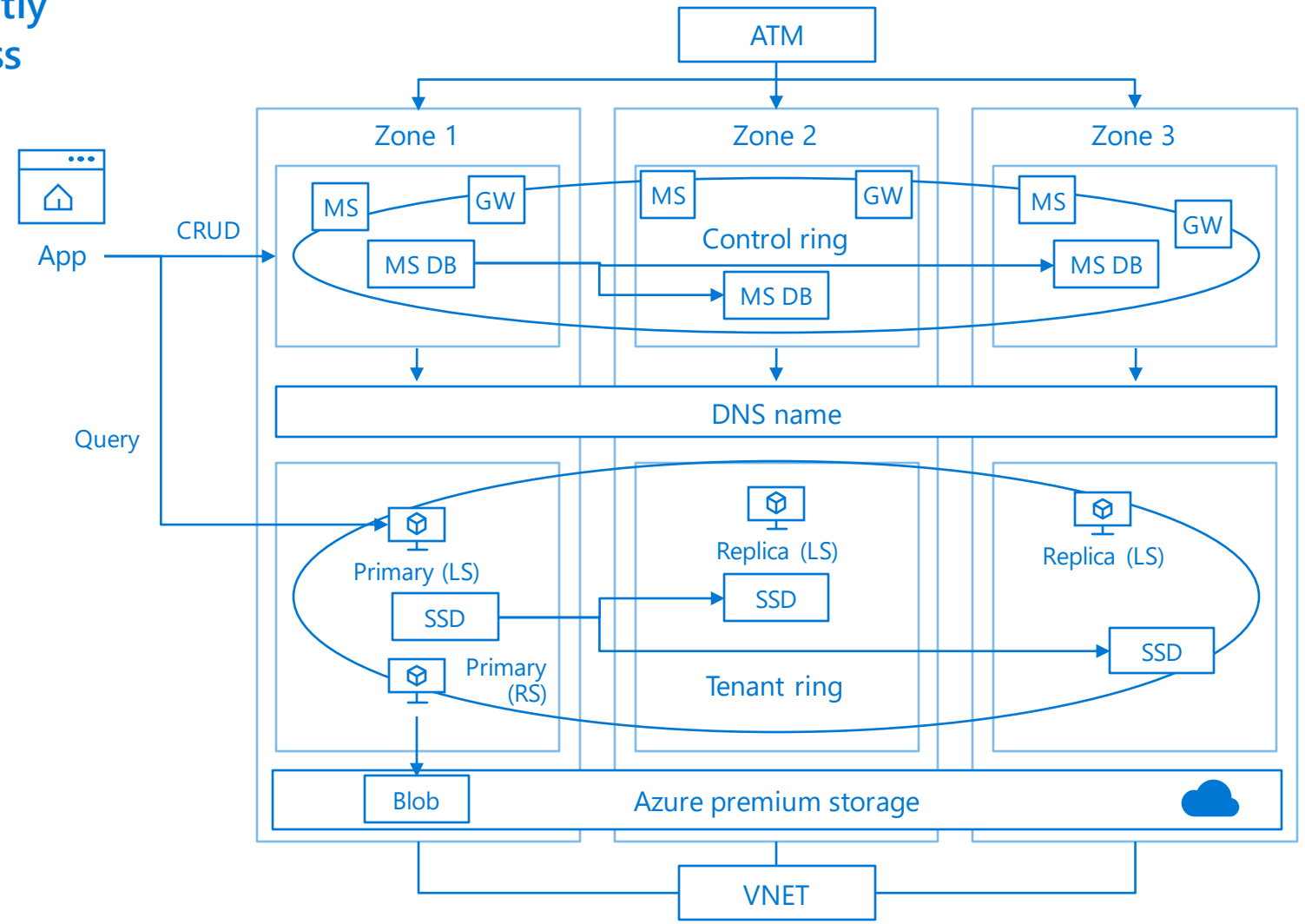
HA architecture for remote storage configurations

Remote storage configurations are used for Basic, Standard or General Purpose tiers



HA architecture for Zone redundant configuration

Zone redundant configurations are currently only supported in the Premium or Business Critical tiers



Software as a service (SaaS)

Central directory (catalog) stores customer profiles

One database per end customer (tenant)

Often for security and isolation

Some rely on schema customization

Data-dependent routing is a common data-access path

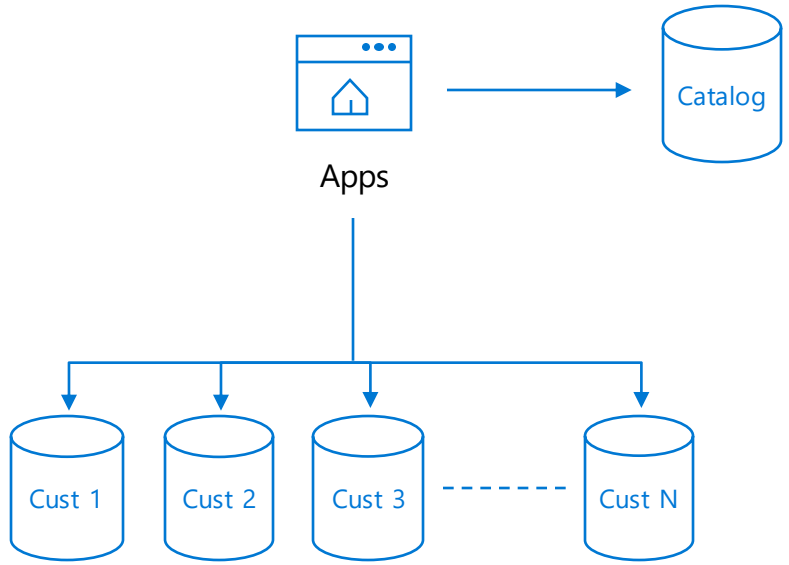
Highly selective key-lookup queries, multi-joins, and more

Mid to low data-entry rate

No need for cross-customer (fan-out) queries

Most tenants are small and "cold," and some might have hot spots

Optimize cost of goods sold (COGS) by picking the right service tier for the customer (mostly basic)

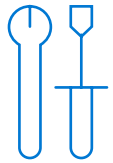


Elastic databases at a glance

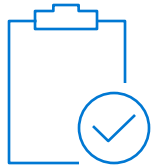
Manage and monitor multi-tenant apps with the isolation benefits of one customer per database

Free yourself from the administration overhead of designing, buying, building, and managing each customer's environment

Elastic database pools and elastic database pricing model



Elastic database tools: client library and split-merge service



Elastic database job

Elastic database queries (preview) and transactions

Manage and scale multiple databases

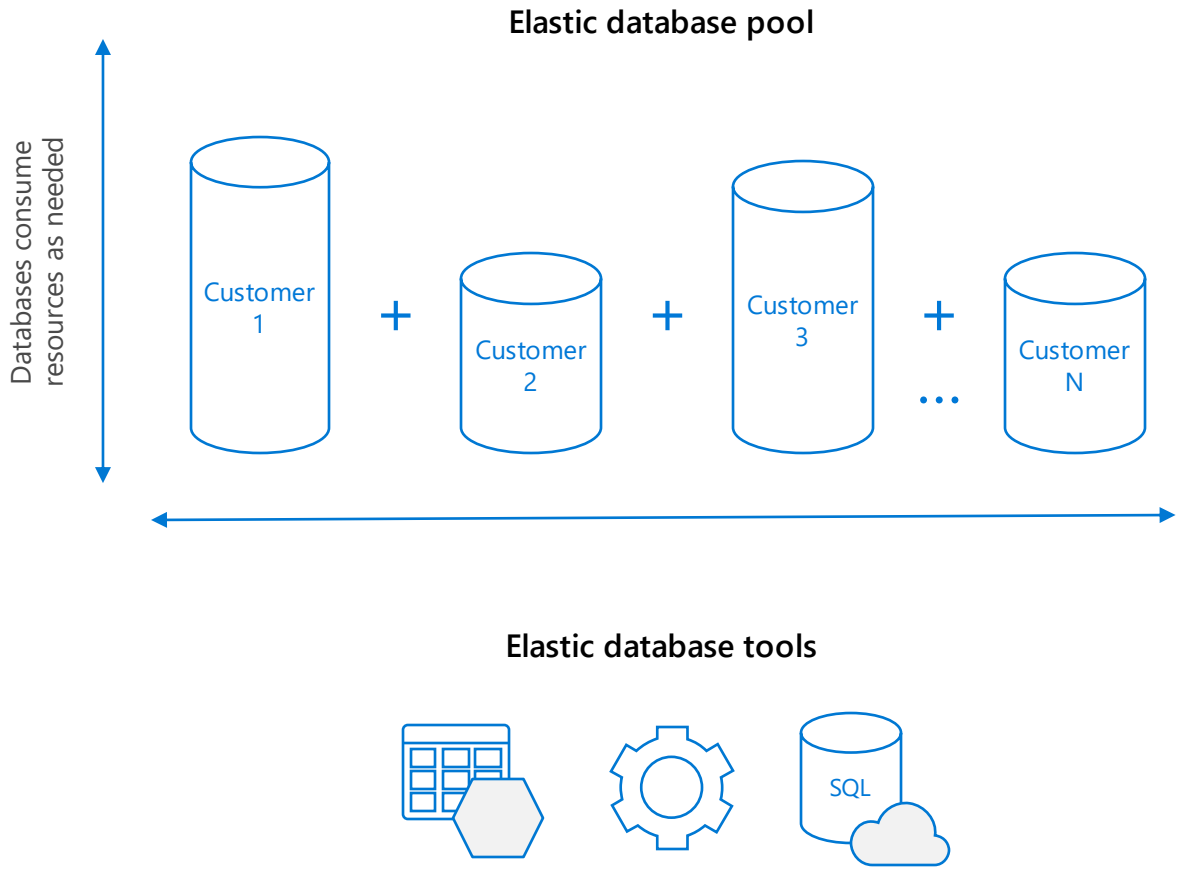
An elastic database pool is a collection of resources and storage that are used by multiple databases

Elastic database jobs allow you to perform tasks across databases in the pool, including:

Performing administrative tasks, such as deploying new schemas

Updating reference data, such as making product information common across all databases

Rebuilding indexes to improve query performance



Build secure apps

Flexibility to work your way

Platforms

Develop with your choice of popular platforms including Windows, Linux, and Mac

Tools

Use Azure Management Portal with HTML5 support, PowerShell, REST APIs, SQL Server Management Studio, Azure Data Studio and Visual Studio

Languages

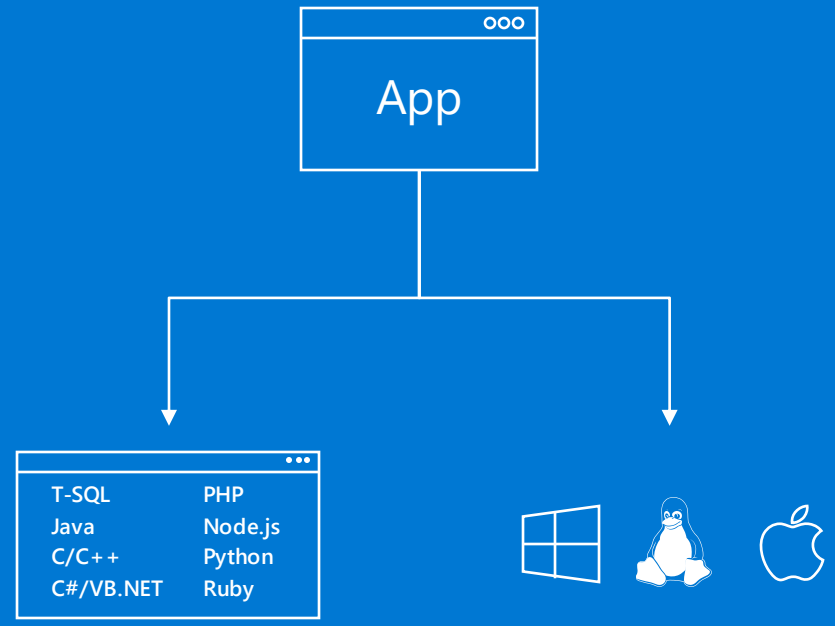
Develop with a choice of popular languages, such as C#, Java, Node.js, Ruby, PHP, and Python

Frameworks

Leverage popular frameworks including Entity, Hibernate ORM, Ruby on Rails, and Django

Your Azure solution

Build secure apps that connect with the languages and platforms you prefer



Programmatic capabilities

Platforms

Develop with a choice of popular platforms and technologies, including .NET, Java, PHP, Ruby on Rails, and Node.js

JSON support

Query JSON using standard T-SQL syntax; use JSON with all components of Azure SQL Database, such as In-Memory OLTP

Temporal tables

Keep a full history of all changes made to table; use for easy point-in-time restore or calculate trends over time

T-SQL editor

Use the HTML5-based T-SQL editor in Azure Management Portal

JSON Support in Azure SQL Database

Easily work with JSON data and integrate your database with modern services

Built-in functions
ISJSON, JSON_VALUE,
JSON_MODIFY, JSON_QUERY

```
[
  {
    "Number":"SO43659",
    "Date":"2011-05-31T00:00:00"
    "AccountNumber":"AW29825",
    "Price":59.99,
    "Quantity":1
  }
  {
    "Number":"SO43661",
    "Date":"2011-06-01T00:00:00"
    "AccountNumber":"AW73565",
    "Price":24.99
    "Quantity":3
  }
]
```

OPENJSON
Transforms JSON text to table

FOR JSON
Formats result set as JSON text

Number	Date	Customer	Price	Quantity
SO43659	2011-05-31 T00:00:00	MSFT	59.99	1
SO43661	2011-06-01 T00:00:00	Nokia	24.99	3

Formatting data as JSON

Format your database content as JSON directly
in a SQL query

```
SELECT CustomerName, PhoneNumber, FaxNumber
FROM Sales.Customers
FOR JSON PATH
[
{
"CustomerName":"Eric Torres",
"PhoneNumber":"(307) 555-0100",
"FaxNumber":"(307) 555-0101“
},
{
"CustomerName":"Cosmina Vlad",
"PhoneNumber":"(505) 555-0100",
"FaxNumber":"(505) 555-0101“
},
{
"CustomerName":"Bala Dixit“
,"PhoneNumber":"(209) 555-0100",
"FaxNumber":"(209) 555-0101“
}
]
```

Querying JSON data

JSON functions let you use JSON data in any SQL query

Id	Data
1	{"Price":50, "Color":"White", "tags":["toy","children","games"]}

```
SELECT Id, JSON_VALUE(Data, '$.Color'),
JSON_QUERY(Data, '$.tags')
FROM Products
WHERE JSON_VALUE(Data, '$.Color') = 'White'
```

1	White	["toy","children","games"]

Modifying JSON data

JSON functions let you use JSON data in any SQL query

Id	Data
1	{"Price":50, "Color":"White", "tags":["toy","children","games"]}

```
UPDATE Products
SET Data = JSON_MODIFY(Data, '$.Price', 60)
WHERE Id = 1
```

Id	Data
1	{"Price":**60**, "Color":"White", "tags":["toy","children","games"]}

Temporal Tables

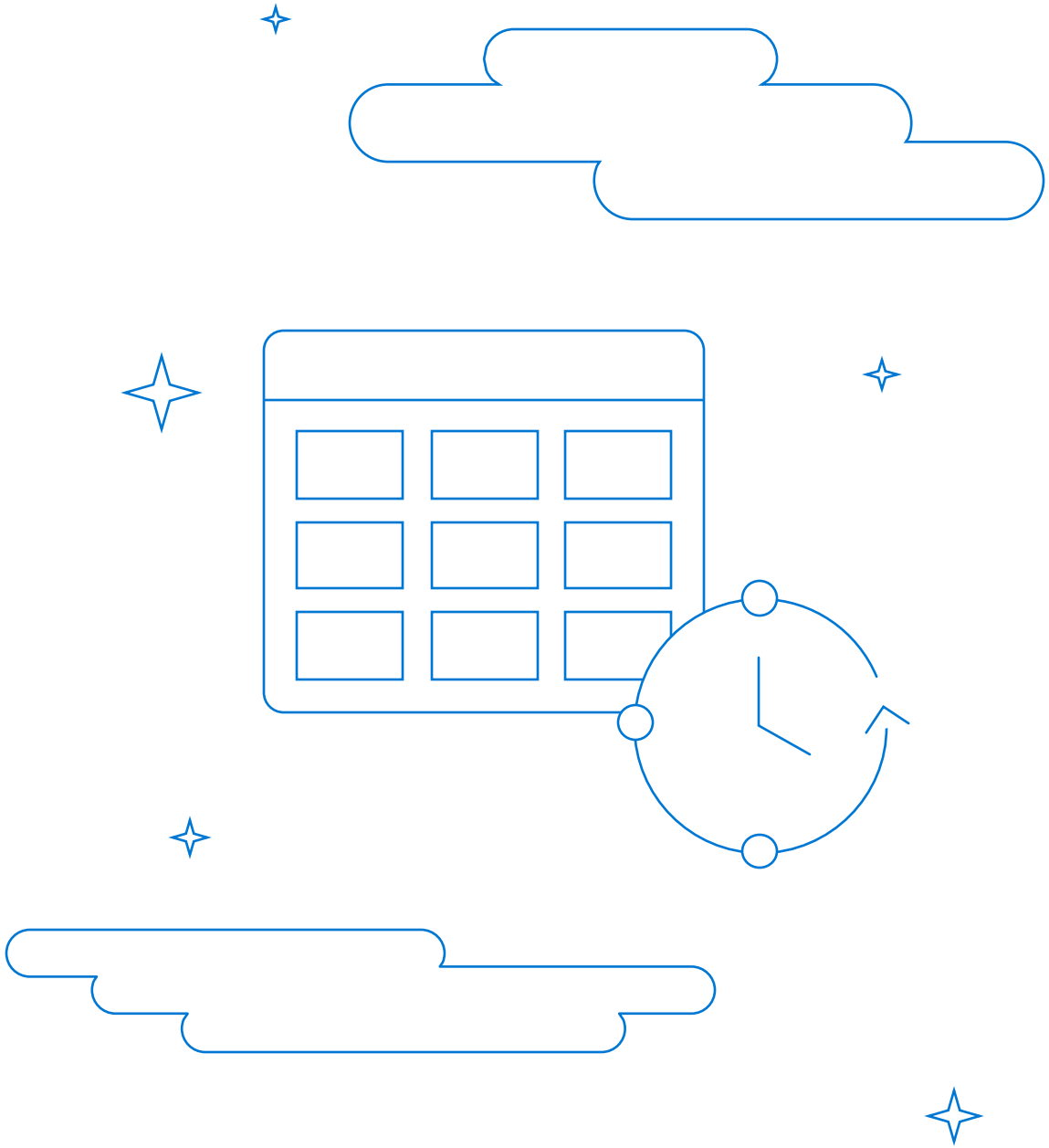
Track and analyze the history of changes in data with no custom coding

Audit data changes

Reconstruct state of data stored in the table at any point in time

Calculate trends over time

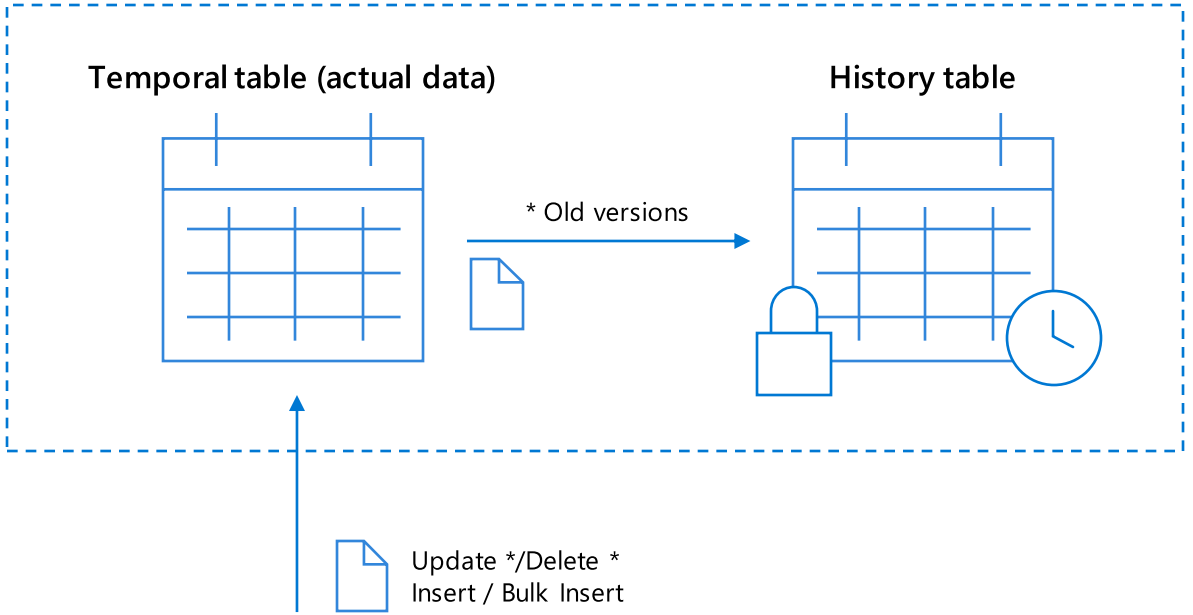
Maintain a slowly changing dimension for decision support applications



Reveal historical data with temporal tables

Implemented as a pair of tables—one current, one historical

The history table cannot have data inserted or deleted from it directly and its schema cannot be directly modified



Creating a temporal table

Temporal Tables can be created with your preferred tool

SQL Server Management Studio

SQL Server Data Tools

T-SQL

```
CREATE TABLE WebsiteUserInfo
(
    [UserID] int NOT NULL PRIMARY KEY CLUSTERED
  , [UserName] nvarchar(100) NOT NULL
  , [PagesVisited] int NOT NULL
  , [ValidFrom] datetime2 (0) GENERATED ALWAYS AS ROW START
  , [ValidTo] datetime2 (0) GENERATED ALWAYS AS ROW END
  , PERIOD FOR SYSTEM_TIME (ValidFrom, ValidTo)
 )
 WITH (SYSTEM_VERSIONING = ON (HISTORY_TABLE =
dbo.WebsiteUserInfoHistory));
```

Reading from the history table

There are many ways to read data from the history table

Example) To see the top 10 users ordered by the number of visited web pages as of an hour ago:

Use the AS OF clause

```
DECLARE @hourAgo datetime2 = DATEADD(HOUR, -1, SYSUTCDATETIME());
SELECT TOP 10 *
FROM dbo.WebsiteUserInfo
FOR SYSTEM_TIME AS OF @hourAgo
ORDER BY PagesVisited DESC
```

Reading from the history table

Example) To perform basic statistical analysis for the previous day:

Use the BETWEEN … AND … clause

```
DECLARE @twoDaysAgo datetime2 = DATEADD(DAY, -2, SYSUTCDATETIME());
DECLARE @aDayAgo datetime2 = DATEADD(DAY, -1, SYSUTCDATETIME());
SELECT    UserID,
          SUM (PagesVisited) as TotalVisitedPages,
          AVG (PagesVisited) as AverageVisitedPages,
          MAX (PagesVisited) AS MaxVisitedPages,
          MIN (PagesVisited) AS MinVisitedPages,
          STDEV (PagesVisited) as StDevVisitedPages
FROM dbo.WebsiteUserInfo
FOR SYSTEM_TIME BETWEEN @twoDaysAgo AND @aDayAgo
GROUP BY UserId
```

Setting Retention history

Temporal Tables may increase database size more than regular tables, particularly if:

- You retain historical data for a long period of time
- You have an update or delete heavy data modification pattern

Developing a data retention policy for managing data in the history table is an important aspect of planning and managing the lifecycle of every temporal table

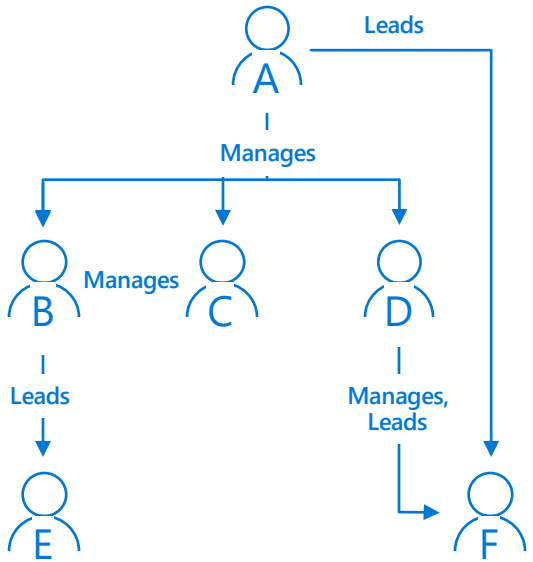
Ensure retention policy is enabled at the database level

```
ALTER DATABASE <myDB>
SET TEMPORAL_HISTORY_RETENTION ON
```

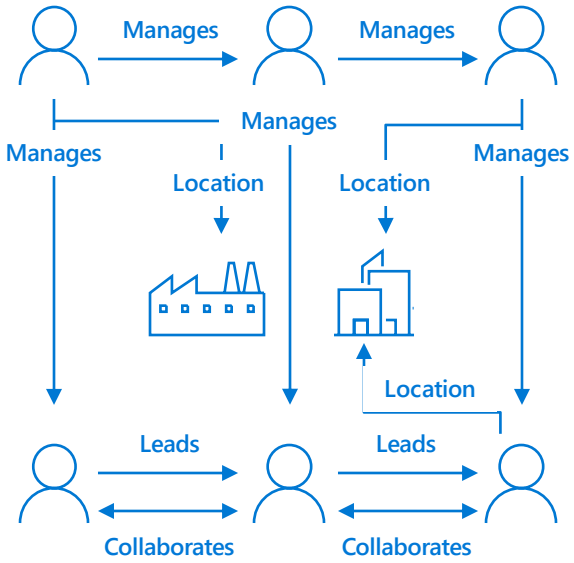
Retention policy can be set when the table is created or can be defined or altered after table creation

```
ALTER TABLE dbo.WebsiteUserInfo
SET (SYSTEM_VERSIONING = ON (HISTORY_RETENTION_PERIOD = 9 MONTHS));
```

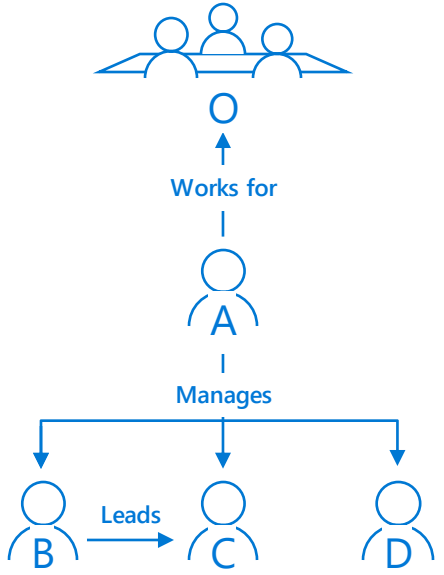
Graph Database use cases



Uncover interconnected or hierarchical data entities with multiple parents



Organically grow many-to-many relationships as the business evolves



Analyze interconnected data relationships, and identify non-obvious connections

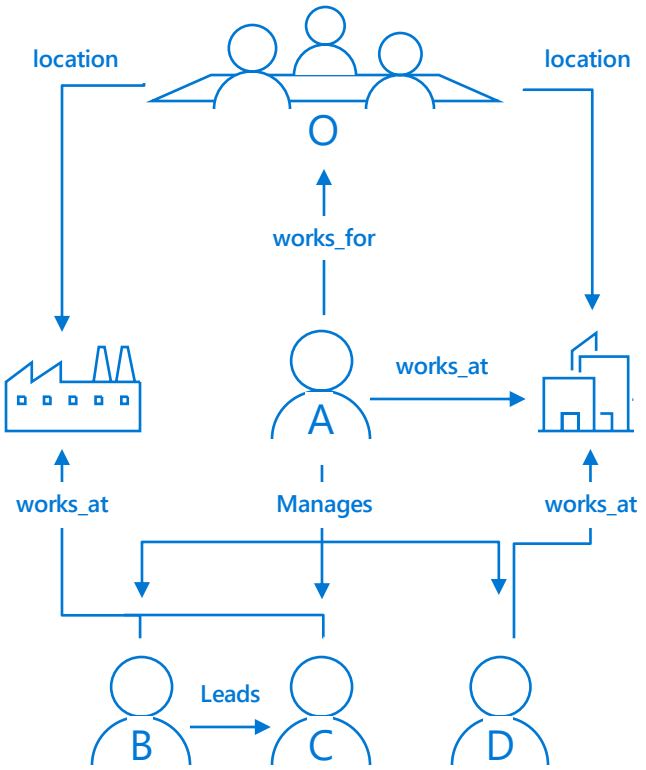
SQL Graph

Graph objects

Create nodes and edges

Properties associated with nodes and edges

```
CREATE TABLE Person (ID INTEGER PRIMARY KEY,
name VARCHAR(100)) AS NODE;

CREATE TABLE Organization (ID INTEGER PRIMARY KEY,
name VARCHAR(100)) AS NODE;

CREATE TABLE Manages AS EDGE;

CREATE TABLE works_for (StartDate date) AS EDGE;
```



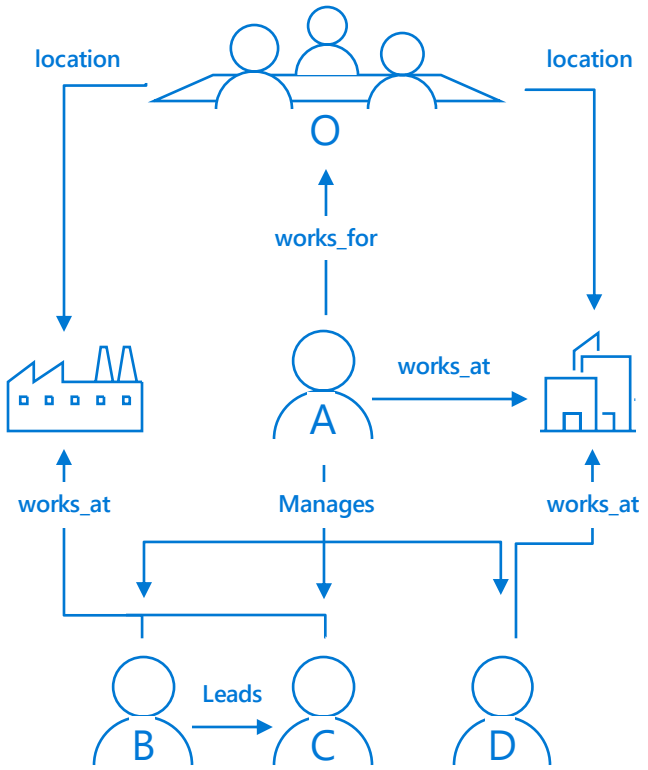
SQL Graph

Graph objects

Query language extension

Multi-hop navigation and join-free pattern matching

```
SELECT person2.name
  FROM Person person1,
       Manages,
       Person person2,
       works_at,
       location
 WHERE MATCH(person1-(Manages)->person2-(works_at)->location)
   AND person1.name = 'Alice'
```



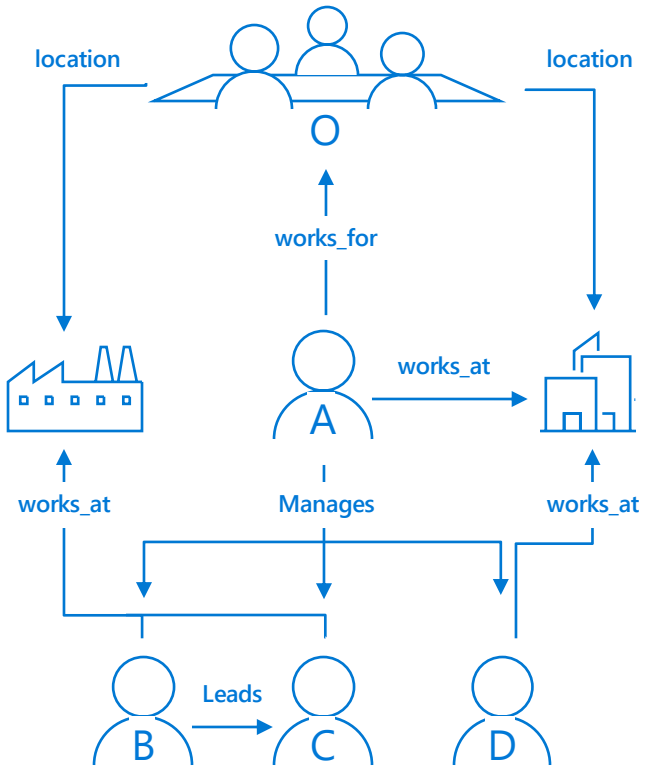
SQL Graph

Graph objects

Query language extension

Integrated in SQL Engine

Queries can lookup against existing SQL database tables and graph nodes/edges
Column store, Advanced Analytics/ML, HA, etc.
Security and compliance



SQL Graph

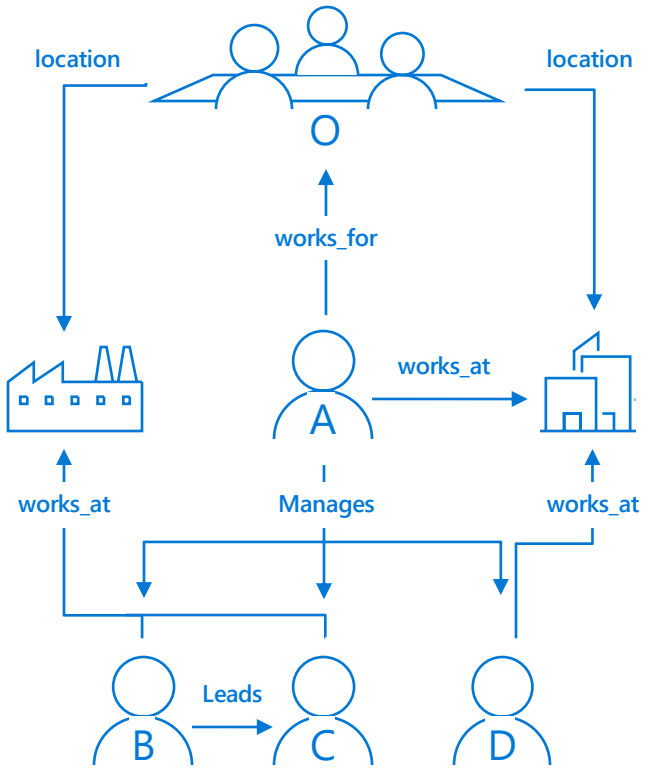
Graph objects

Query language extension

Integrated in SQL Engine

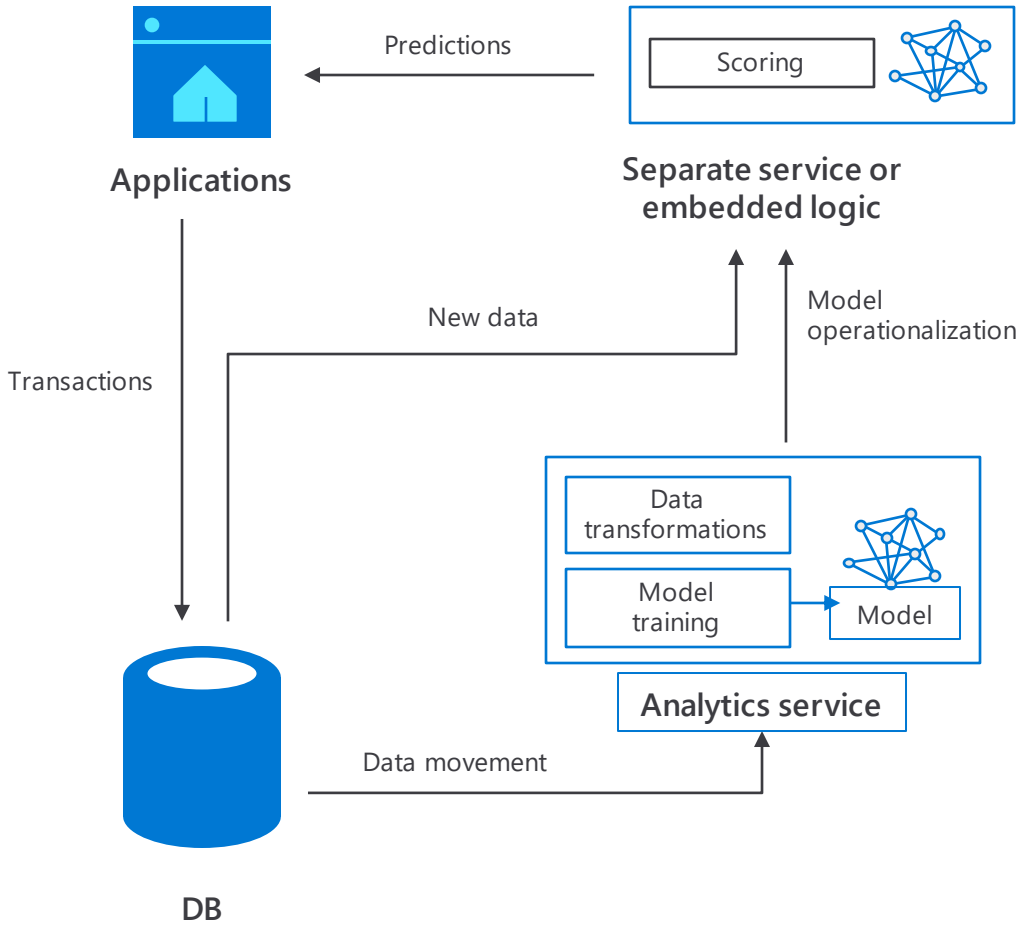
Tooling and ecosystem

Existing tools will all work out of the box, including backup and restore, import and export, etc.

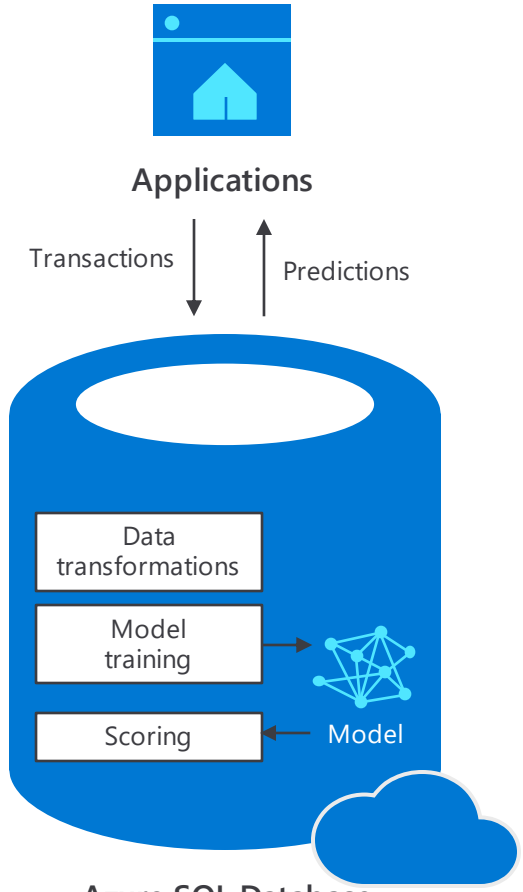


Machine Learning Services in Azure SQL Database

Machine learning outside of database



In-database machine learning



Machine Learning Services in Azure SQL Database

Capabilities

Extensible in-database analytics, exposed through T-SQL

Preview with R, Python coming soon

No data movement, resulting in faster time to insights

Real-time analytics on transactional data with native PREDICT

Integration with existing application workflows

Unified governance across analytics and storage

Running R script in Azure SQL Database:

```
/* Input table schema */
create table Iris_Data (name varchar(100), length int, width int);
/* Model table schema */
create table my_iris_model (model varbinary(max));

declare @iris_model varbinary(max) = (select model from my_iris_model);
exec sp_execute_external_script
  @language = 'R'
, @script = '
            IrisPredict <- function(data, model){
            library(e1071)
            predicted_species <- predict(model, data)
            return(predicted_species)
            }
            IrisPredict(input_data_1, model);
            '
, @parallel = default
, @input_data_1 = N'select * from Iris_Data'
, @params = N'@model varbinary(max)'
, @model = @iris_model
with result sets ((name varchar(100), length int, width int
, species varchar(30)));
```

Values highlighted in yellow are SQL queries embedded in the original R script

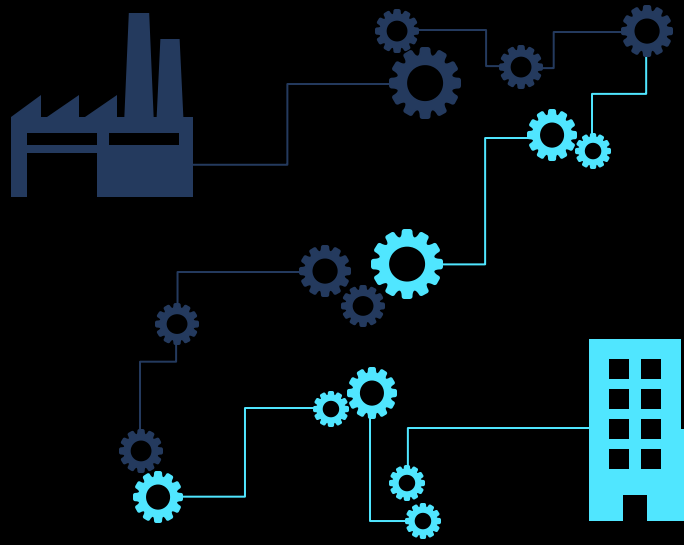
Values highlighted in aqua are R variables that bind to SQL variables by name

Microsoft

Azure SQL Database Ledger

Ledger technologies enable digital trust

Companies are moving from intermediaries and manual auditing **that are slow and costly…**



…to ledger technologies that **reduce cost, saves time, and lowers risk**

Blockchain market growth predictions are growing

1,213 views | May 13, 2020, 10:03am EDT

Will Enterprise Blockchain Survive? Report Puts Blockchain Market At $21 Billion By 2025

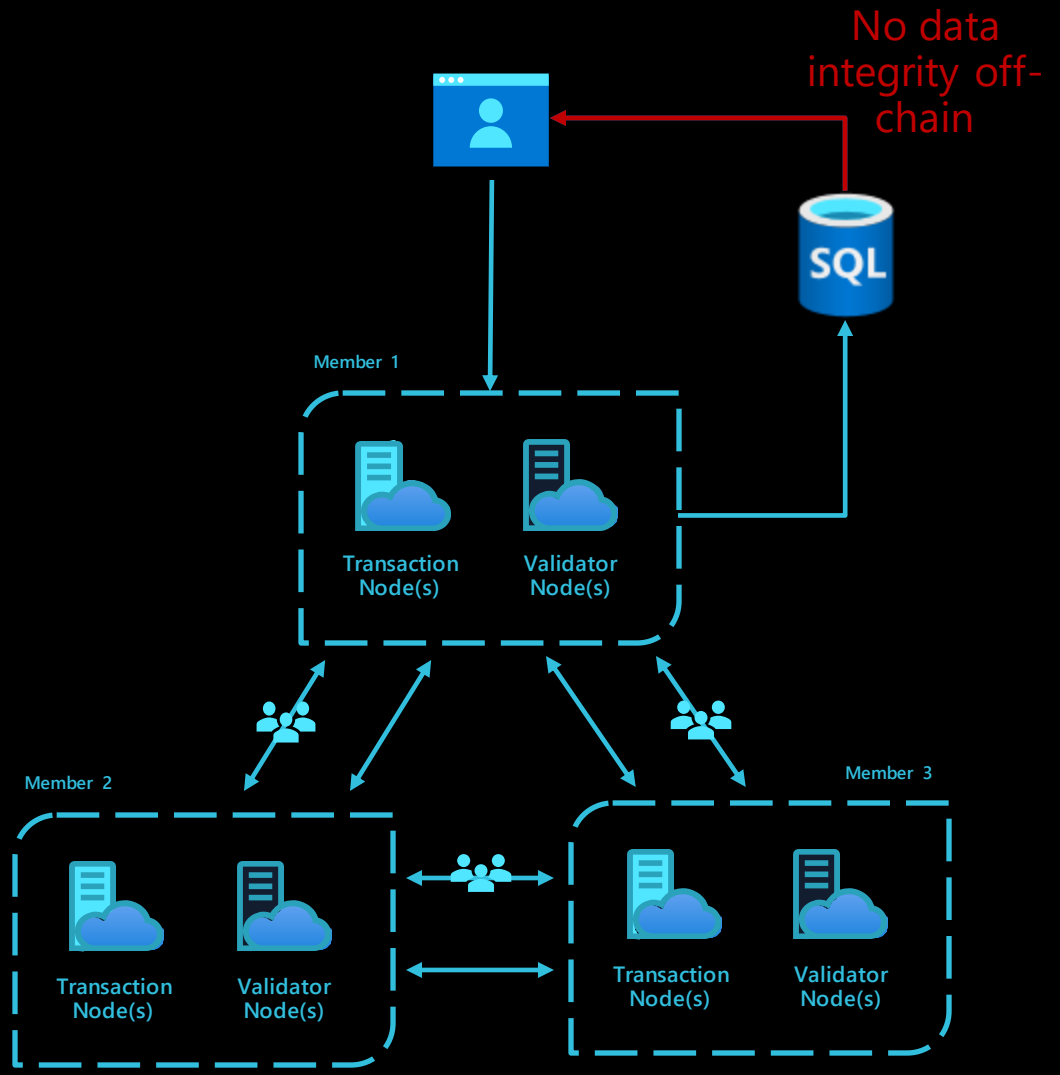
https://www.forbes.com/sites/robertanzalone/2020/05/13/will-enterprise-blockchain-survive-a-new-report-says-that-the-blockchain-technology-market-will-reach-21-billion-by-2025/#7a5f793954b8

Ninety percent of permissioned blockchain projects are misaligned to blockchain technology, because they remain centralized database projects at the core. These projects can be implemented more quickly, more cost-effectively, and with less risk and higher quality by avoiding blockchain altogether.

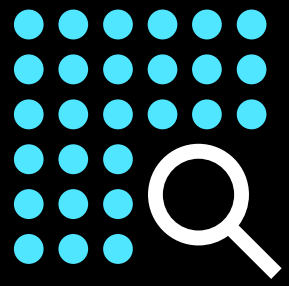
Gartner Predicts 2019: Blockchain Technologies

Blockchains are overkill for centralized scenarios

- Decentralization requires all parties to host nodes on the network to participate in consensus
- Governance rules must be established by the consortium and deployed/managed
- Latency associated with network consensus can impact transaction throughput (<1000 TPS for Ethereum)
- Off-chain storage patterns for querying data are a typical pattern, but data integrity is lost in the process
- Bespoke development with immature tooling makes development and management challenging



Azure SQL Database ledger – The power of blockchain in SQL



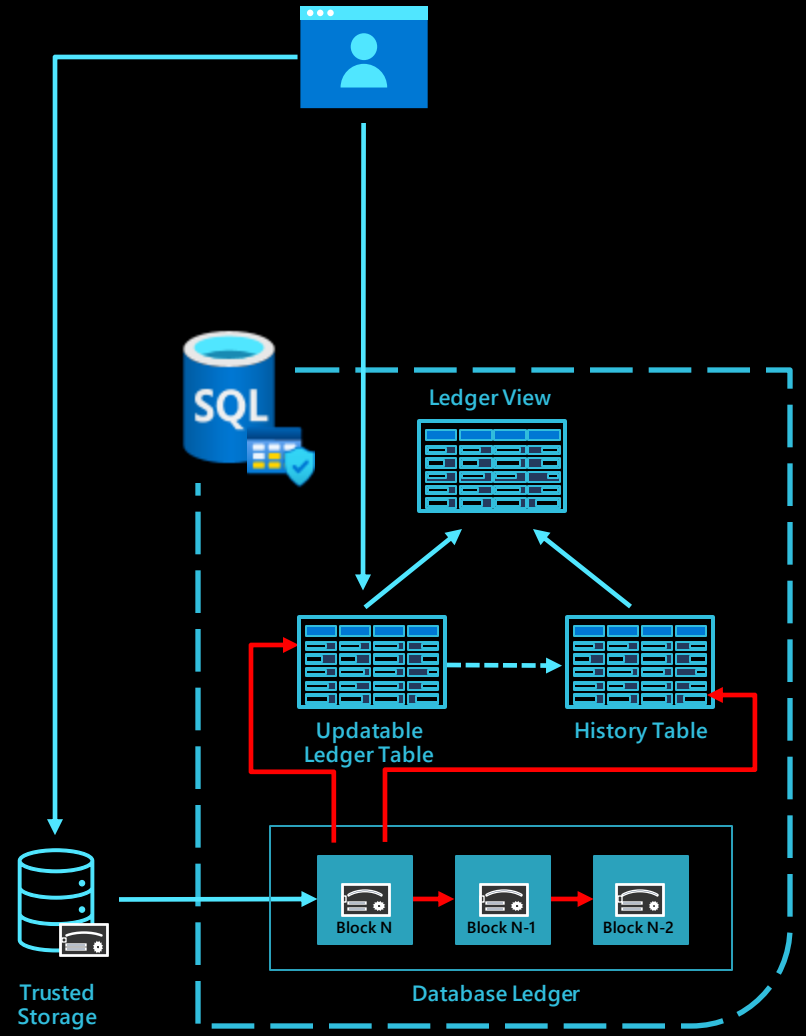
Makes data in SQL tamper-evident through cryptography

Provides a historical record of all changes, verified through cryptographic proofs

The same SQL you already know across Azure and on-premises

Ledger Tables – Updatable and Append-Only

- Updatable Ledger Tables are standard SQL tables which allow updates and deletes
- The history of rows that have been updated or deleted are preserved in the history table and easy-to-query Ledger View
- Integrity of the updatable and history tables are maintained through cryptographic links from the Database Ledger
- System periodically uploads digital receipts to a customer-configured trusted storage service
- Customer can use digital receipts to verify the integrity of the data
- Append-Only Ledger Tables block UPDATE/DELETE at the API and remove the need for a history table



Storage for database digests

Immutable Blob Storage

- Store data in a Write Once, Read Many state based on policies
- Data blobs created can be set to read-only mode for a user-specified interval
- Data is functionally locked or held based on policies
- Can provide audit logging support but must trust creator of the logs
- Microsoft is in the trusted computing base

Azure Confidential Ledger (ACL)

- Store data in a Write Once, Read Many state for perpetuity
- Data blobs written to the ledger cannot be modified
- Runs on Confidential Enclaves which provides tamper-proof guarantees
- Creates transaction receipts and serialized ledger files, which contain cryptographic constructs that can be verified by customers
- Microsoft is outside of TCB. Ledger source code is open source (CCF)

Example

Updatable Ledger Tables

Creating an account balance updatable ledger table

```
CREATE TABLE [Account].[Balance]
(
    [CustomerID] INT NOT NULL PRIMARY KEY CLUSTERED,
    [LastName] VARCHAR (50) NOT NULL,
    [FirstName] VARCHAR (50) NOT NULL,
    [Balance] DECIMAL (10,2) NOT NULL
)
WITH
(
    SYSTEM_VERSIONING = ON,
    LEDGER = ON
);
GO
```

	ledger_table_name	history_table_name	ledger_view_name
1	Account.Balance	Account.MSSQL_LedgerHistoryFor_1525580473	Account.Balance_Ledger

Add 4 accounts in 2 separate transactions

Tx1: Add Nick with an opening balance of $50

Tx2: Add John, Joe and Mary

1. Each transaction has it's own unique transaction ID
2. Tx2 modified 3 rows, each tracked with a ledger sequence number

Updatable ledger table

Results Messages

	CustomerID	LastName	FirstName	Balance	ledger_start_transaction_id (1)	ledger_end_transaction_id	ledger_start_sequence_number (2)	ledger_end_sequence_number
1	1	Jones	Nick	50.00	999	*NULL*	0	*NULL*
2	2	Smith	John	500.00	1002	*NULL*	0	*NULL*
3	3	Smith	Joe	30.00	1002	*NULL*	1	*NULL*
4	4	Michaels	Mary	200.00	1002	*NULL*	2	*NULL*

Update Nick's balance from $50 to $100

Updatable ledger table – Nick's balance is now $100

	CustomerID	LastName	FirstName	Balance	ledger_start_transaction_id	ledger_end_transaction_id	ledger_start_sequence_number	ledger_end_sequence_number
1	1	Jones	Nick	100.00	1055	*NULL*	0	*NULL*
2	2	Smith	John	500.00	1002	*NULL*	0	*NULL*
3	3	Smith	Joe	30.00	1002	*NULL*	1	*NULL*
4	4	Michaels	Mary	200.00	1002	*NULL*	2	*NULL*

History Table – Shows the historical value of row containing Nick's opening balance

	CustomerID	LastName	FirstName	Balance	ledger_start_transaction_id	ledger_end_transaction_id	ledger_start_sequence_number	ledger_end_sequence_number
1	1	Jones	Nick	50.00	999	1055	0	1

Ledger View – Shows Nick's update as a delete followed but a subsequent insert

	CustomerID	LastName	FirstName	Balance	ledger_transaction_id	ledger_sequence_number	ledger_operation_type_id	ledger_operation_type_desc
1	1	Jones	Nick	50.00	999	0	1	INSERT
2	2	Smith	John	500.00	1002	0	1	INSERT
3	3	Smith	Joe	30.00	1002	1	1	INSERT
4	4	Michaels	Mary	200.00	1002	2	1	INSERT
5	1	Jones	Nick	50.00	1055	1	2	DELETE
6	1	Jones	Nick	100.00	1055	0	1	INSERT

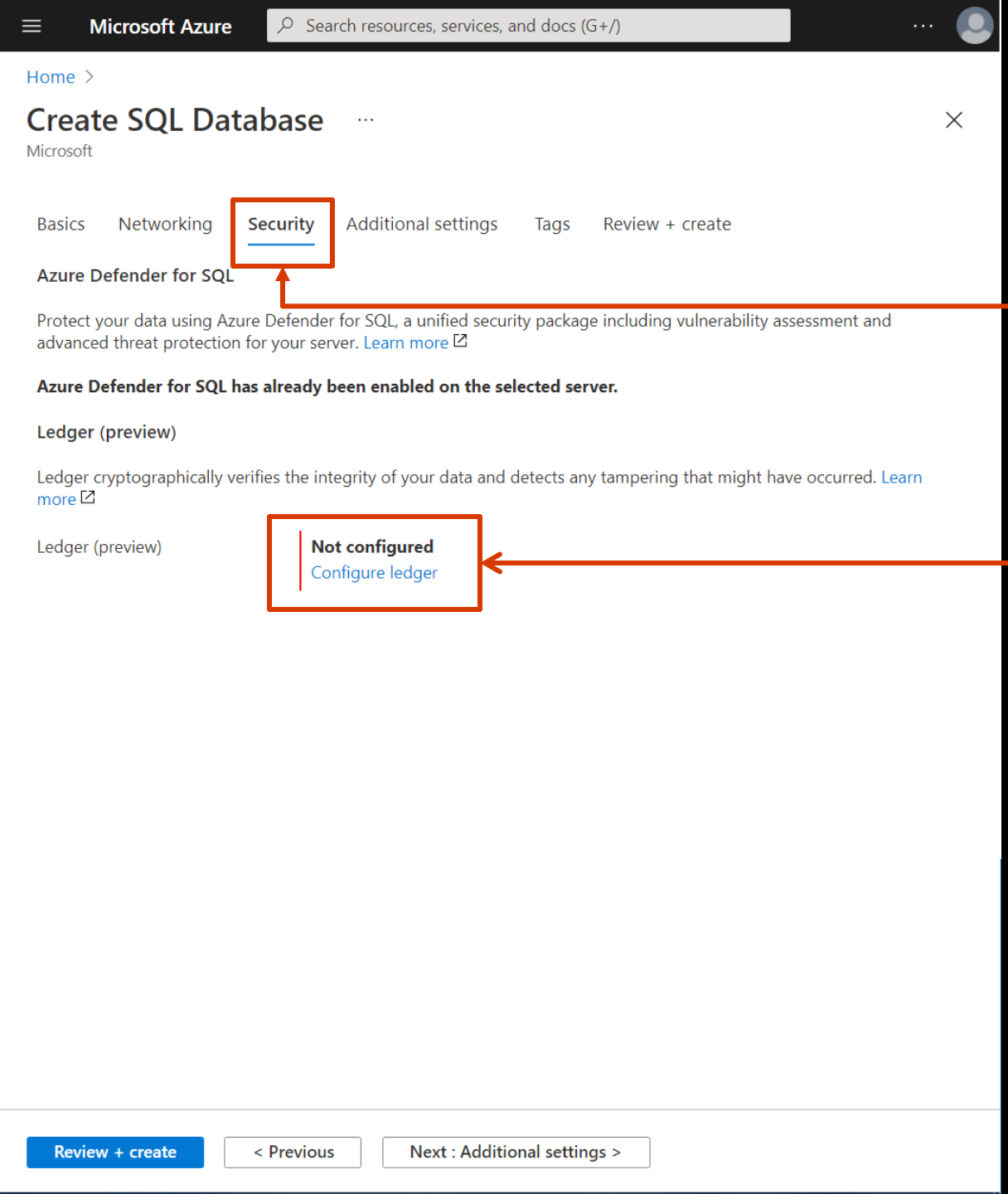
The database ledger

Sys.database_ledger_transactions - Records the table hashes for each transaction in the database as well as the user who issued the transaction

	transaction_id	block_id	transaction_ordinal	commit_time	principal_name	table_hashes
1	999	0	0	2021-03-23 20:18:08.2700000	janders	0xB982EE5A88DFE8EF08BE7564D62273BD17306231C8E22E052644805…
2	1002	0	1	2021-03-23 20:18:12.9300000	janders	0xB982EE5AB931133CF9B8E6FCD06C9AF25C0F0C6A9A91A12C89A84AB…
3	1055	0	2	2021-03-23 20:40:08.9500000	janders	0xB982EE5A38F20FA9D8ABFC3C3523284FE65466DAA9E91166447648B…
4	1091	0	3	2021-03-23 21:36:22.2533333	janders	0x9D13BF5E345245E7456EC748BC895E0E1323379BD04EBC35638D91E…

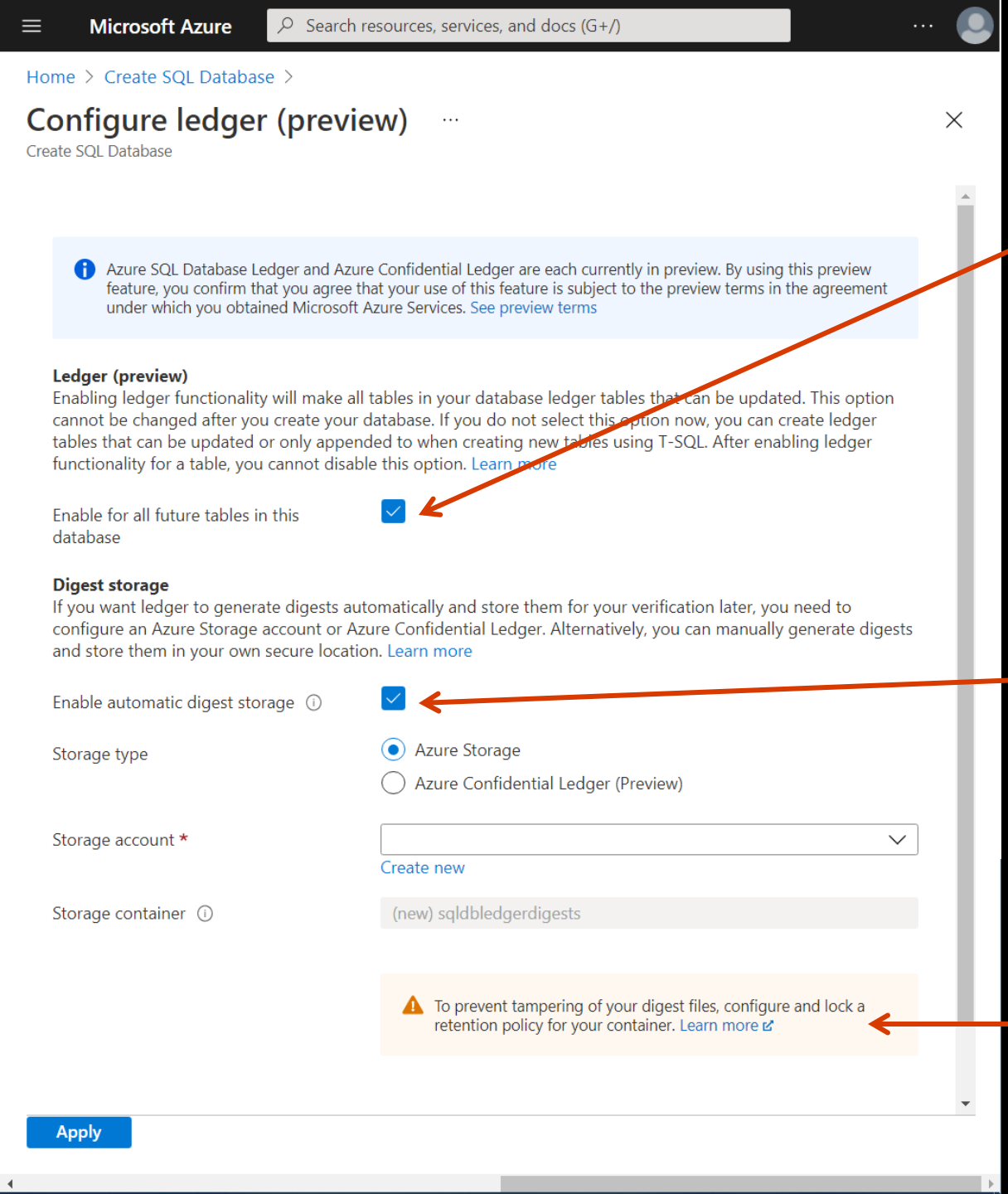
Sys.database_ledger_blocks – Records the hash of each block created in the database, along with the # of transactions in the block

	block_id	transactions_root_hash	block_size	previous_block_hash
1	0	0x8F3C4C8ADF99EAEE24A783CB1AC282A12E9C9ECA619DDE19B2C98D8ECCA5E4A5	4	*NULL*



"Security" tab is new in the Create pane

Ledger configuration is not enabled by default



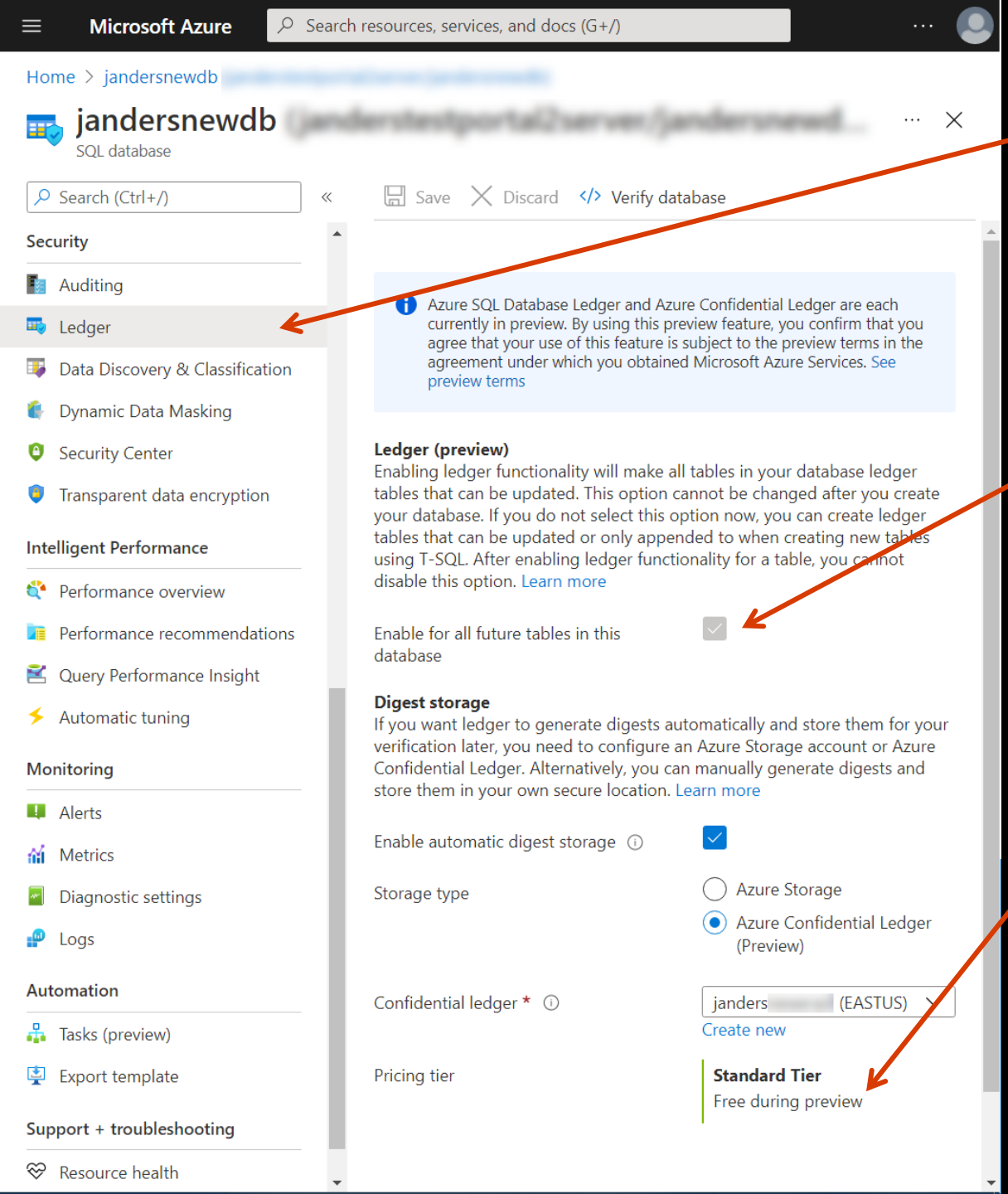
Enables "ledger database" ensuring all tables are updatable ledger tables

- If not selected, users can still create ledger tables in T-SQL

Automatically generates digests and uploads to Azure Storage or ACL

- If not selected, customers will have to manually generate and store their digests

Digests should be protected by an immutability policy

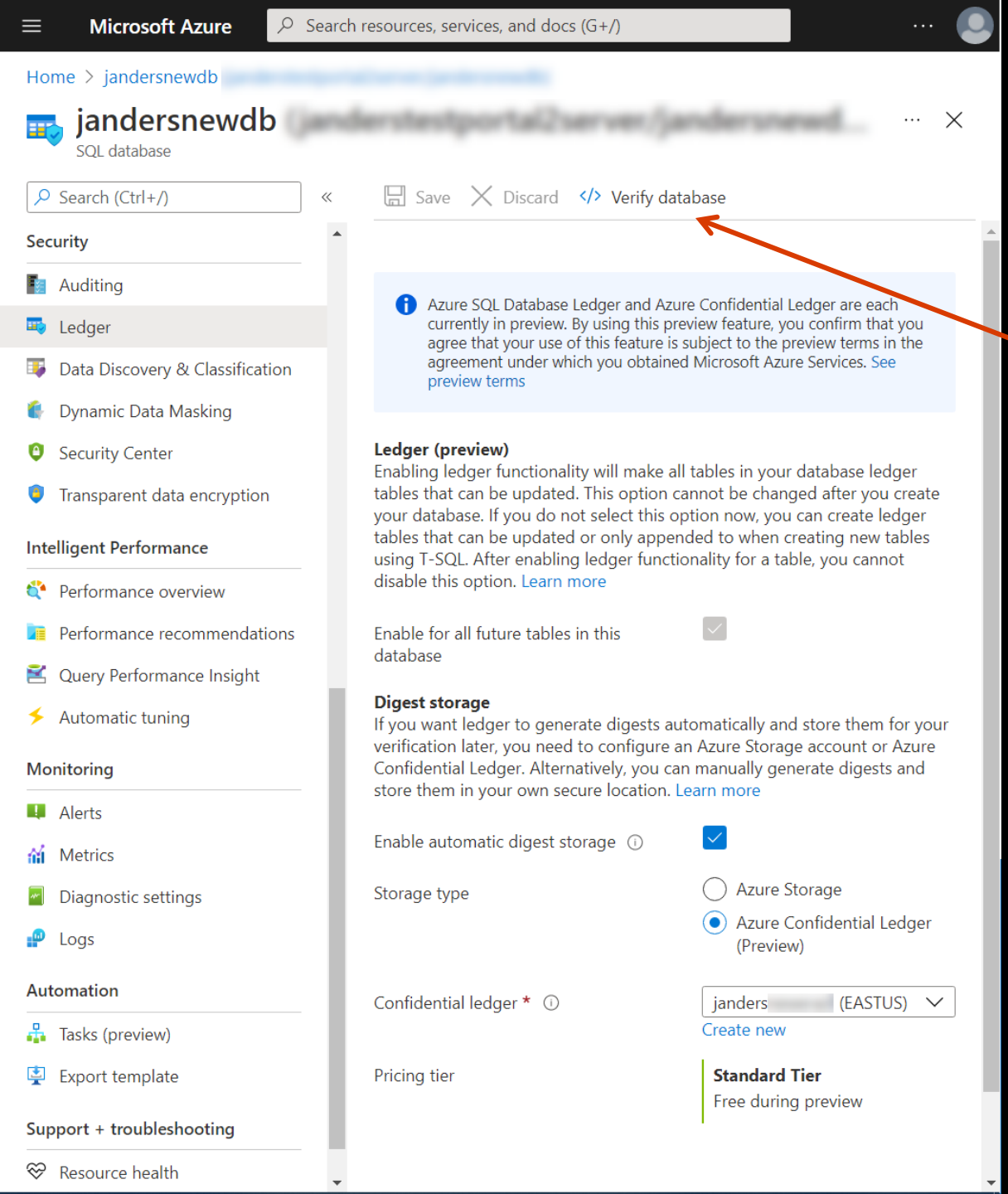


Ledger is in the Security section of the Manage experience

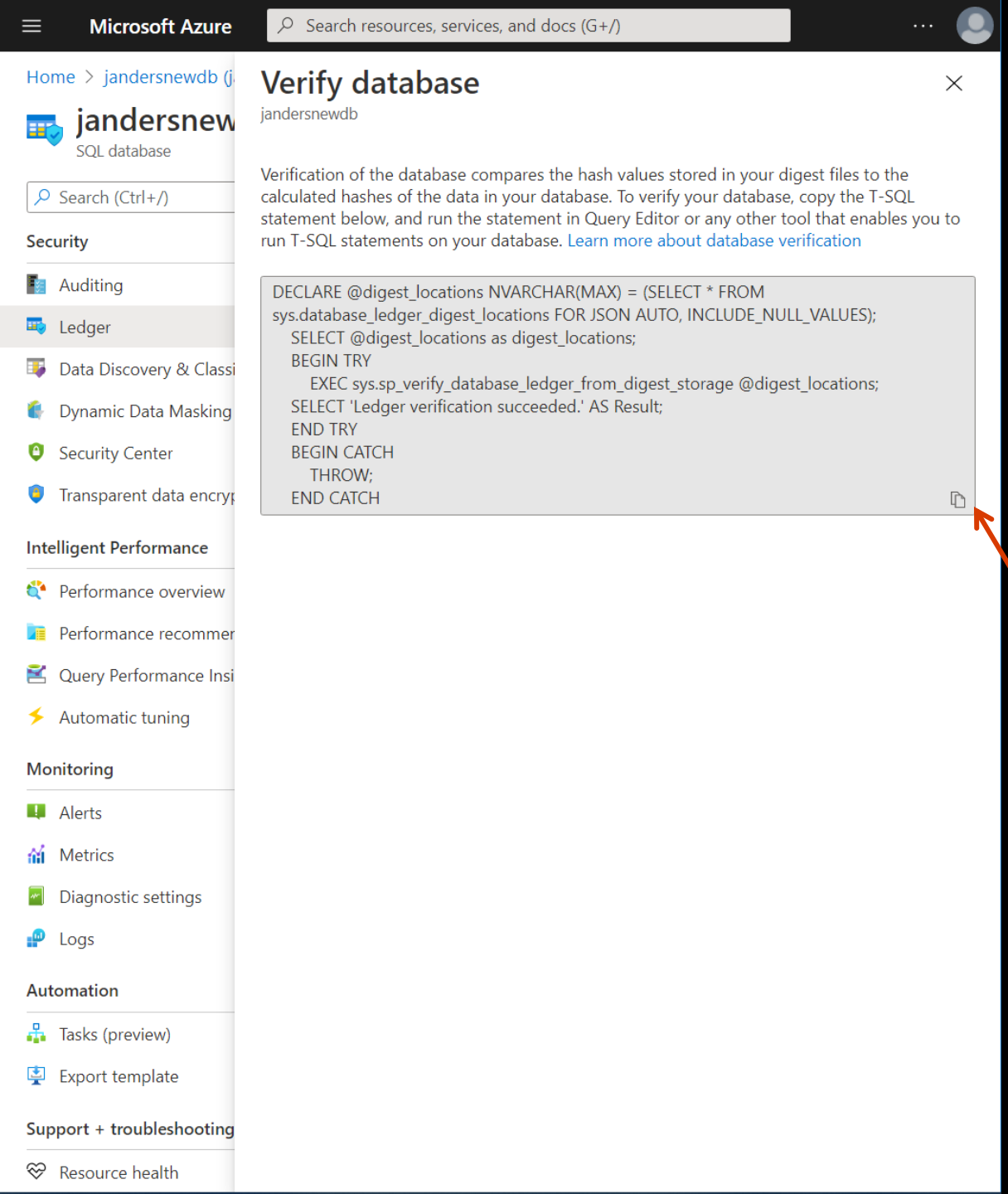
Ledger database cannot be disabled after Create

- If not enabled during create, it cannot be enabled afterwards
- Users can still create ledger tables using T-SQL

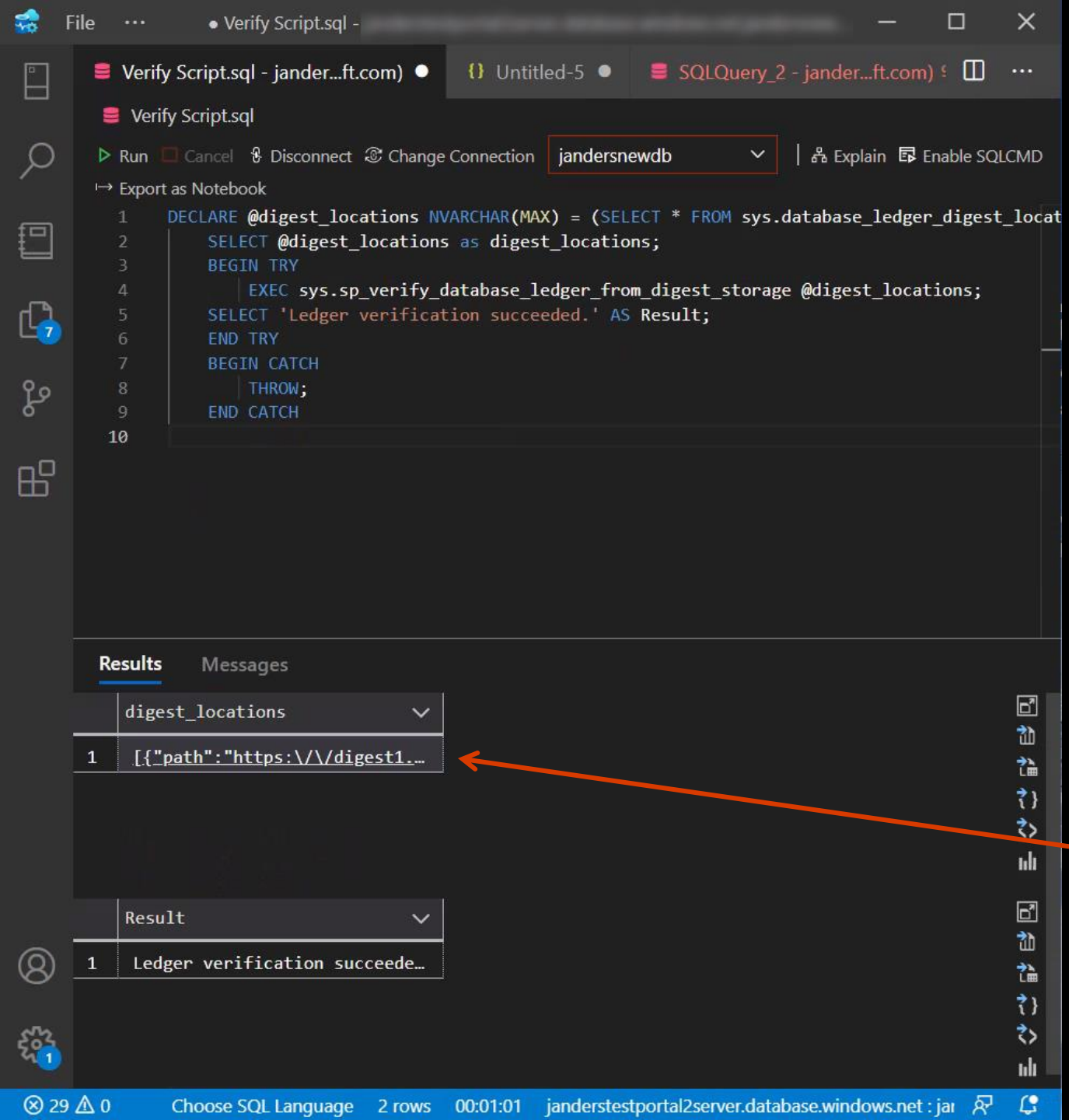
If ACL is chosen for digest storage, note that in Preview it is free, but will be charged at GA (Price TBD)



Verify database generates the T-SQL script to run database verification

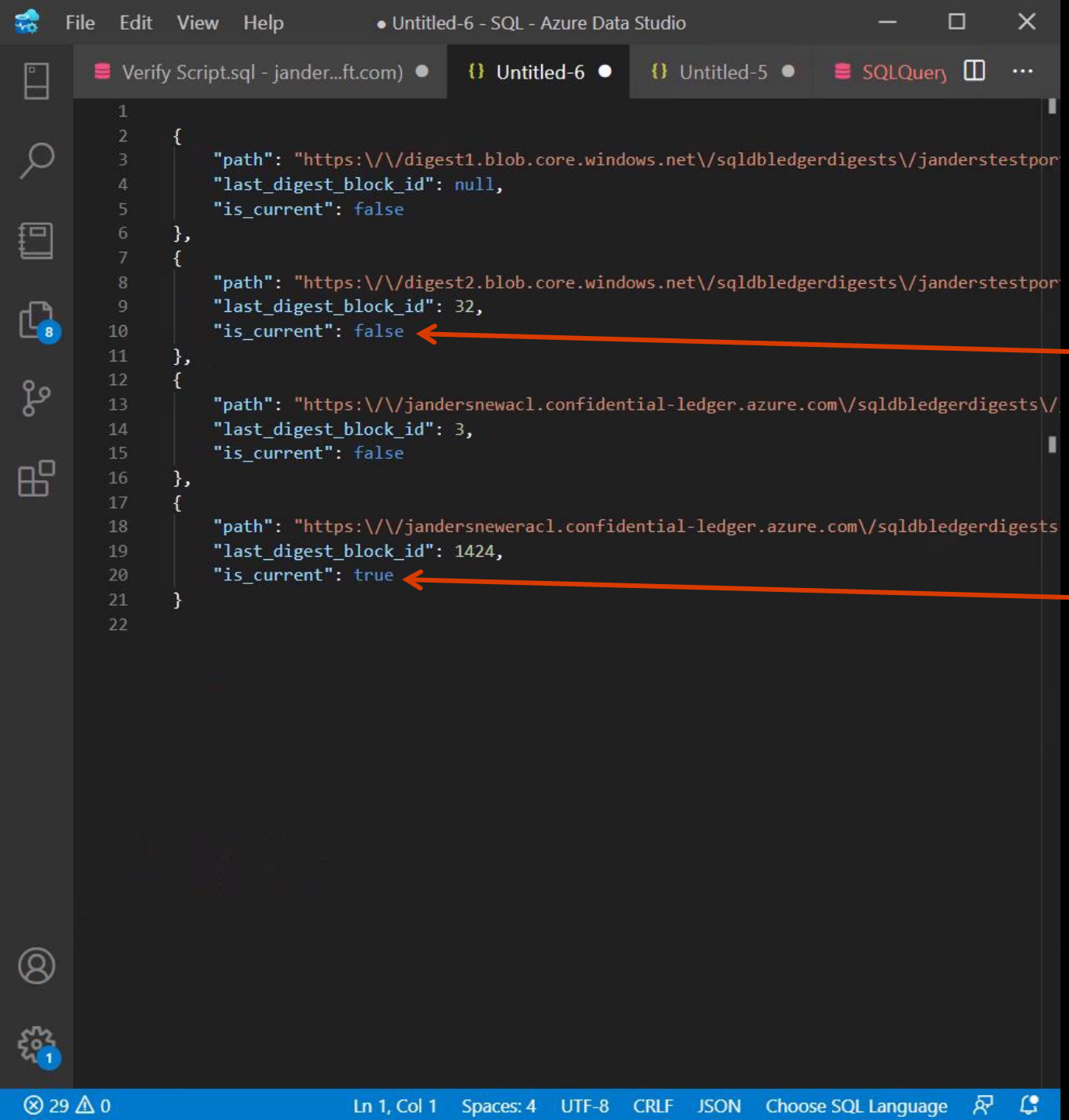


Copy the T-SQL for execution in Query Editor, Azure Data Studio or SQL Server Management Studio



Execution will show you the locations of your digest storage and results.

Opening the digest_locations will show you where verification extracted the digests from



“false” indicates previous configuration of digest storage

“true” indicates the current configuration of digest storage

Scenarios for ledger tables

Streamlining Audits

Cryptographically proving data has not been tampered to other parties whether external or internal (auditors or regulators)

Multi-Party Business Processes

Alternative to blockchain for systems that are centralized solutions at their core (trust, but verify)

Trusted Off-Chain Store for Blockchain

Blockchain solutions typically replicate chain data “off-chain” to traditional databases. Ledger tables maintains integrity of blockchain data

Ledger capability comparison

	SQL ledger	AWS QLDB	Blockchain
Distributed architecture with decentralized consensus & business logic	✗	✗	✓
Tokenization of assets	✗	✗	✓
Centralized architecture providing tamper-evident proofs to users	✓	✓	✗
Query ledger data in a performant manner without adding additional infra	✓	✓	✗
Support for updates and deletes while maintaining forward integrity	✓	✓	✗
Does not require new development, enable on existing systems	✓	✗	✗
Support for on-prem, provisioned cloud and serverless	✓	✗	✗
Ability to backup/restore ledger data while maintaining data integrity	✓	✗	✗
Support for customer managed keys for encryption	✓	✗	✗
Automated digest management	✓	✗	✗

Customers & Partners using Azure SQL Database ledger

"bp decided to explore alternatives to address the major impediments of the blockchain solution they were using, e.g. developer velocity, querying of the ledger and infrastructure costs. Azure SQL Database ledger provides a tamper evident data store for a centralised solution that relies on a high degree of trust in the integrity of the data. Using **Azure SQL Database ledger** has helped **increase developer velocity** and we expect it to enhance bp's ability to **build secure trusted applications** to support our core value of safety."

Christian Mare
Azure Architect
Digital Production & Business Services

"In the time we've been working with it, **Azure SQL Database ledger** has proven incredibly powerful for organizations that need attestation, and auditing for their end-to-end data, without the overhead of a whole blockchain consortium. With the ledger feature, you have a **best-in-class database**, allowing you to **build with your existing enterprise stack, providing security, with increased speed of development.**"

Chris-Lloyd Jones
Product & Engineering Lead
Emerging Technology

"**Azure SQL Database ledger** delivers our platform with **all of the benefits that blockchain** technology provides, **without the additional heavy lifting** of the blockchain infrastructure, performance considerations and challenges associated with data residency. Working closely with Microsoft on this technology has enabled us to refine our proposition, providing additional benefits to the worlds commercial banks and regulators alike."

Andrew Smith
Chief Technology Officer

Resources

- Announcement blog
  - https://aka.ms/sql-ledger-blog
- Azure SQL Database ledger Documentation
  - https://aka.ms/sql-ledger-docs
- Whitepaper
  - https://aka.ms/sql-ledger-whitepaper

Microsoft

Inside Azure SQL Managed Instance

Azure SQL

The family of SQL cloud to edge databases

SQL Server on Azure Virtual Machines

Best for lift and shift and/or workloads requiring OS-level access

Azure SQL Managed Instance

Best for modernizing existing apps

Azure SQL Database

Best for supporting modern cloud apps

Azure SQL Edge

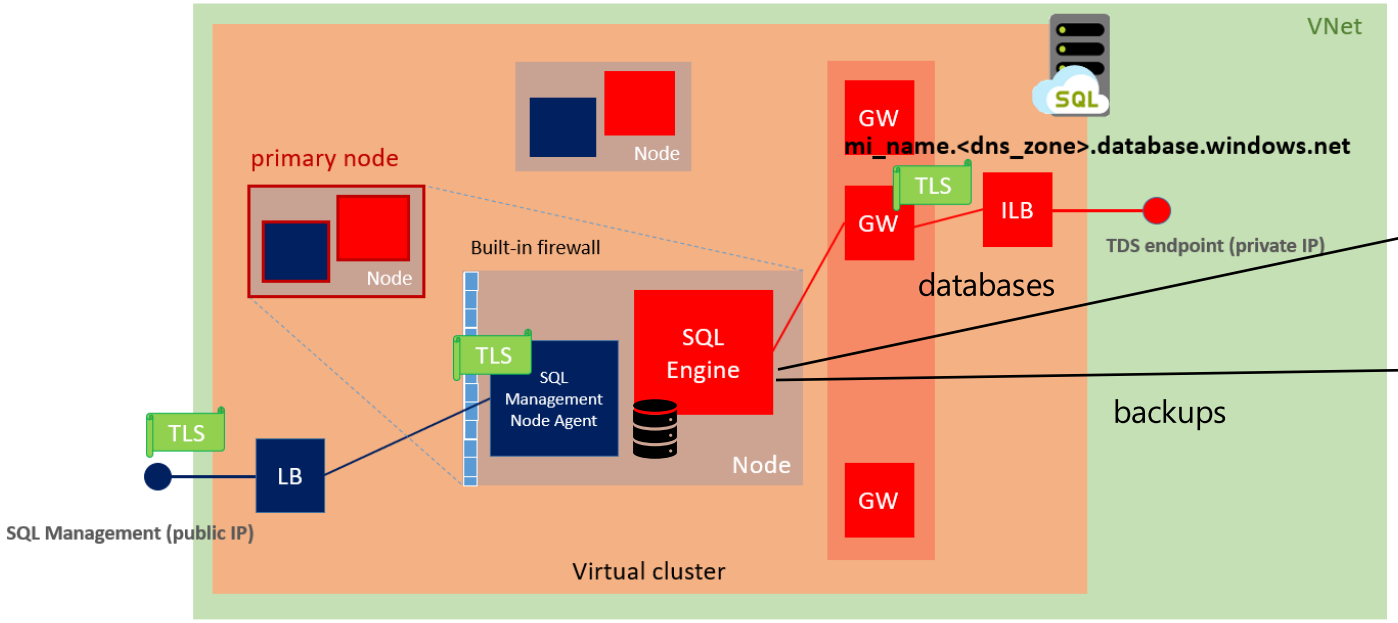
Best for extending apps to IoT edge

Infrastructure-as-a-Service | **Platform-as-a-Service** | **Edge Computing**

Is it SQL Server

- Pre-installed SQL with abstraction from OS and Infrastructure
- It is the same engine but versionless
- Almost 100% compatible T-SQL language (aka.ms/azuretsqldiff)
- Fully Managed Service = SQL+cloud to automate
- SQL Server Agent and Database Mail
- Replication and Resource Governor
- Service Broker, Distributed Transactions, Linked Servers, SQLCLR
- Machine Learning Services
- Doesn't come with SSRS, SSAS, or SSIS*
- Support hosting MDS, SSIS & SSRS databases

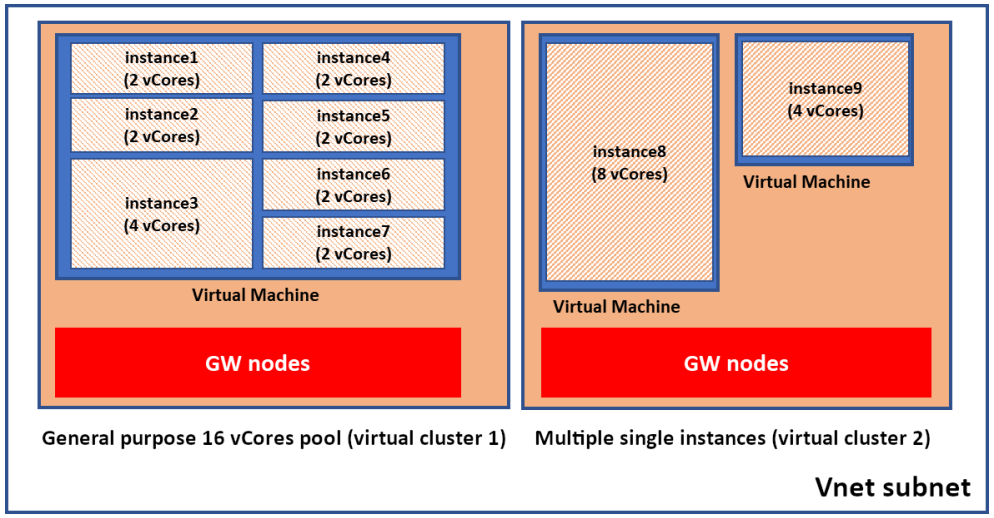
Azure SQL Managed Instance Architecture



Azure Service Fabric

- Dedicated virtual cluster
- Node = Virtual Machine
- Private virtual network
- TDS endpoint through private or public IP
- Gateways abstract connection
- Management services connect to management endpoint
- Agents operate within the cluster to manage the service
- Storage exists on the nodes or on Azure Storage

- Multiple instances can exist in the cluster
- Each have their own virtual machine
- Instance pools allow for multiple instances in a VM and smaller vCore sizes



Deploy, Connect, Configure

Deploy

Choose region, service tier, vCores, and Max Storage

You choose Max Storage for instance based on possible max size

Choose hardware options **New**

Service-aided subnet configuration

Connect

Inside the virtual network with Private IP

Outside using public endpoint/port with NSG

Configure

Configure outside of SQL with the portal or CLI

Change tier, vCores, or max storage

Configure inside SQL with T-SQL or SSMS

What's different?

No OS or file system access

No manual restarts or SQL Server Config Manager

Tempdb managed (customizable coming soon!)

Some global trace flags allowed

Service tiers – Deployment options

General purpose

Most business workloads

Remote storage

IOPS
$
Built-in HA

P 16TB

Business critical

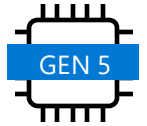
Workloads that require low latency, fast recovery, and a readable secondary

Local storage

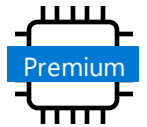
IOPS++
$$$
In-memory

P S S R 16TB
PREVIEW

Hardware options



Intel Broadwell CPU
80 vCores/5.1Gb per vCore



Intel Ice Lake CPU
80 vCores/7 Gb per vCore
Memory optimized –
64 vCores/13.6 per vCore

Resource limits

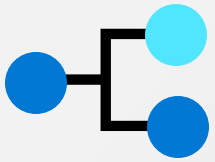
- Memory
- Max Log Size
- I/O throughput and latency
- Size of Tempdb
- Max concurrent workers
- Backup Retention

Azure SQL Managed Instance security

Network security

VNET
Firewall Rules, NSG
Minimum TLS

Identity and access



Azure RBAC
SQL and/or AAD Auth
Windows Auth **New**
Managed identities **Preview**
Roles & Permissions
Row-level security

Data protection

Encryption-in-flight (TLS)
Encryption-at-rest (TDE)
Storage endpoint policy
User-managed keys
Dynamic Data Masking

Security management

SQL Server Audit
Blob Storage, Log Analytics, Event Hub
Data Discovery & Classification
Microsoft Defender for SQL
Vulnerability Assessment
Advanced Threat Protection

Performance

Capabilities

Same engine = same capabilities

Choose service tier and vCores to match resource needs

Consider the new Premium hardware options

Change files/sizes to boost I/O perf on General Purpose

Intelligent Query Processing

Monitoring

Azure Monitor and SQL Insights outside of SQL

Full DMVs, XEvent, and Query Store inside of SQL

Lightweight Query Profiling and Query Plan Debugging

Troubleshooting

Is it running or waiting?

Use your existing skills, tools, and knowledge

You may need a different deployment option

Availability

High Availability

Built-in and completely automated

General Purpose = Failover Instance

Business Critical = Availability Groups

Service Level Agreement (SLA)

Availability guarantee of at least 99.99%

Redundancy

System databases in replicas

Auto-failover groups across regions

Connection abstraction built-in

Disaster Recovery

Built-in and completely automated

Full, diff, and log backups regularly

Long-term backup retention up to 10 years

Geo, Zone, or Local redundancy

Backup control

Manual COPY_ONLY backups

Restore from any SQL Server or Managed Instance

Recover easily

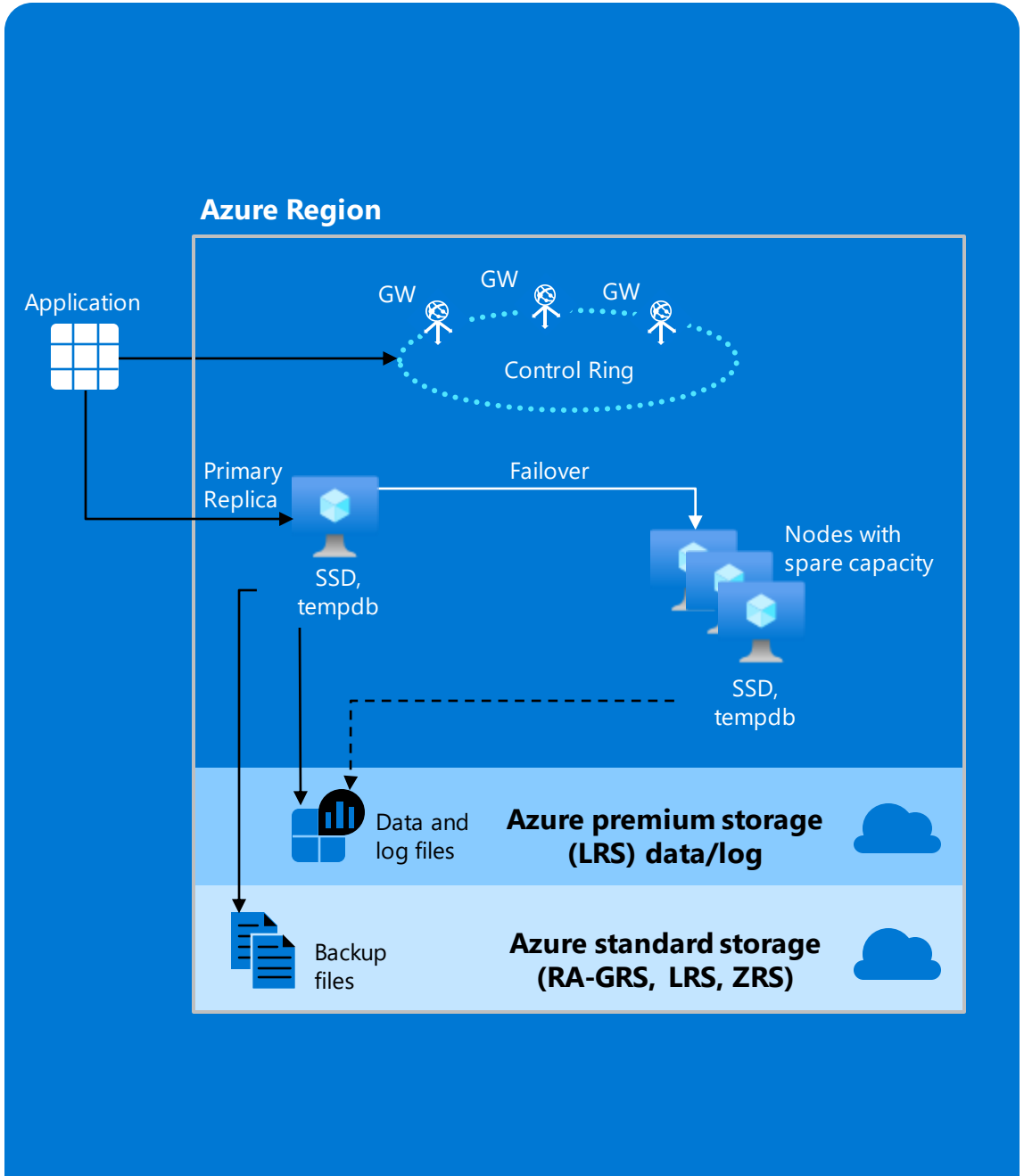
Simple to use PITR

Recover deleted databases

Geo database restore

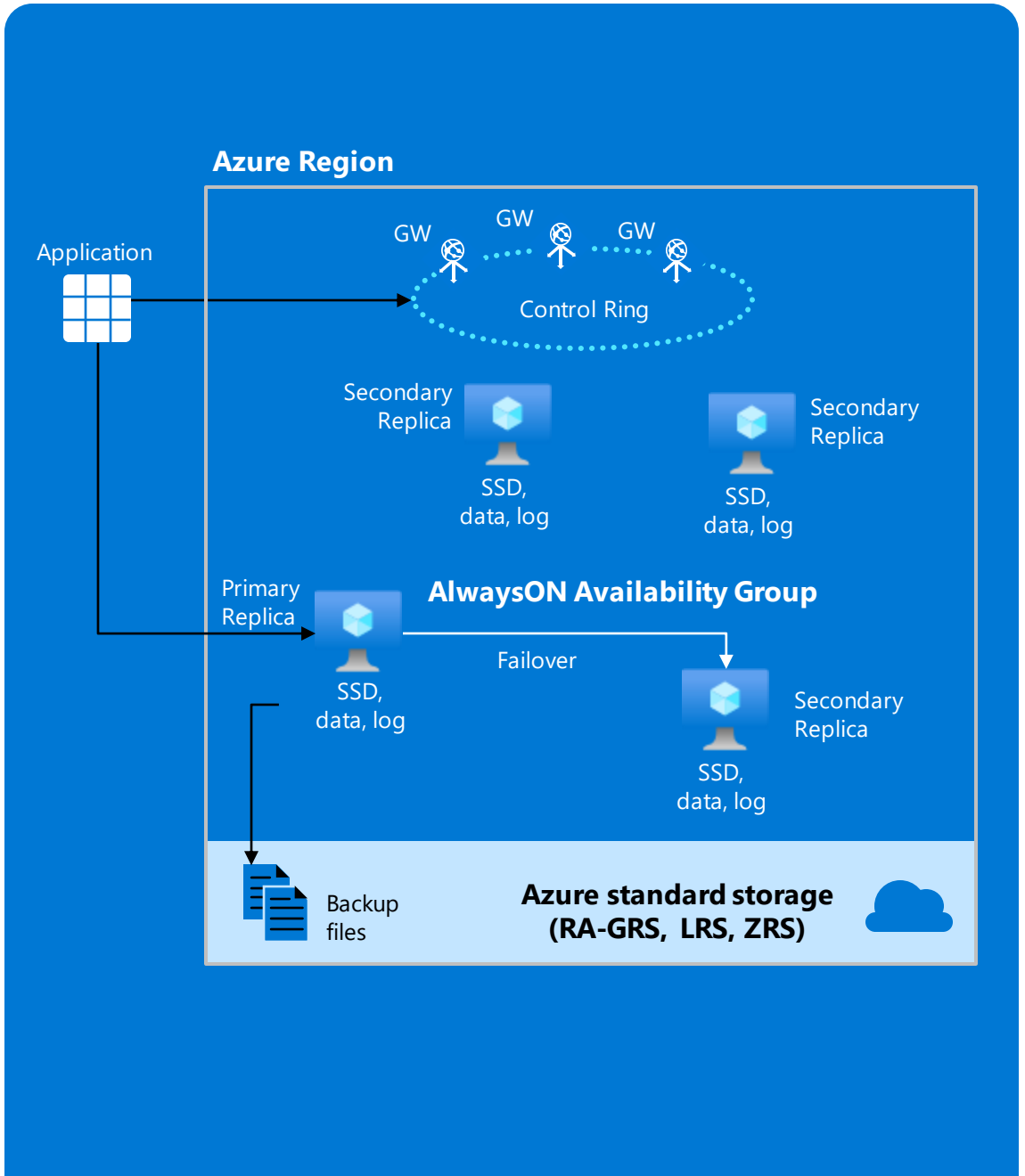
General Purpose High Availability

- Behaves like Failover Cluster Instance
- Remote storage provides data redundancy within a datacenter
- Backup files are in a different location with geo-redundancy
- Failover decisions based on SQL and Service Fabric
- Recovery time depends on spare capacity
- Connectivity redirection built-in



Business Critical High Availability

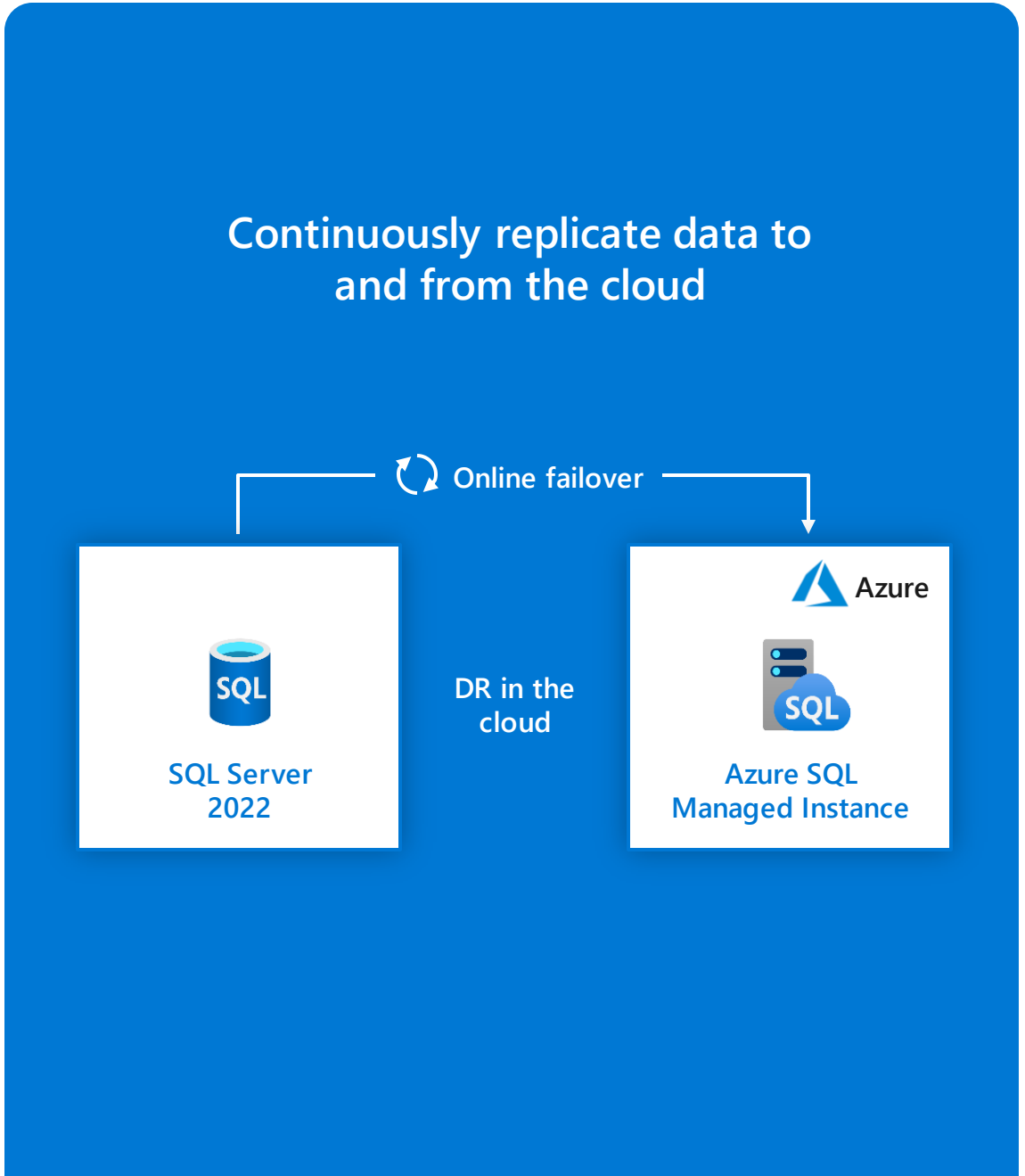
- Based on Always On Availability Groups
- 3 secondary replicas automatically created
- Four replicas kept available
- Backup files in a different location with geo-redundancy
- At least one secondary must sync for commits
- Automatic failover based on SQL and Service Fabric
- Recovery time extremely fast
- Connectivity redirection built-in
- Read Scale-Out from one of the replicas



Business continuity through Azure SQL Managed Instance

Disaster recovery in the cloud with link feature in Azure SQL Managed Instance

- Deploy and configure easily with PaaS
- Optionally use Azure SQL Managed Instance for read-scale out
- Built-in distributed availability group (DAG)
- Restore Azure SQL Managed Instance databases back to SQL Server



Migrate to Azure SQL Managed Instance

Discover and Assess

Azure Migrate

Data Migration Assistant (DMA)

Azure Data Studio

Migrate

Restore a backup

Database Migration Service (DMS)

Log Replay Service (LRS)

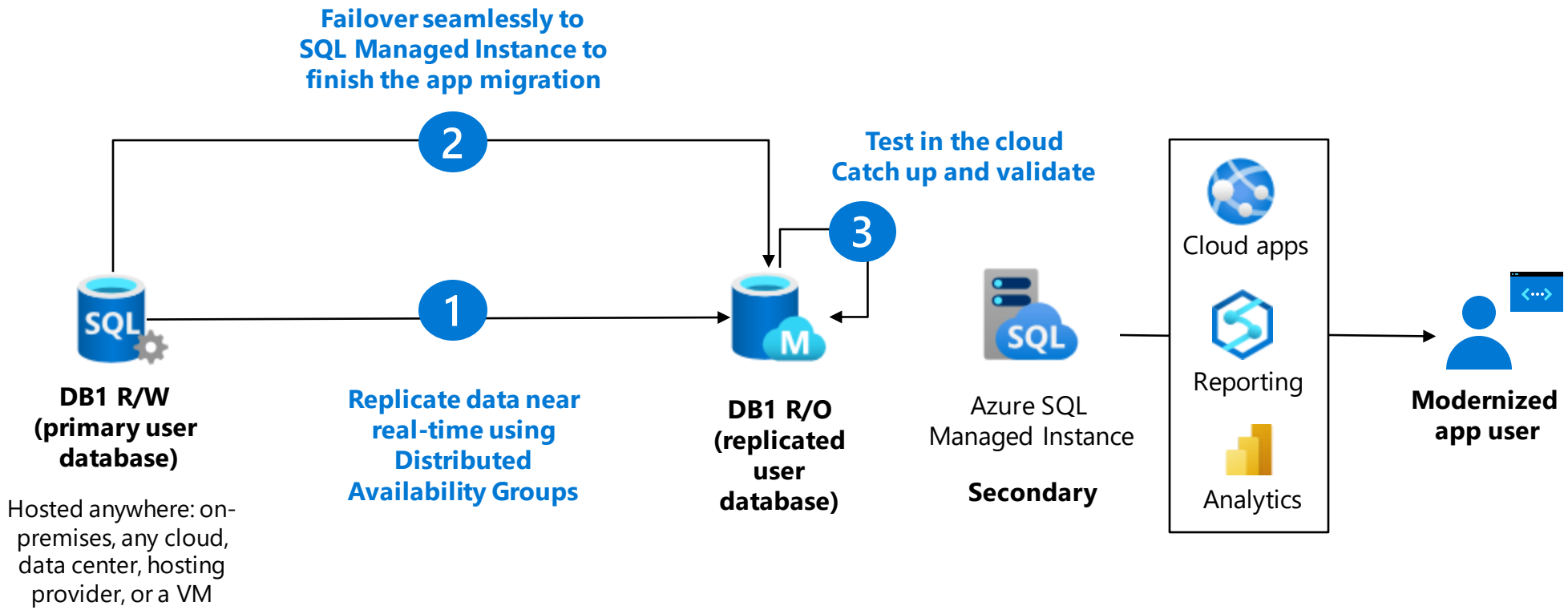
Inline with Azure Data Studio

Link feature in Managed Instance

Consider the following…

- Replication, bcp, BACPAC, ADF as alternatives
- DMS can migrate logins, SQL Agent jobs, and SSIS packages
- Script anything else you need
- Choose your deployment option per your resource needs
- Choose service tier that fit your RTO and RPO needs

Link feature for Managed Instance for Migration



Customer stories

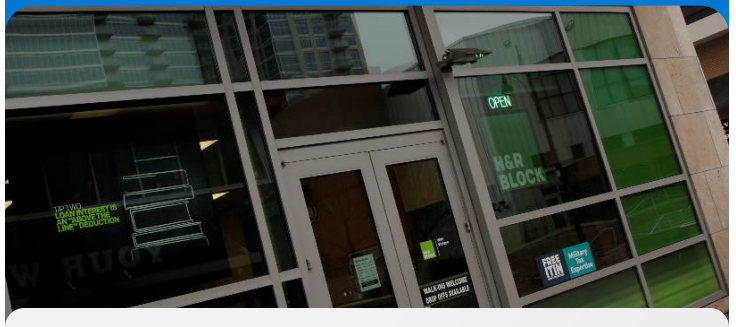
Modernization in the cloud for efficient business operations

KOMATSU

"We determined [Azure SQL Managed Instance] was the best choice for us in terms of scalability, cost, and performance.... We've seen a 49 percent cost reduction and 25 to 30 percent performance gains."

Nipun Sharma: Analytics Architect, Business Technology and Systems

Unified data architecture opened the door to AI and machine learning

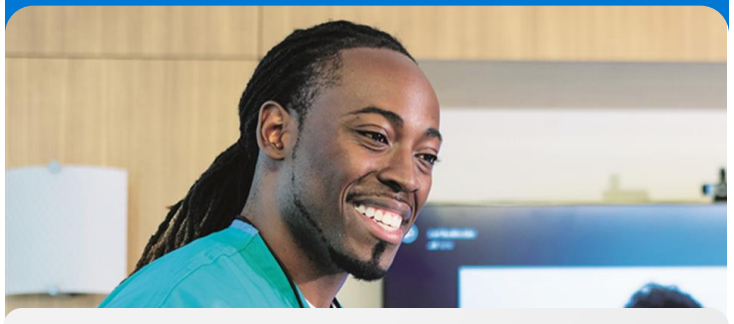


H&R BLOCK

"[SQL Managed Instance] gives us a smooth migration path for moving existing workloads to Azure with minimal technical reengineering."

Sameer Agarwal, Manager, Enterprise Data Analytics

Data transformation and real-time analytics



MCS

"With Azure SQL Managed Instance and Azure Data Factory, we can now serve more customers at the same time, helping us to grow in the future."

Sigfredo Garcia Irizarry, Asst Exec Vice President of IT

SQL Server vs Azure SQL Managed Instance

	SQL Server	Azure SQL Managed Instance
Deploy	Customer installs SQL, OS, and Infrastructure	Simple deploy: Pre-installed SQL and Infrastructure
Patching	Customer managed	Versionless
Physical file placement	Customer configures and tunes	Hands-free
FCI or AG	Customer deploys, configures, and monitors	Built-in, easy, switch, managed
Backups	Customer setups up DR plan, executes, and monitors	Built-in, redundant, managed, retention
Engine capabilities	Full 100% SQL Server engine	Almost 100% SQL Server engine
BI Services	Comes with license installed separately	Use other Azure services

Summary

- Azure SQL Managed Instance is the **best of SQL Server as a fully Managed Service with a versionless engine**
- **All the SQL Server instance capabilities** you need with a familiar engine, languages, and tools.
- **Enterprise class security** plus Azure Defender for SQL
- All the **performance capabilities and monitoring** of SQL you need
- **Built-in HADR** including replicas and redundant backups
- **Migrate** with almost zero downtime from SQL Server

Resources

Microsoft Learn: Azure SQL fundamentals learning path
aka.ms/azuresqlfundamentals

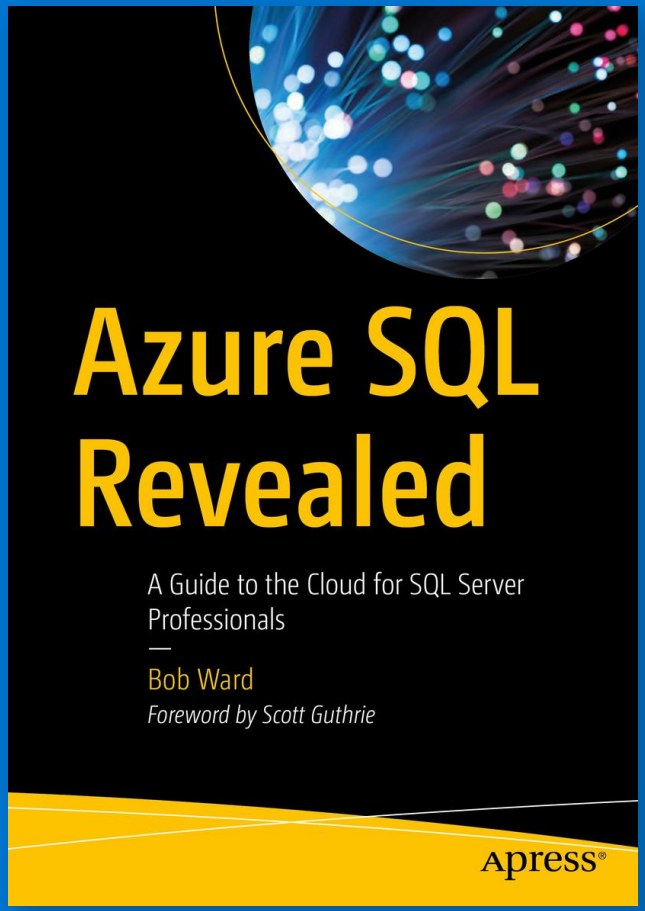
Select the Azure SQL Workshop
aka.ms/sqlworkshops

How to choose tool
aka.ms/chooseazuresql

Azure SQL documentation
aka.ms/azuresqldocs
aka.ms/azuresqlmi

Data Migration Guide
aka.ms/datamigration

More videos from our team
aka.ms/azuresql4beginners
aka.ms/dataexposed



aka.ms/azuresqlbook

Migrate to Azure SQL Database

Database migration journey

Assess

- Involve stakeholders
- Calculate your TCO
- Discover and evaluate apps

Migrate

- Select a migration strategy
- Find recommended tools
- Apply the migration strategy

Optimize

- Analyze your costs
- Save with offers
- Reinvest to do more

Secure and manage

- Industry-leading security
- Protect your data
- Monitor cloud health

Tools and services for your migration journey

Database Migration Service (DMS)

Enables offline & online migrations to Azure SQL Database

Data Migration Assistant (DMA)

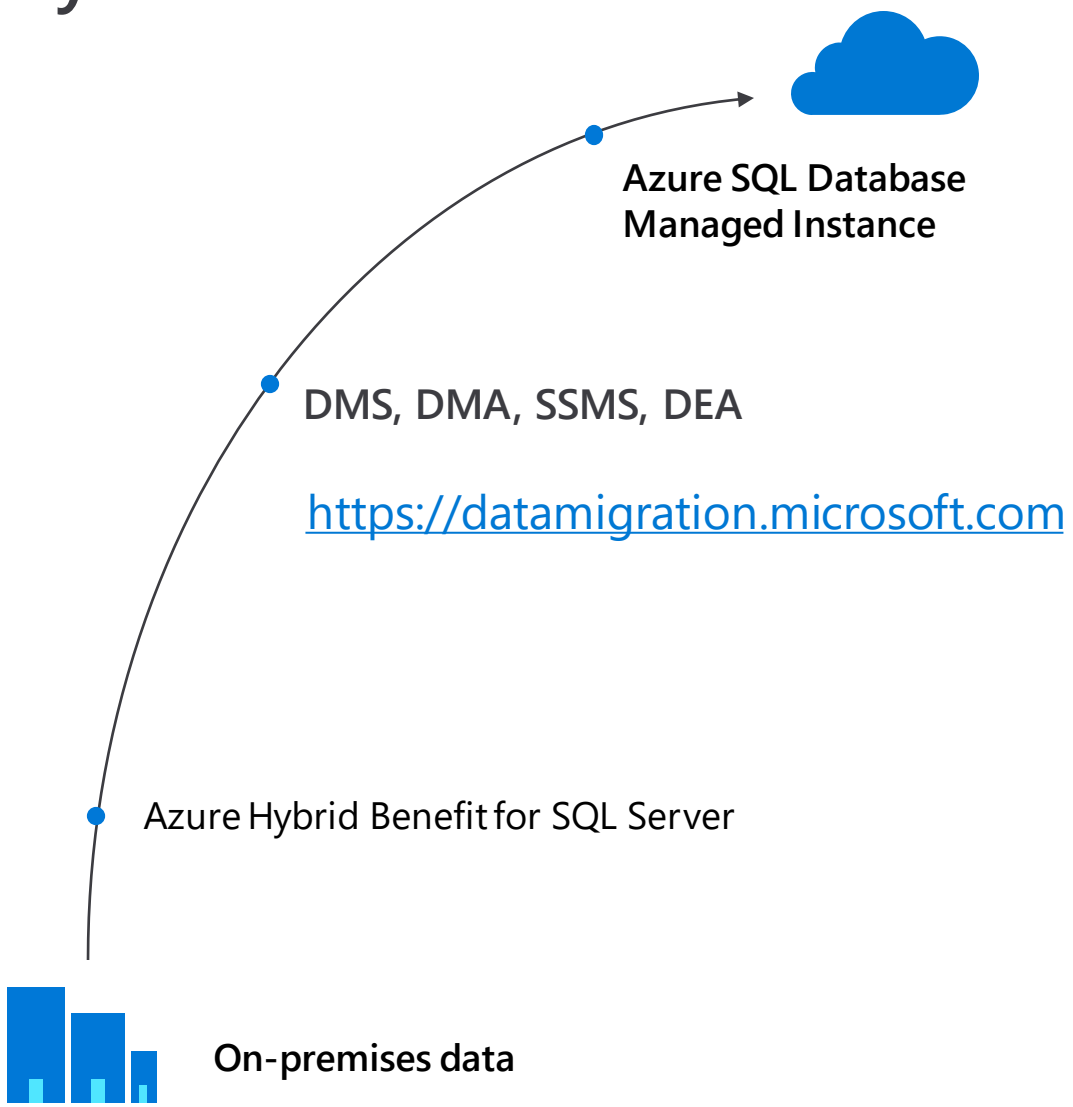
Assess database compatibility and feature parity

SQL Server Management Studio (SSMS)

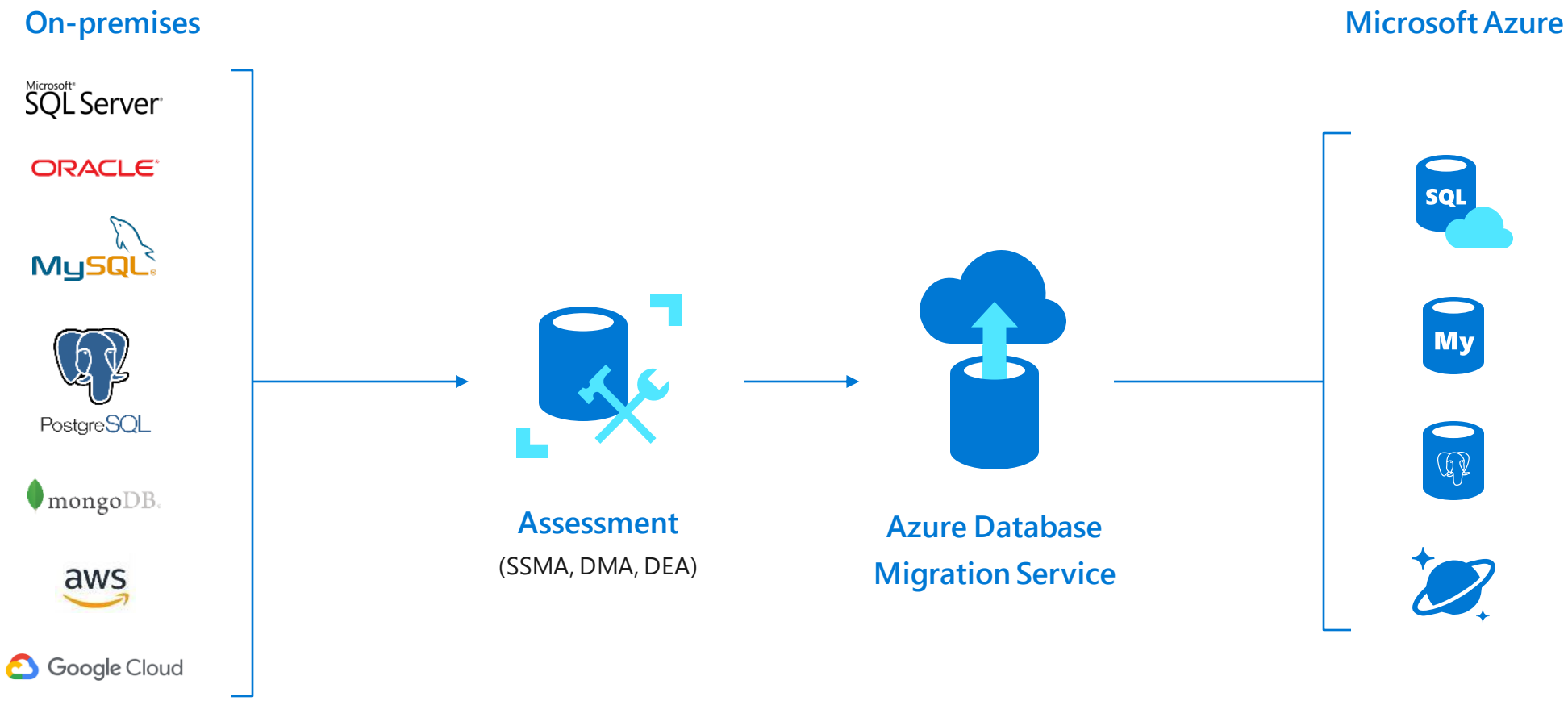
Integrated environment for managing SQL Server

Database Experimentation Assistant (DEA)

Evaluate target version of SQL Server for a given workload



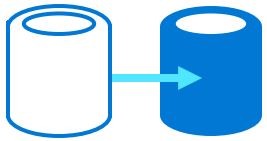
Tools and services for your migration journey



Azure Database Migration Service

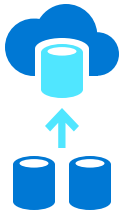
Accelerate your transition to Azure

Homogeneous sources



Heterogeneous sources

Orchestration



Scale migration

Near-zero downtime

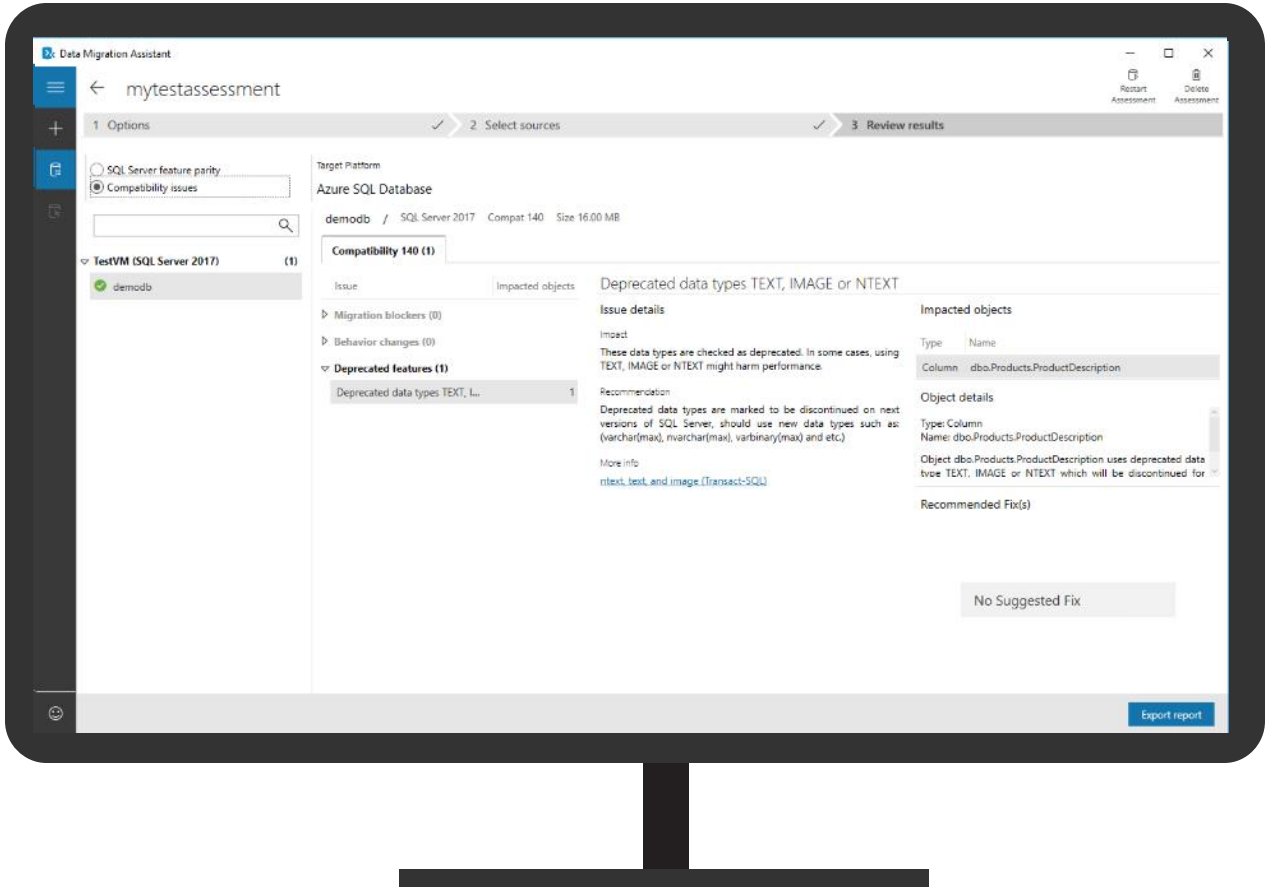
A seamless, end-to-end solution for moving on-premises databases to Azure

Data Migration Assistant

Assess on-premises SQL Server instance(s) for migrating to Azure SQL database(s)

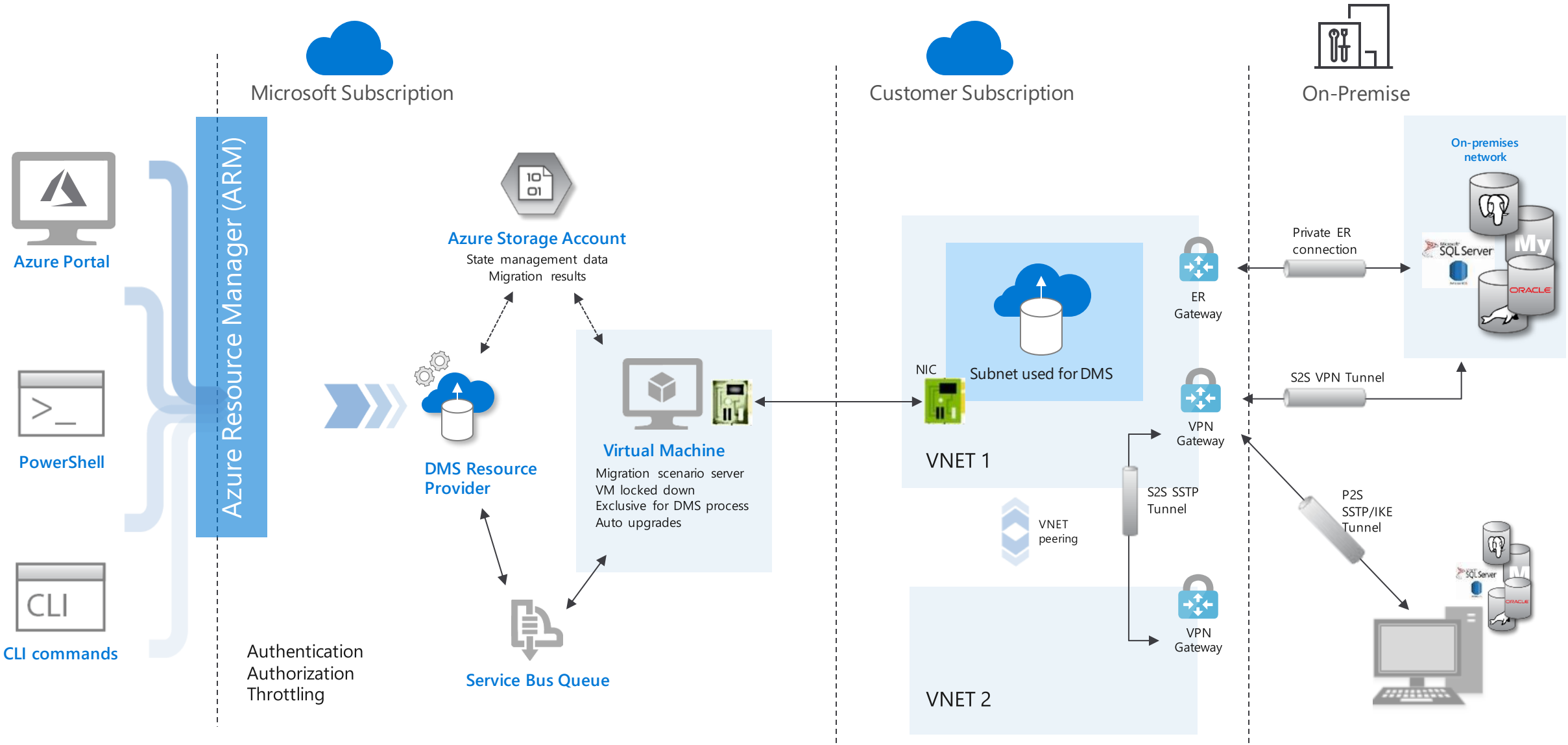
Discover issues that can affect an upgrade

Migrate an on-premises SQL Server instance to a modern SQL Server instance



Database Experimentation Assistant

Azure Database Migration Service



Online migration with backup and restore technology

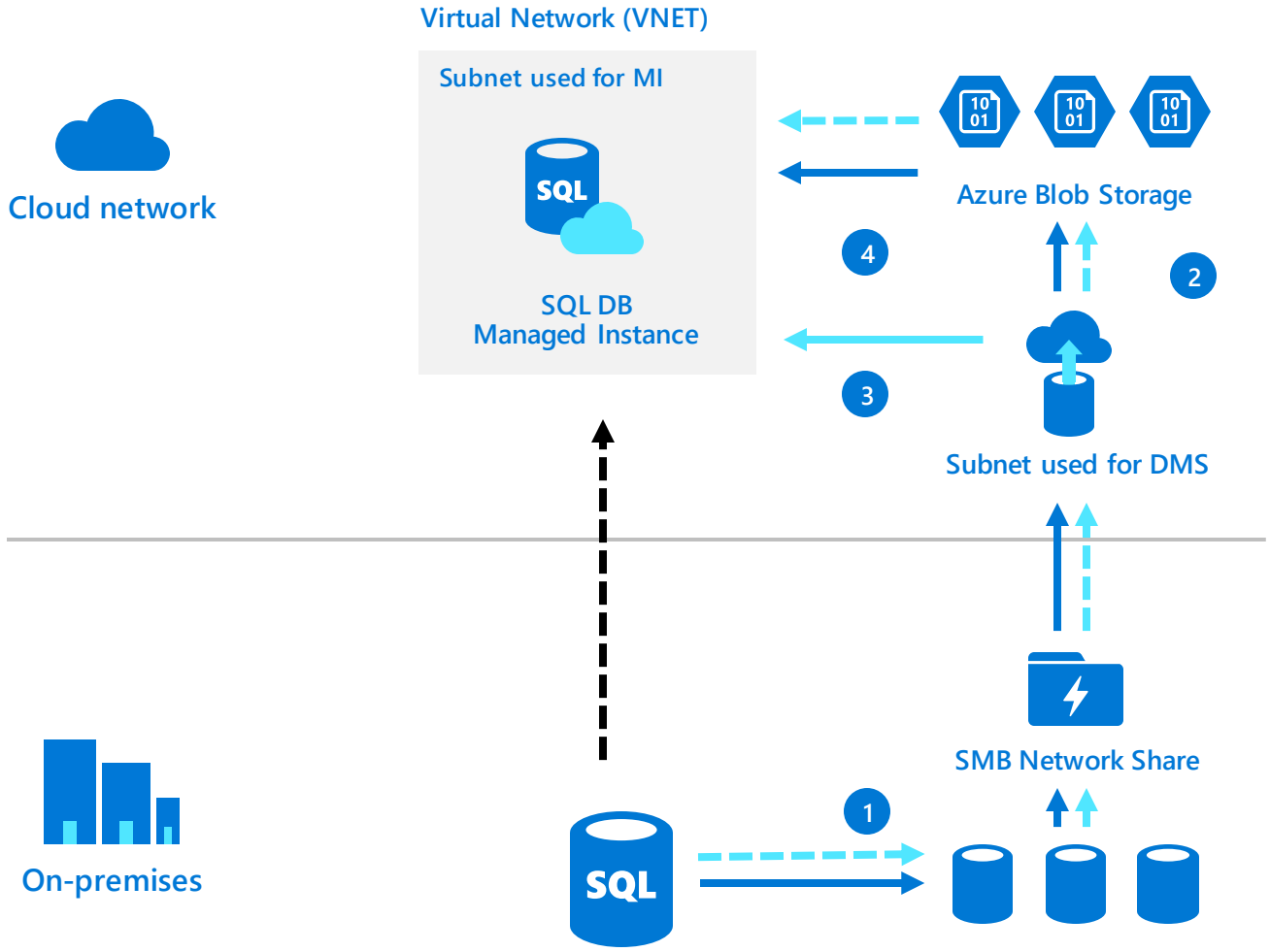
SQL Server to Azure SQL Database Managed Instance example

1. Provide existing backups in network share
2. DMS upload backup files to Azure storage
3. DMS initiate the migration to Managed Instance
4. Full backup restored and Transaction log backups continuously applied until cutover

Stop incoming traffic to source databases, provide Tail-Log backup, initiate cutover in DMS and change the application connection strings

Legend

- Full Database backup files
- Transaction log backup files
- Site to site connectivity (VPN or ExpressRoute)

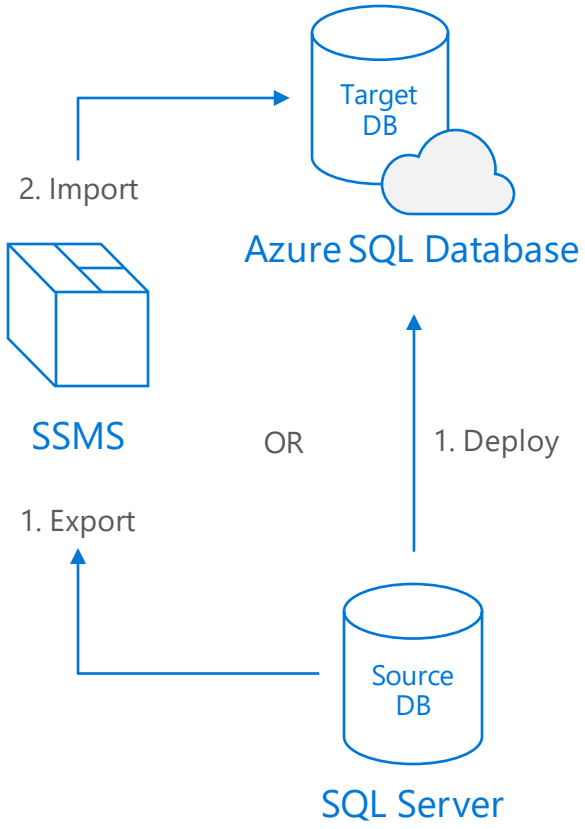


SQL server management studio

Migrate a compatible database using SQL Server Management Studio

Use SSMS to deploy to Azure SQL Database

Use SSMS to export a BACPAC and then import it to Azure SQL Database



Migration Cookbook

Migrate an on-premises SQL Server database to Azure SQL Database

The Migration Cookbook describes various approaches you can use to migrate an on-premises SQL Server database to the latest Azure SQL Database Update

Download: https://azure.microsoft.com/en-us/resources/choosing-your-database-migration-path-to-azure/en-us/

Migration Centre: https://azure.microsoft.com/en-us/migration/

Thank you

Migration vers Azure

Outils de migration | Azure migration center | Guide de migration | FastTrack pour Azure | Partenaires Expert Azure

Les clés de la réussite : Personnes | Méthologie | Technologie

Des outils pour chaque étapes

Evaluation

Azure Migrate

SQL Server Migration Assistant (SSMA)

Data Migration Assistant (DMA)

Migration

Azure Site Recovery (ASR)

Azure Database Migration Service

Azure Data Box

Optimisation

Azure Cost Management

Database Experimentation Assistant

Administration

Azure Security & Management (e.g., Blueprint, Security Center, Backup, Monitor)

Ainsi que des solutions partenaires

MOVERE
Cloudamize
CloudAtlas®
BitTitan
appOrbit
CHEF
STRATOZONE
turbonomic
DATOMETRY
Zerto
Corent
intigua
stiim
ATTUNITY
MORPHIS
Ispirer
Informatica
QuerySurge

Des outils pour chaque étapes

Evaluation

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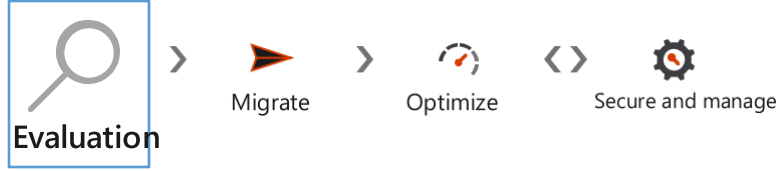
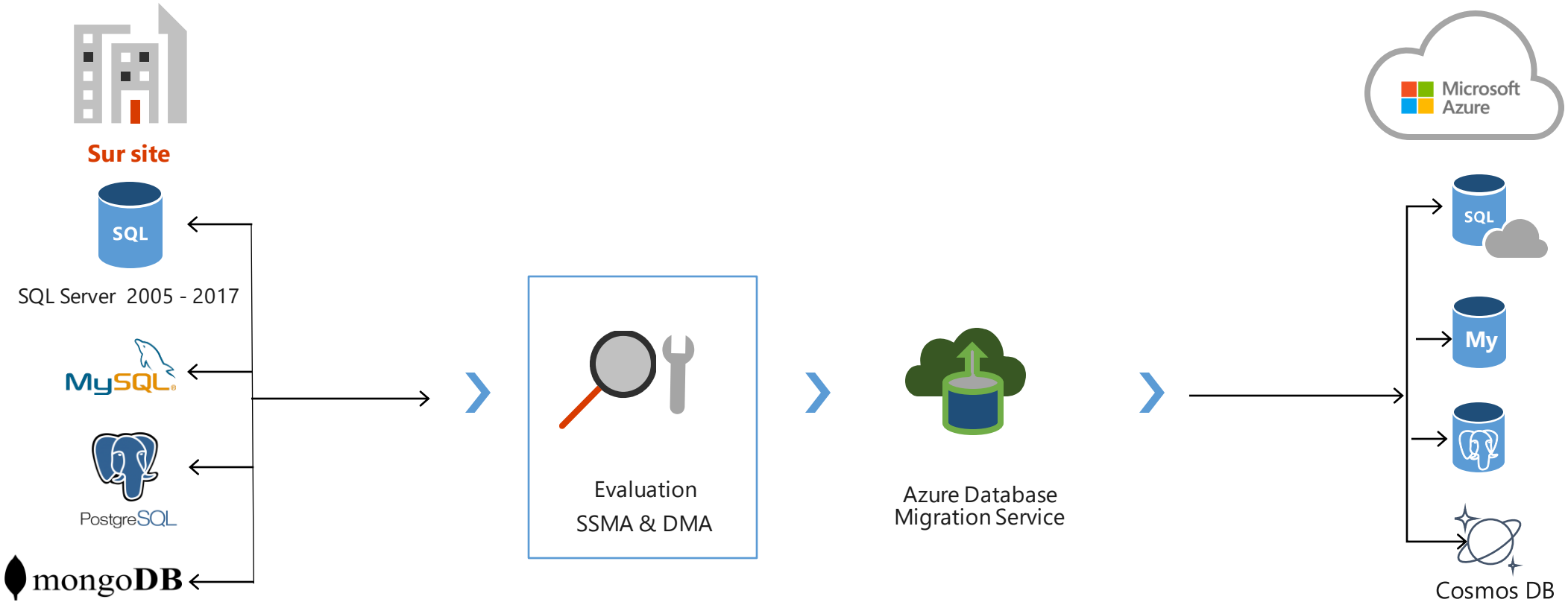
Informatica
QuerySurge



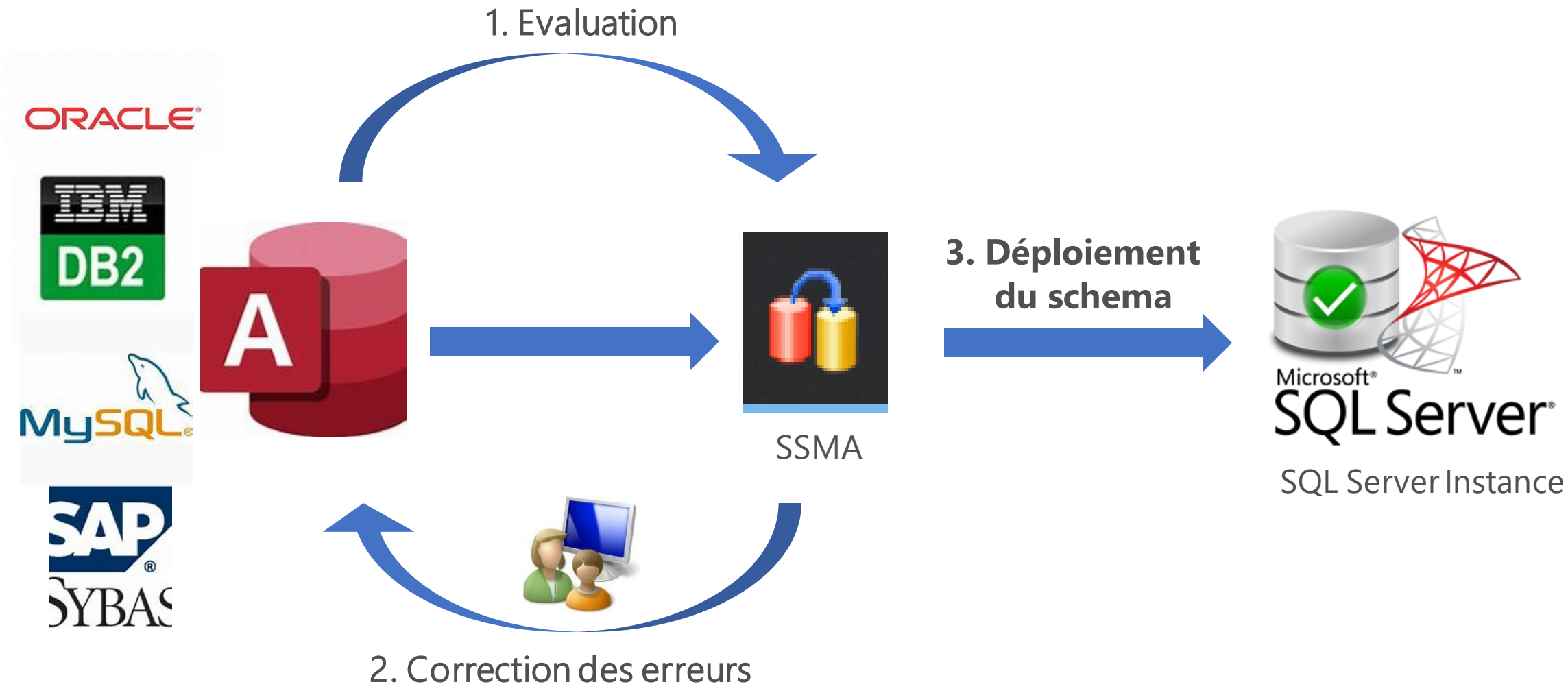
1ère phase : l'évaluation



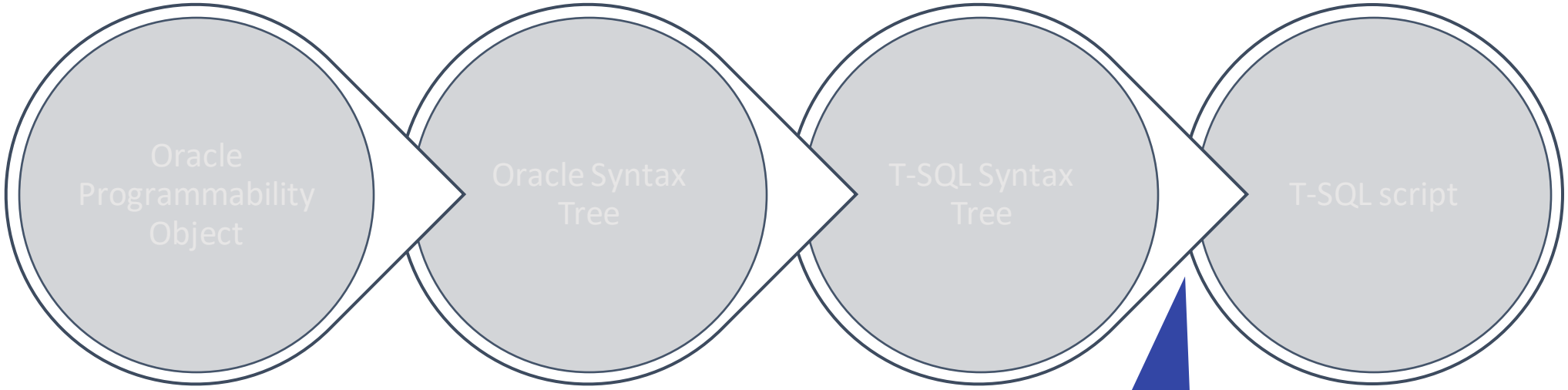
Les critères d’évaluations

- **Performance :** Analyser la performance actuelle et déterminer celle attendue après la migration.
- **Compliance :** Recenser si vous êtes soumis à des règles de sécurités spécifiques ou une régulation particulière.
- **Temps d’arrêt :** Comprendre les exigences métier concernant la charge de travail à migrer. Est-ce qu'un temps d'arrêt est acceptable ? Cela aura un impact sur l'approche de migration, l'ensemble des outils et les délais.
- **Plan de reprise :** Établir s'il y a des exigences de récupération après sinistre pour les charges de travail des applications prises en charge par la base de données et comprendre les exigences de RTO et de RPO.
- **Disponibilité :** Après la migration, quelles sont les exigences de disponibilités ?
- **Activités personnalisées** : Il peut y avoir des solutions tierces utilisés avec la base de données qui ne sont pas actuellement pris en charge sur Azure SQL Database.

SQL Server Migration Assistant (SSMA)



SSMA – Assistant de migration



SQL Server Migration Assistant

Microsoft SQL Server Migration Assistant (SSMA) est l'outil conçu pour automatiser les migrations vers SQL Server depuis Microsoft Access, IBM DB2, MySQL, Oracle, et SAP ASE.

Un outil par Bases de données sources :

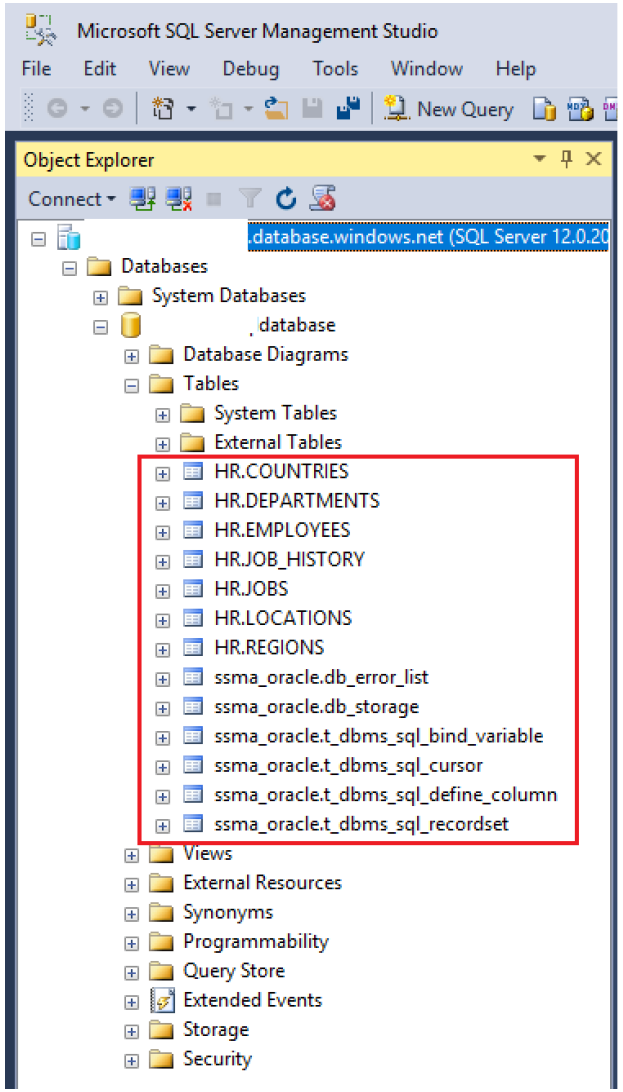
SSMA for Access
SSMA for DB2
SSMA for MySQL
SSMA for Oracle
SSMA for SAP ASE

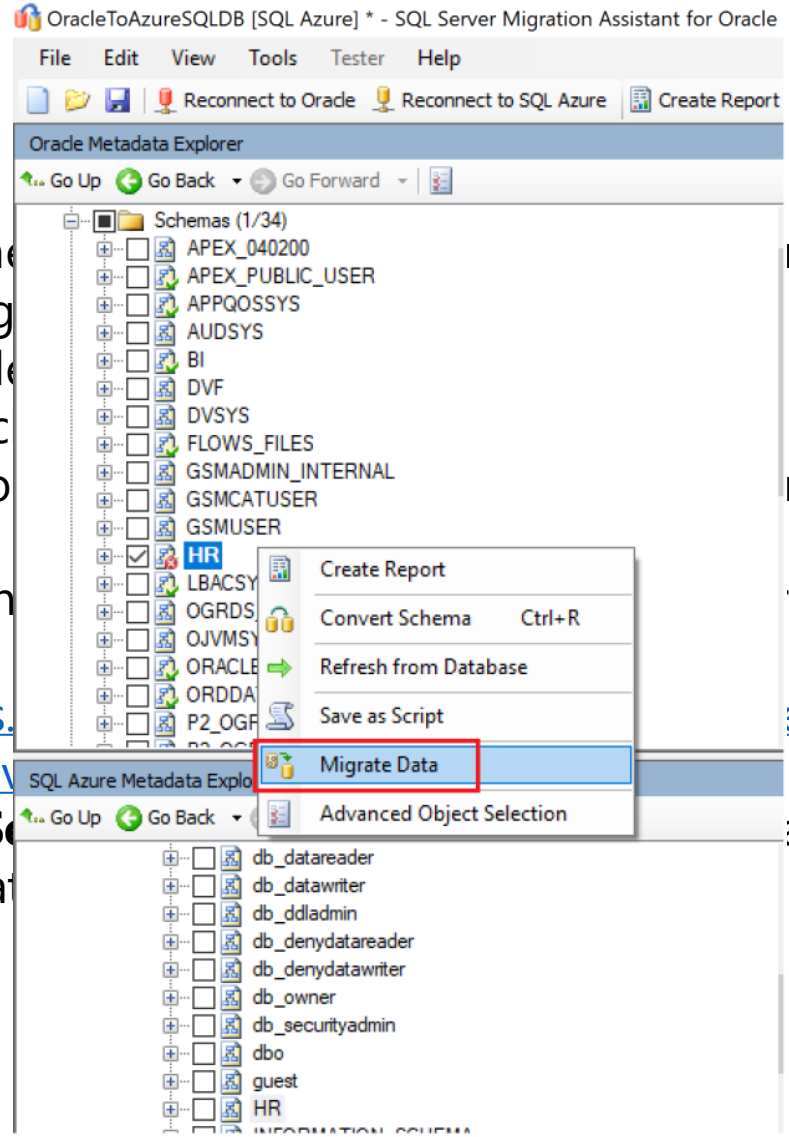
SQL Server Migration Assistant

Microsoft SQL Server Migration Assistant (SSMA) est l'outil conçu pour automatiser les migrations vers SQL Server depuis Microsoft Access, IBM DB2, MySQL, Oracle, et SAP ASE

Versions supportées :
SQL Server 2012
SQL Server 2014
SQL Server 2016
SQL Server 2017 on Windows and Linux
SQL Server 2019 on Windows and Linux
Azure SQL Database
Azure SQL Database Managed Instanced
Azure SQL Data Warehouse (uniquement avec SSMA pour Oracle).

Utilisation en mode graphique





Now that the
re SQL DB, we can proceed
to migrating
Under Oracle
select the sc
the data.
Right click o
rate Data.

Note: When
IaaS, follow the instructions
provided at
https://docs.
e/migrating-oracle-data-
into-sql-serv
to ensure **S**
are setup up correctly
before initiat

SSMA en ligne de commandes

```
Microsoft (R) SQL Server Migration Assistant Command Line Application
SSMA for Oracle Version 7.11.0
Copyright (C) Microsoft Corporation. All rights reserved.

Usage: SSMAforOracleConsole.exe
      -s|script scriptfile
          (required, XML file containing SSMA commands to be executed)
     [-v|variable variablevaluefile]
          (XML file containing values of parameter variables defined in the
           scriptfile)
     [-v|variable $variablename$ variablevalue]
          (override value for parameter variable defined in the scriptfile)
     [-c|serverconnection serverconnectionfile]
          (XML file containing connection information for servers involved in
           the migration project)
     [-l|log logfile]
          (log file for logging SSMA activities)
     [-e|projectenvironment projectenvironmentfolder]
          (custom project environment settings folder)
     [-x|xmloutput [xmloutputfile]]
          (console output in XML format, if not specified output by default
           is in `plain text' format)
     [-p|-securePassword add|remove|list|import|export]
          (password management, must be the only option in command line, type
           -p -? for more options)
     [-?](show syntax summary)
```

Example: SSMAforOracleConsole.exe
-s C:\SSMABin\ssma-script.xml
-c C:\SSMABin\ssma-server.xml
-v C:\SSMABin\variable-value.xml
-v $myvar$ new-value
-e C:\SSMA-Environment
-l C:\SSMABIN\Logs\SSMAlog.txt

Database Migration Assistant

Depuis Azure Migrate ou en locale

Azure Data Migration Assistant

- Détecte les problèmes de compatibilité
  - SQL Server, Azure SQL Database et Managed Instance
  - Caractéristiques partiellement prises en charge ou non prises en charge
- Recommande des améliorations de performance et de fiabilité
  - Propose la mise en oeuvre de nouvelles fonctionnalités
- Migrez vers une plate-forme cible prise en charge
  - SQL Server 2012 et +
  - Azure SQL Database
  - Azure SQL Database Managed Instance

Data Migration Assistant (Administrator)

Projects

New project

Get started here

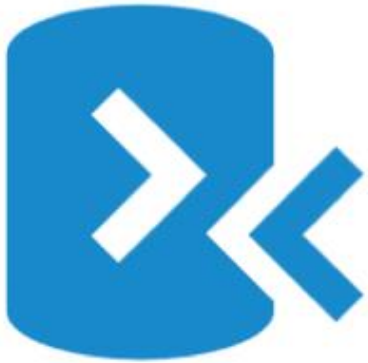
Click this button to create a new project.

Recent

No recent project

Open project

Welcome to Data Migration Assistant



Data Migration Assistant (Administrator)

Projects

New project

Assessment project

Migration project

No recent project

Open project

Welcome to Data Migration Assistant

Data Migration Assistant (Administrator)

Projects

New project

Recent

No recent project

Open project

New Assessment

Project name

Assessment0112

Where

Browse

MyDocument > AssessmentProject > SQL...

Source server type

SQL Server

Target server type

Azure SQL Database

Create

Welcome to Data Migration Assistant

Data Migration Assistant

Assessment0112

Delete Assessment

1 Options > 2 Select sources > 3 Review results

Select report type

Check database compatibility

Discover migration blocking issues and deprecated features by analyzing databases you choose in your source server to be migrated to SQL Database.

Check feature parity

Discover unsupported or partially-supported features and functions that your applications may rely on. Get guidance around these areas that may need some re-engineering.

Benefit from new features (coming soon...)

Discover new SQL Database features that are applicable to the databases in your source once migrated to SQL database platform.

Next

Data Migration Assistant

Assessment0112

Export Assessment | Restart Assessment | Delete Assessment

1 Options ✓ | 2 Select sources ✓ | 3 Review results

SQL Server featu e parity
Compatibility issues

Target Platform

Azure SQL Database V12

Inventory / SQL Server 2008 Compat 80 Size 5.29 GB

10.125.14.81 (6)

- U000010
- U000011
- U000012
- U000013
- U000014
- U000015

Issue	Impacted objects
Migration blockers (8)	
New column in output of 'sp_h...	4
Discontinued DBCC command...	4
Remove user-defined type (UD...	1
Detected statements that refer...	1
Constant expressions are not a...	1
SQL Mail has been discontinued	1
FOR BROWSE is not allowed in...	1
Table hints in indexed view def...	1
Behavior changes (5)	
Unqualified Join(s) detected	2
SERVERPROPERTY('LCID') resul...	2
SET ROWCOUNT used in the c...	1
FOR XML AUTO queries return...	1
ORDER BY specifies integer or...	1
Deprecated features (2)	
Deprecated data types TEXT, I...	4
Remove references to undocu...	1

Remove user-defined type (UDT)s named after the reserved GEOMETRY and GEOGRAPHY data types.

Issue details

Impact

Microsoft SQL Server introduced new data types GEOMETRY and GEOGRAPHY for storing "Spatial Data". The terms used for spatial data types should not be used as names for either common language runtime (CLR) or alias UDTs.

Recommendation

Remove UDTs named after the reserved GEOMETRY and GEOGRAPHY data types.

More info

Remove UDTs named after the reserved GEOMETRY and GEOGRAPHY data types

Impacted objects

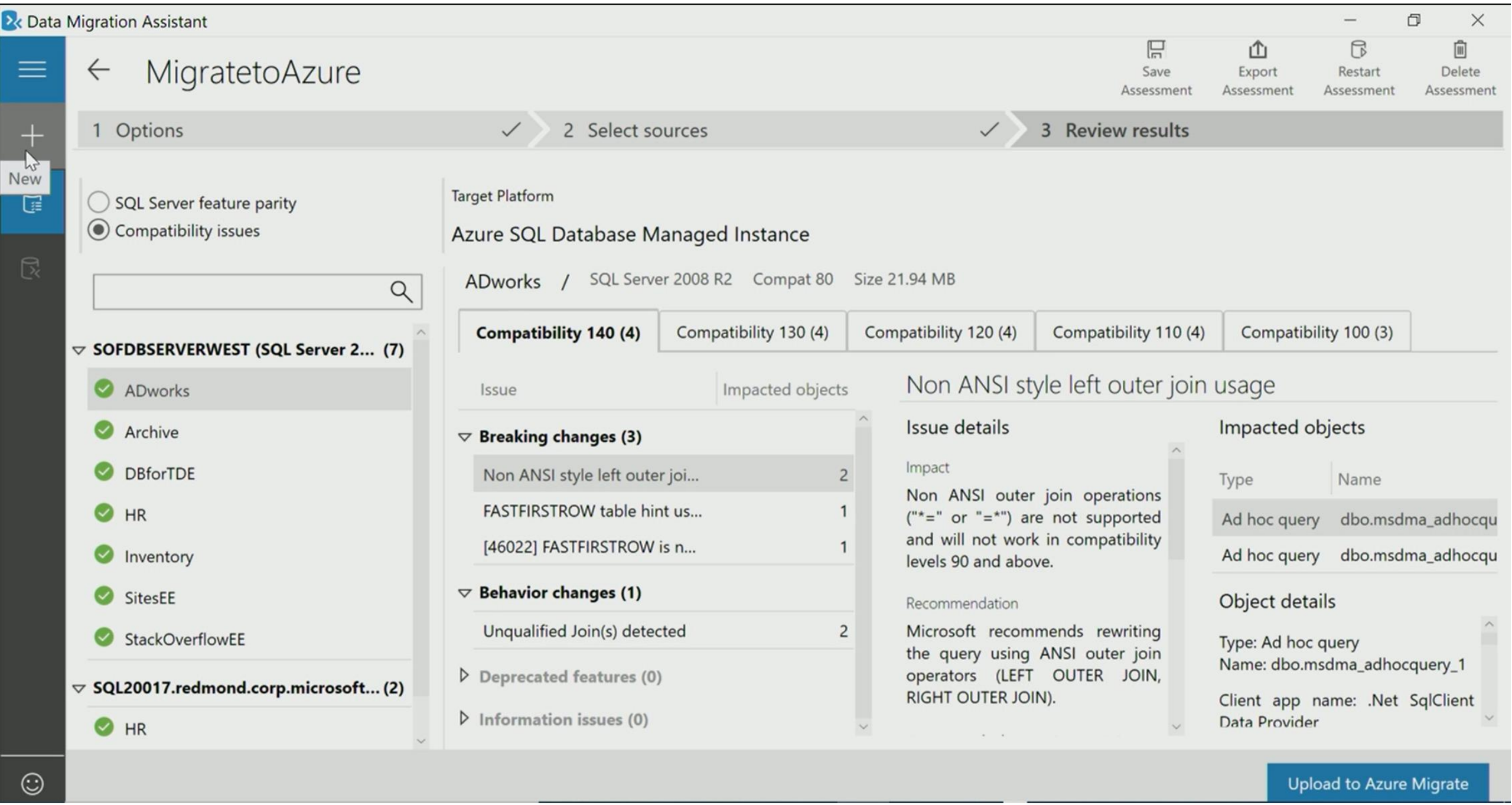
Type	Name
DataType	dbo.GEOMETRY

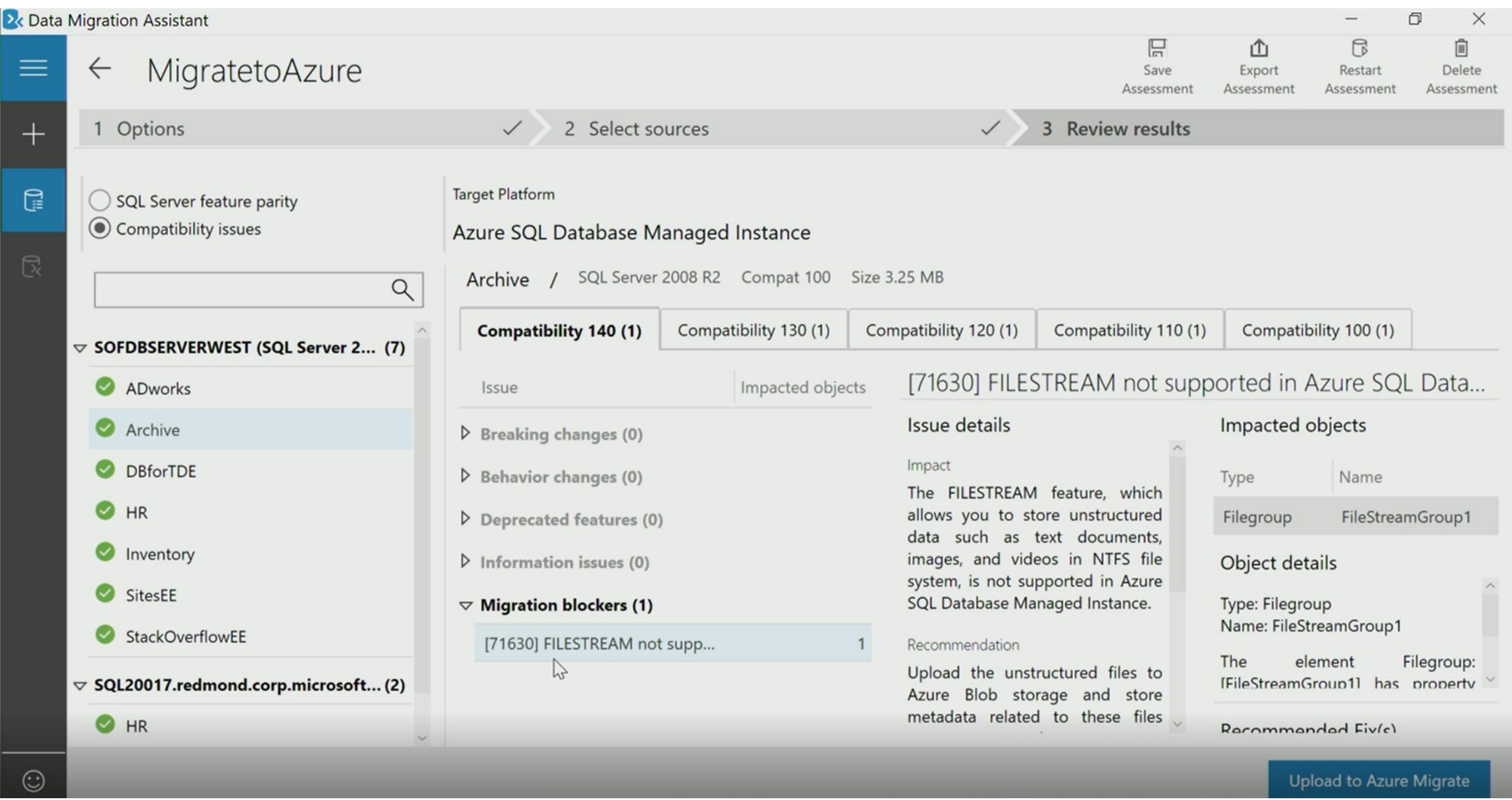
Object details

Type: DataType
Name: dbo.GEOMETRY

User Defined Types should not be named as GEOMETRY or GEOGRAPHY. Remove UDTs named after the reserved GEOMETRY and GEOGRAPHY data types.

Save as | Upload to Azure


Data Migration Assistant
MigratetoAzure
Save Assessment
Export Assessment
Restart Assessment
Delete Assessment
New
1 Options
2 Select sources
3 Review results
SQL Server feature parity
Compatibility issues
Target Platform
Azure SQL Database Managed Instance
ADworks / SQL Server 2008 R2 Compat 80 Size 21.94 MB
Compatibility 140 (4)
Compatibility 130 (4)
Compatibility 120 (4)
Compatibility 110 (4)
Compatibility 100 (3)
SOFDBSERVERWEST (SQL Server 2... (7)
ADworks
Archive
DBforTDE
HR
Inventory
SitesEE
StackOverflowEE
SQL20017.redmond.corp.microsoft... (2)
HR
Issue
Impacted objects
Breaking changes (3)
Non ANSI style left outer joi... 2
FASTFIRSTROW table hint us... 1
[46022] FASTFIRSTROW is n... 1
Behavior changes (1)
Unqualified Join(s) detected 2
Deprecated features (0)
Information issues (0)
Non ANSI style left outer join usage
Issue details
Impact
Non ANSI outer join operations ("*=" or "=*") are not supported and will not work in compatibility levels 90 and above.
Recommendation
Microsoft recommends rewriting the query using ANSI outer join operators (LEFT OUTER JOIN, RIGHT OUTER JOIN).
Impacted objects
Type
Name
Ad hoc query dbo.msdma_adhocqu
Ad hoc query dbo.msdma_adhocqu
Object details
Type: Ad hoc query
Name: dbo.msdma_adhocquery_1
Client app name: .Net SqlClient Data Provider
Upload to Azure Migrate


Data Migration Assistant
MigratetoAzure
Save Assessment
Export Assessment
Restart Assessment
Delete Assessment
1 Options
2 Select sources
3 Review results
SQL Server feature parity
Compatibility issues
Target Platform
Azure SQL Database Managed Instance
Archive / SQL Server 2008 R2 Compat 100 Size 3.25 MB
Compatibility 140 (1)
Compatibility 130 (1)
Compatibility 120 (1)
Compatibility 110 (1)
Compatibility 100 (1)
SOFDBSERVERWEST (SQL Server 2... (7)
ADworks
Archive
DBforTDE
HR
Inventory
SitesEE
StackOverflowEE
SQL20017.redmond.corp.microsoft... (2)
HR
Issue
Impacted objects
Breaking changes (0)
Behavior changes (0)
Deprecated features (0)
Information issues (0)
Migration blockers (1)
[71630] FILESTREAM not supp... 1
[71630] FILESTREAM not supported in Azure SQL Data...
Issue details
Impact
The FILESTREAM feature, which allows you to store unstructured data such as text documents, images, and videos in NTFS file system, is not supported in Azure SQL Database Managed Instance.
Recommendation
Upload the unstructured files to Azure Blob storage and store metadata related to these files
Impacted objects
Type
Name
Filegroup
FileStreamGroup1
Object details
Type: Filegroup
Name: FileStreamGroup1
The element Filegroup:
Upload to Azure Migrate

Data Migration Assistant

MigratetoAzure

Save Assessment | Export Assessment | Restart Assessment | Delete Assessment

1 Options ✓ > 2 Select sources ✓ > 3 Review results

- SQL Server feature parity
- Compatibility issues

Target Platform

Azure SQL Database Managed Instance

ADworks
Archive
DBforTDE
HR
Inventory
SitesEE
StackOverflowEE

SQL20017.redmond.corp.microsoft... (2)

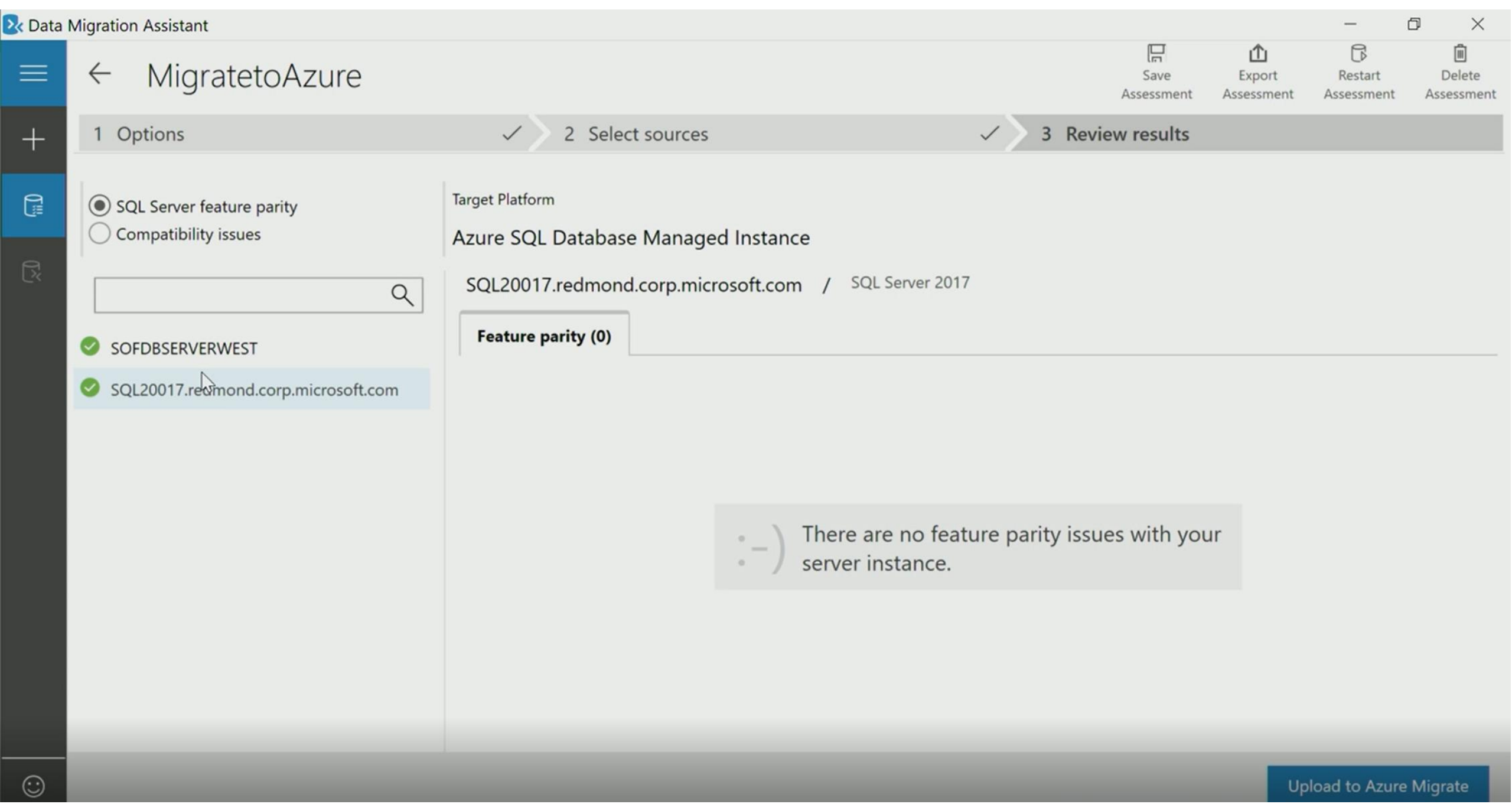
HR
PartsUnlimitedDB

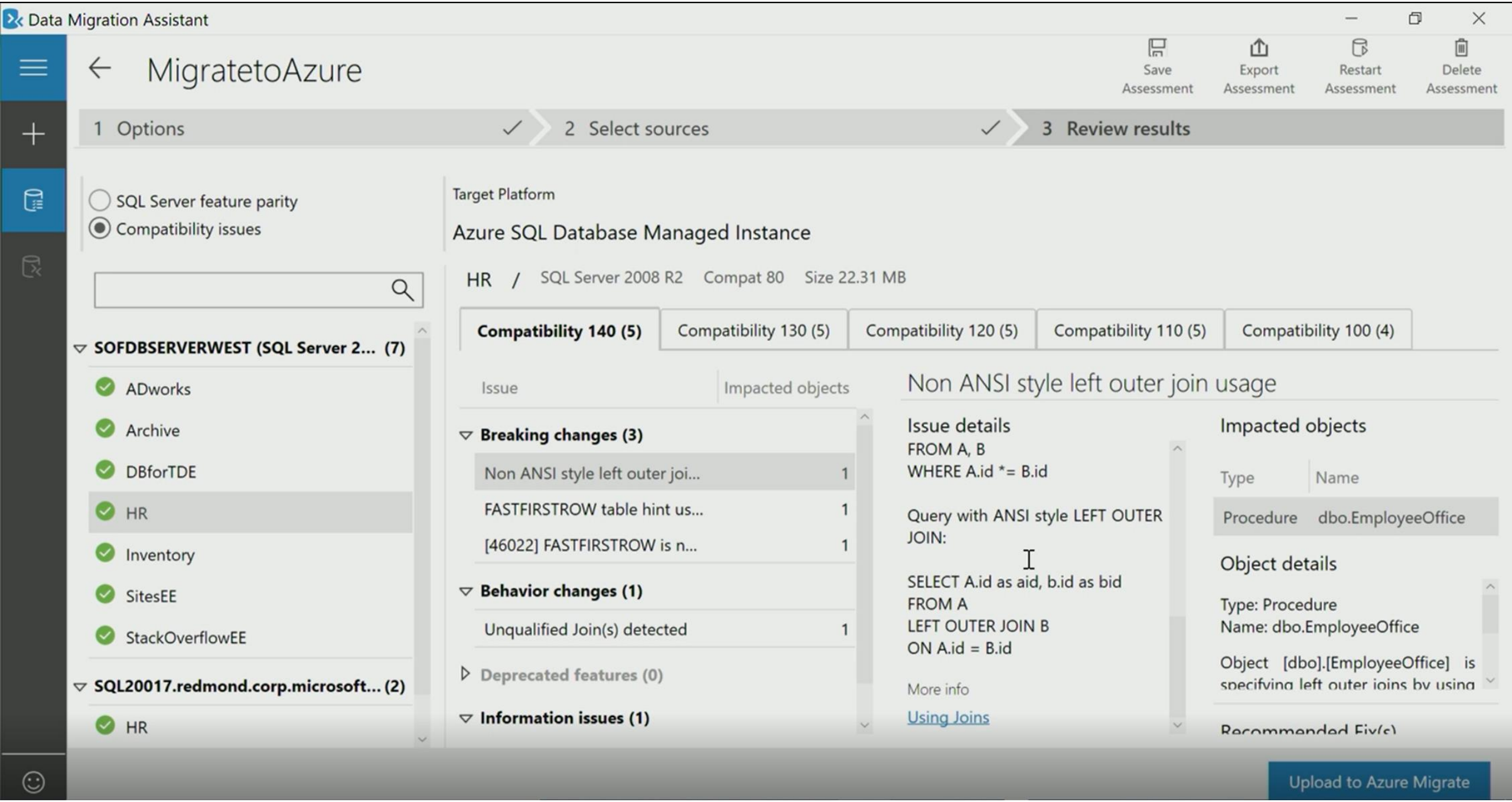
PartsUnlimitedDB / SQL Server 2017 Compat 140 Size 144.00 MB

Compatibility 140 (0)

:-) There are no compatibility issues with your database.

Upload to Azure Migrate


Data Migration Assistant
MigratetoAzure
Save Assessment
Export Assessment
Restart Assessment
Delete Assessment
1 Options
2 Select sources
3 Review results
SQL Server feature parity
Compatibility issues
Target Platform
Azure SQL Database Managed Instance
SQL20017.redmond.corp.microsoft.com / SQL Server 2017
Feature parity (0)
SOFDBSERVERWEST
SQL20017.redmond.corp.microsoft.com
There are no feature parity issues with your server instance.
Upload to Azure Migrate


Data Migration Assistant
MigratetoAzure
Save Assessment
Export Assessment
Restart Assessment
Delete Assessment
1 Options
2 Select sources
3 Review results
SQL Server feature parity
Compatibility issues
Target Platform
Azure SQL Database Managed Instance
HR / SQL Server 2008 R2 Compat 80 Size 22.31 MB
Compatibility 140 (5)
Compatibility 130 (5)
Compatibility 120 (5)
Compatibility 110 (5)
Compatibility 100 (4)
SOFDBSERVERWEST (SQL Server 2... (7)
ADworks
Archive
DBforTDE
HR
Inventory
SitesEE
StackOverflowEE
SQL20017.redmond.corp.microsoft... (2)
HR
Issue
Impacted objects
Breaking changes (3)
Non ANSI style left outer joi... 1
FASTFIRSTROW table hint us... 1
[46022] FASTFIRSTROW is n... 1
Behavior changes (1)
Unqualified Join(s) detected 1
Deprecated features (0)
Information issues (1)
Non ANSI style left outer join usage
Issue details
FROM A, B
WHERE A.id *= B.id
Query with ANSI style LEFT OUTER JOIN:
SELECT A.id as aid, b.id as bid
FROM A
LEFT OUTER JOIN B
ON A.id = B.id
More info
Using Joins
Impacted objects
Type
Name
Procedure dbo.EmployeeOffice
Object details
Type: Procedure
Name: dbo.EmployeeOffice
Object [dbo].[EmployeeOffice] is specifying left outer joins by using
Recommended Fix(s)
Upload to Azure Migrate

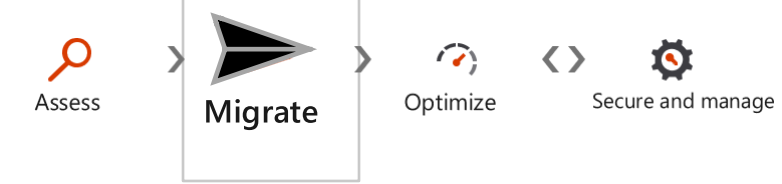
DMA en mode ligne de commandes

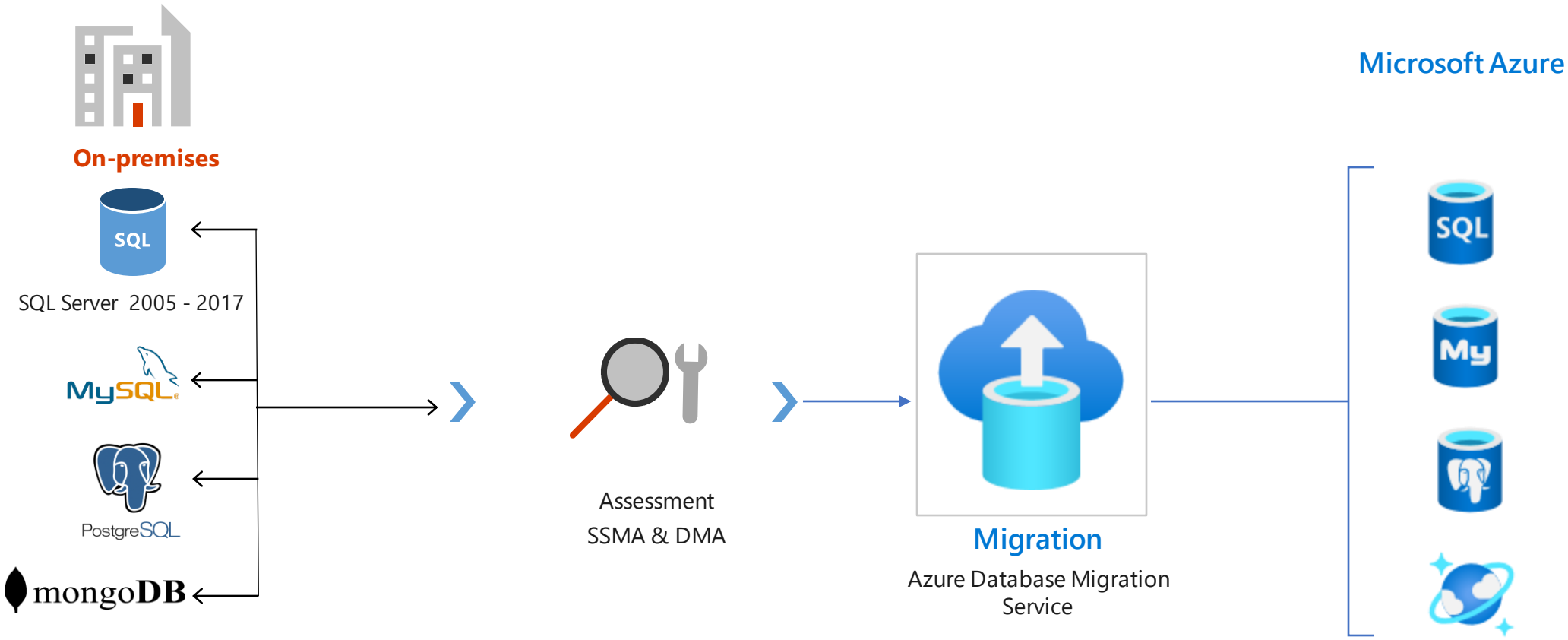
```
DmaCmd.exe /help

/?                                                  Get help
/help                                               Get help

/AssessmentName                                     Name of the assessment
/AssessmentDatabases                                Space delimited connection strings
/AssessmentTargetPlatform                           Target platform for the assessment:
   supported values: AzureSqlDatabase, ManagedSqlServer, SqlServer2012, SqlServer2014,
SqlServer2016, SqlServerLinux2017 and SqlServerWindows2017 (default)
/AssessmentEvaluateCompatibilityIssues              Run compatibility rules
/AssessmentEvaluateRecommendations                  Run feature recommendation
/AssessmentEvaluateFeatureParity                    Run feature parity rules
/AssessmentOverwriteResult                          Overwrite the result file
/AssessmentResultJson                               Full path to the JSON result file
/AssessmentResultCsv                                Full path to the CSV result file
```

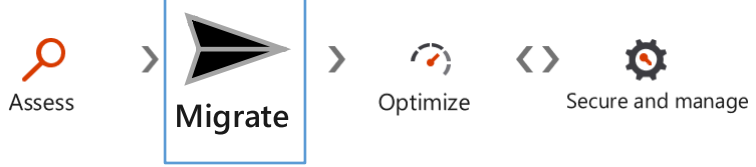
2ème phase : Migration





Migration iso | Arrêt de service minimum | “Usine à migration” (env multiple)

Azure Data Box

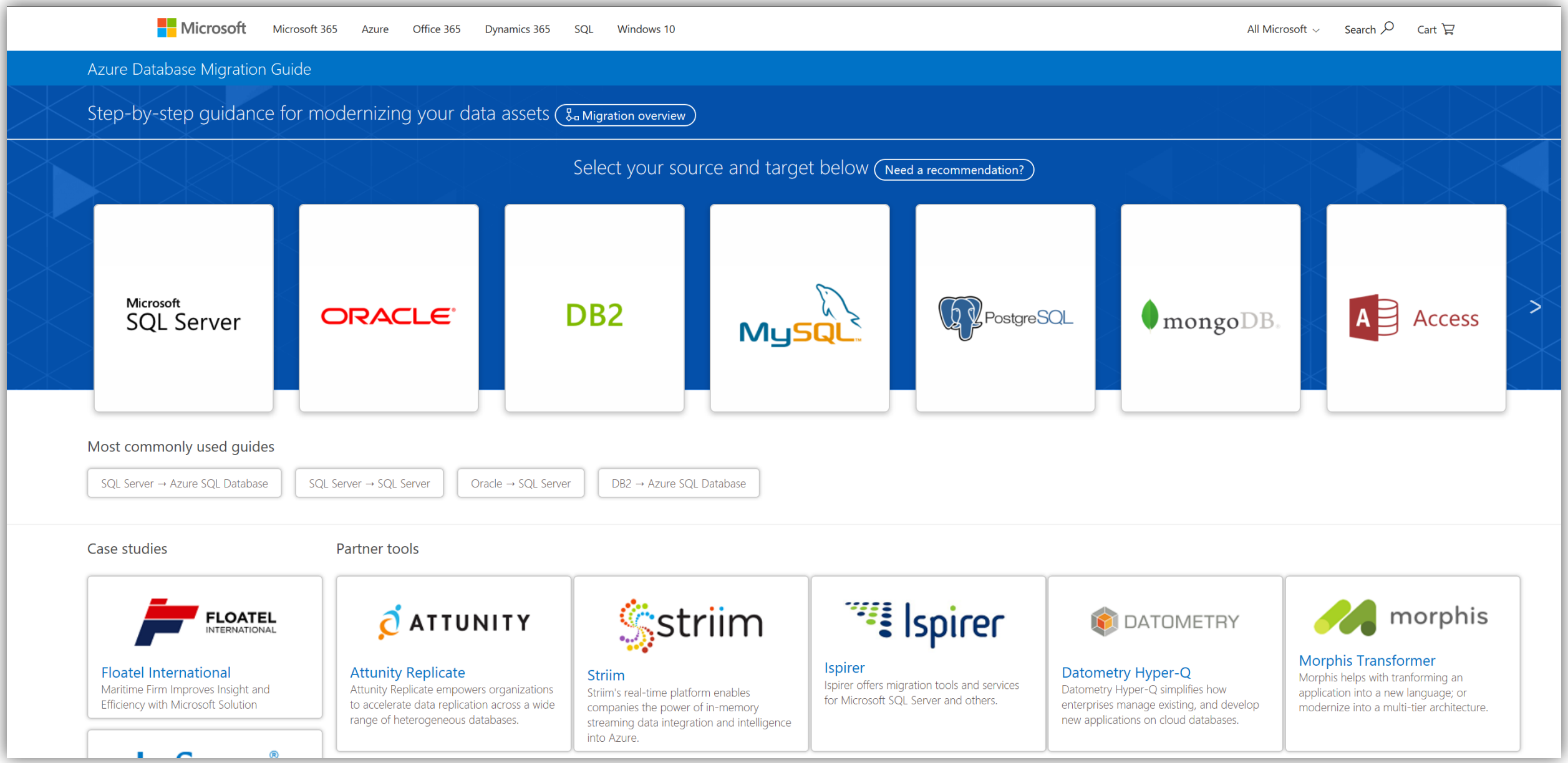


Gateway

100 TB

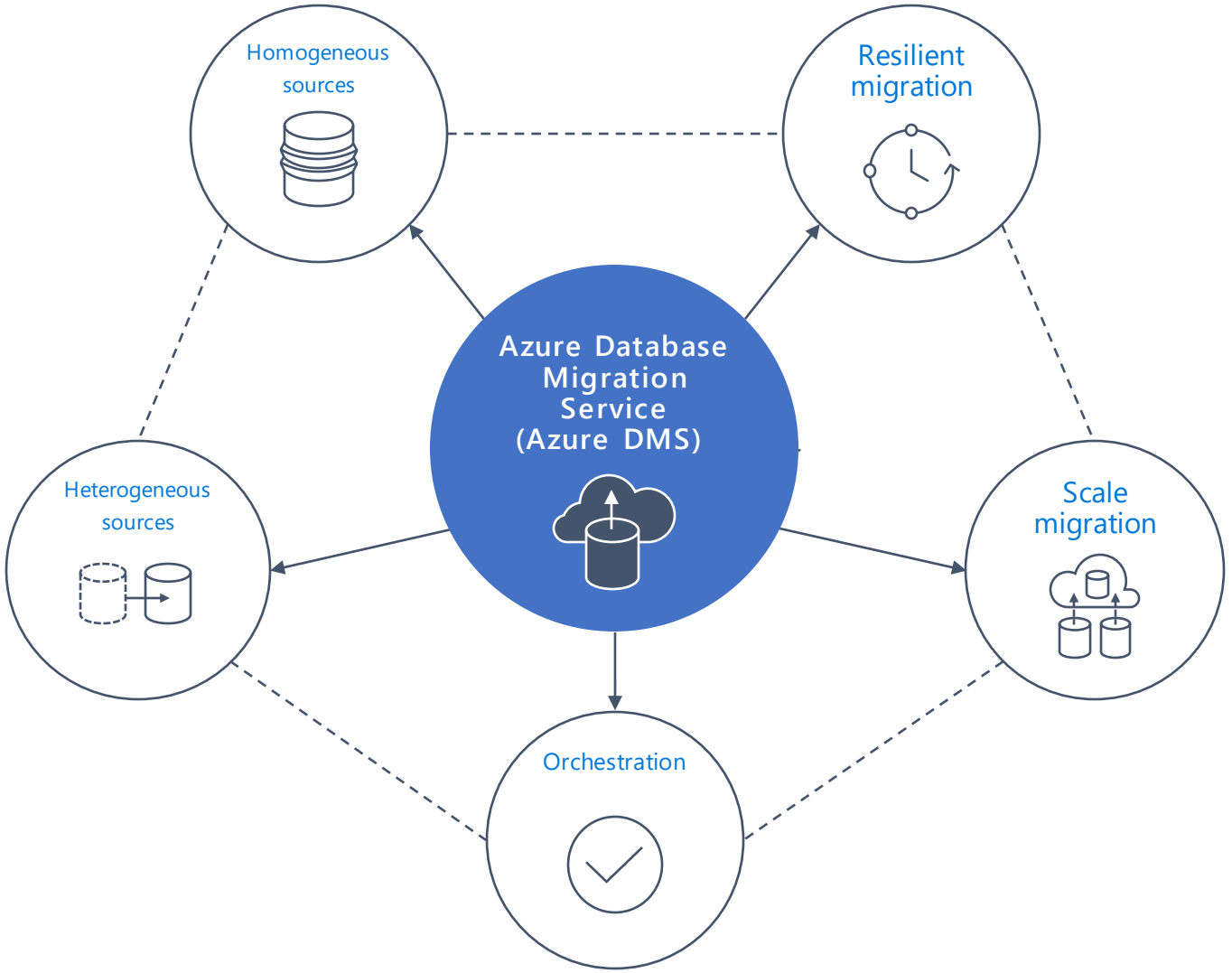
Heavy (1 PB)

Database Migration Guide: http://aka.ms/datamigration

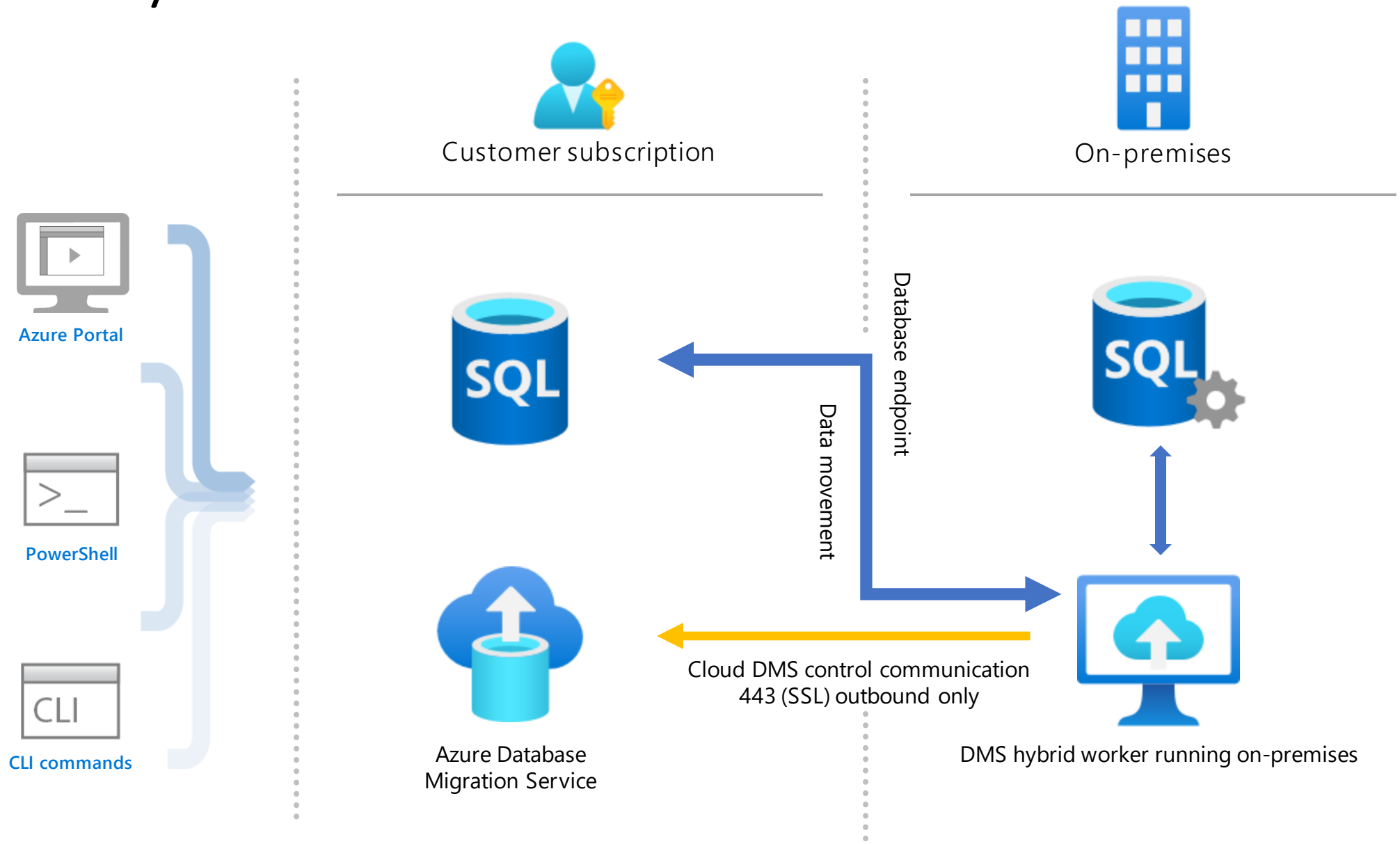


Azure Database Migration Service

Le service pour prendre en charge de bout en bout la migration des bases de données vers le cloud Azure



DMS hybride mode

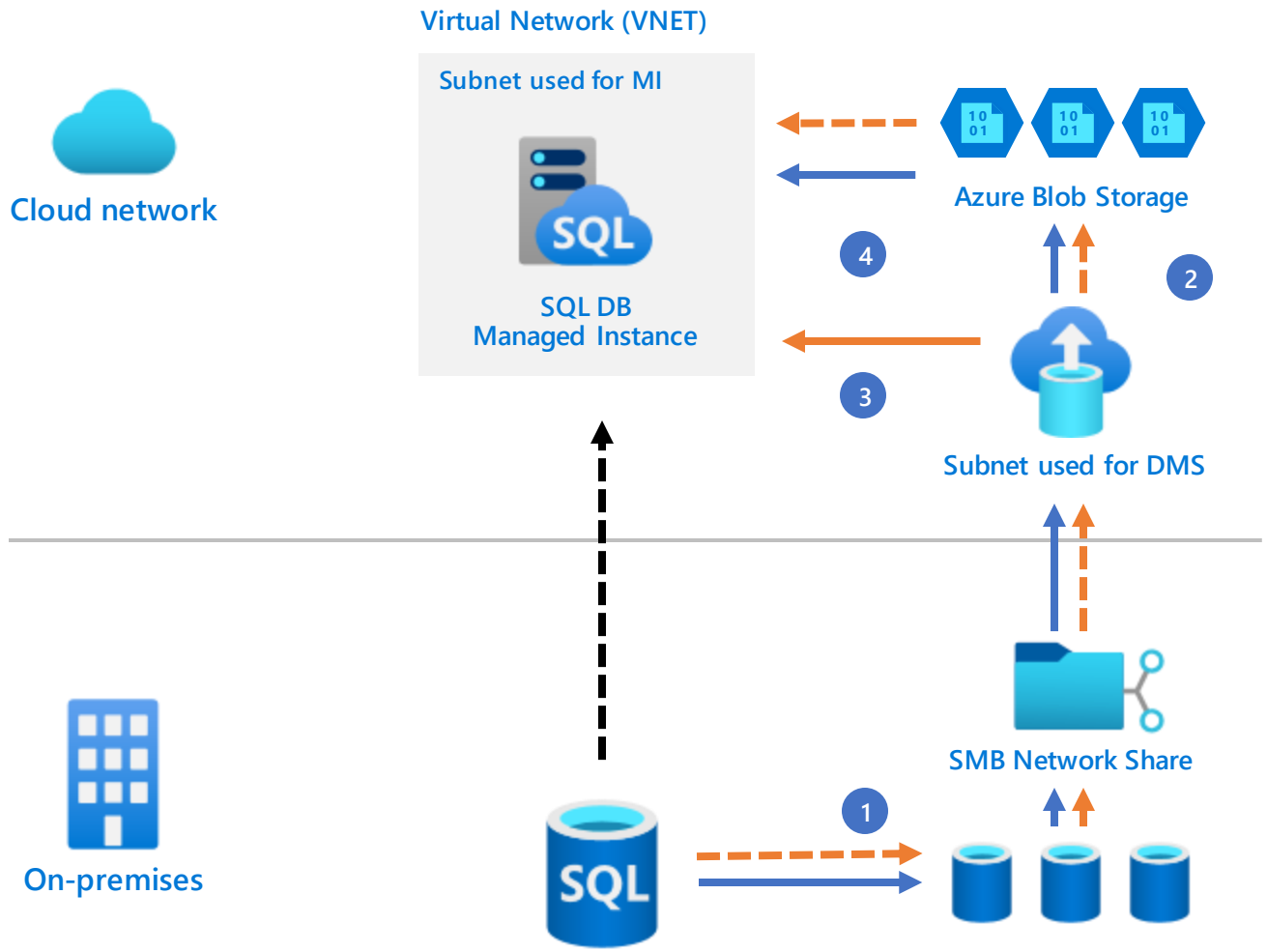


Migration “Online”

SQL Server vers Azure SQL Database Managed Instance exemple

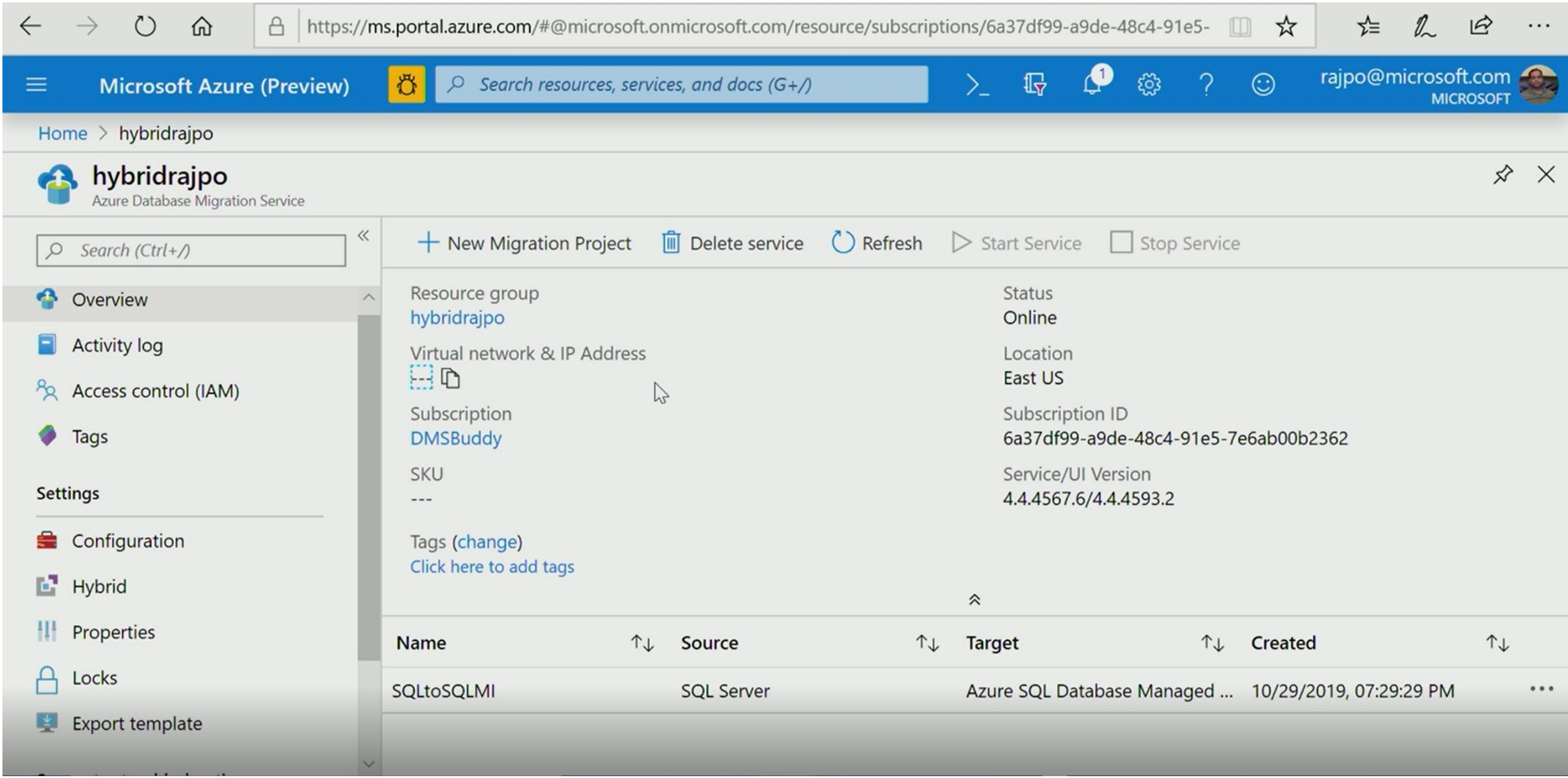
1. Dépôt des sauvegardes existantes sur un partage réseau
2. DMS télécharge les fichiers de sauvegarde dans le stockage Azure
3. DMS initie la migration vers l'instance gérée
4. Sauvegarde complète restaurée et application des journaux de transactions jusqu'à la coupure

- Arrêter le trafic entrant vers les bases de données sources, fournir la dernière sauvegarde ‘Tail-Log’, initier la bascule dans DMS et modifier les chaînes de connexion des applications



Légende

- Full Database backup files
- Transaction log backup files
- Site to site connectivity (VPN or ExpressRoute)


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
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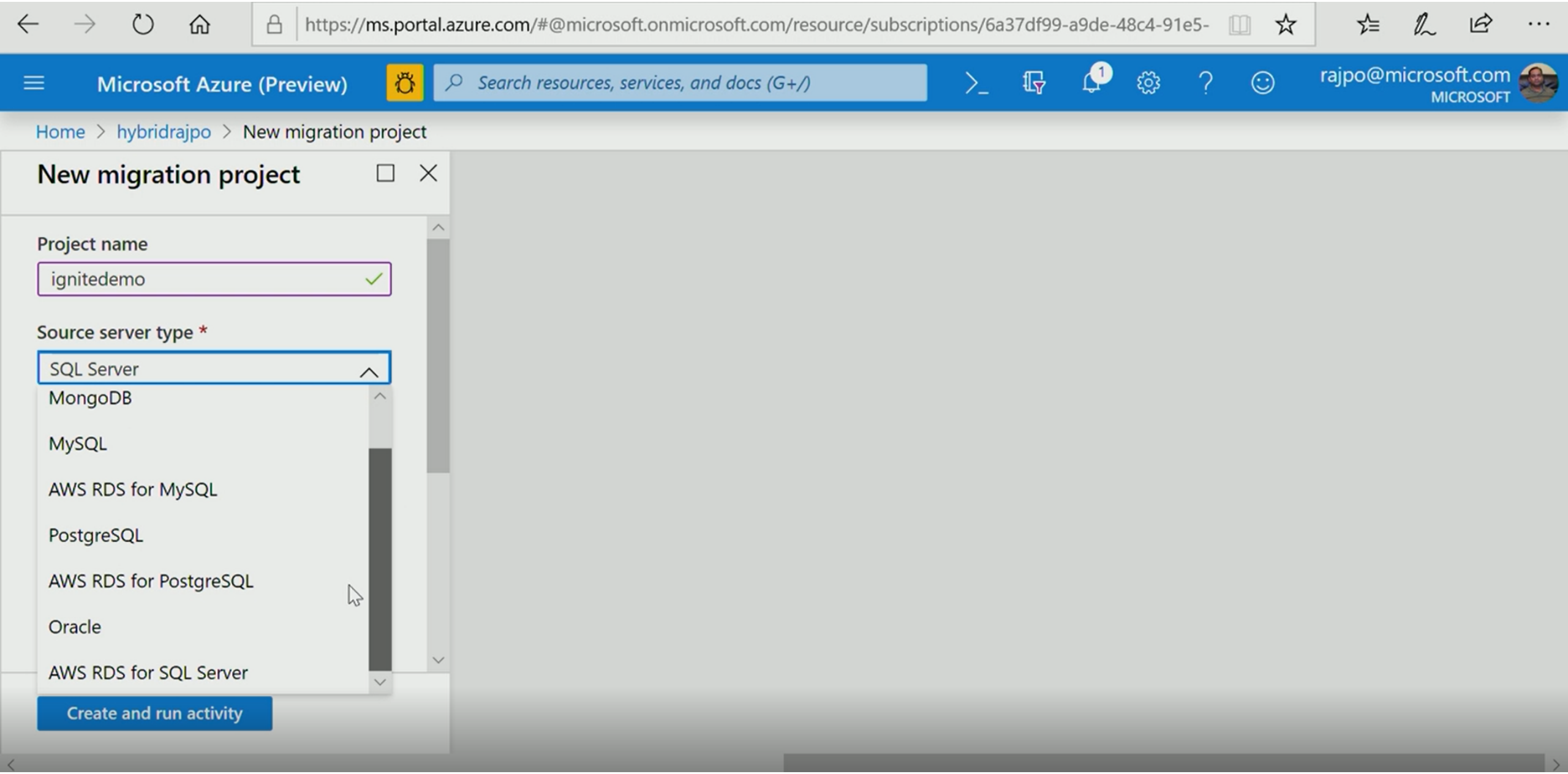
Azure Database Migration Service
Search (Ctrl+/)
Overview
Activity log
Access control (IAM)
Tags
Settings
Configuration
Hybrid
Properties
Locks
Export template
New Migration Project
Delete service
Refresh
Start Service
Stop Service
Resource group
hybridrajpo
Virtual network & IP Address
Subscription
DMSBuddy
SKU

Tags (change)
Click here to add tags
Status
Online
Location
East US
Subscription ID
6a37df99-a9de-48c4-91e5-7e6ab00b2362
Service/UI Version
4.4.4567.6/4.4.4593.2
Name
Source
Target
Created
SQLtoSQLMI
SQL Server
Azure SQL Database Managed ...
10/29/2019, 07:29:29 PM


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
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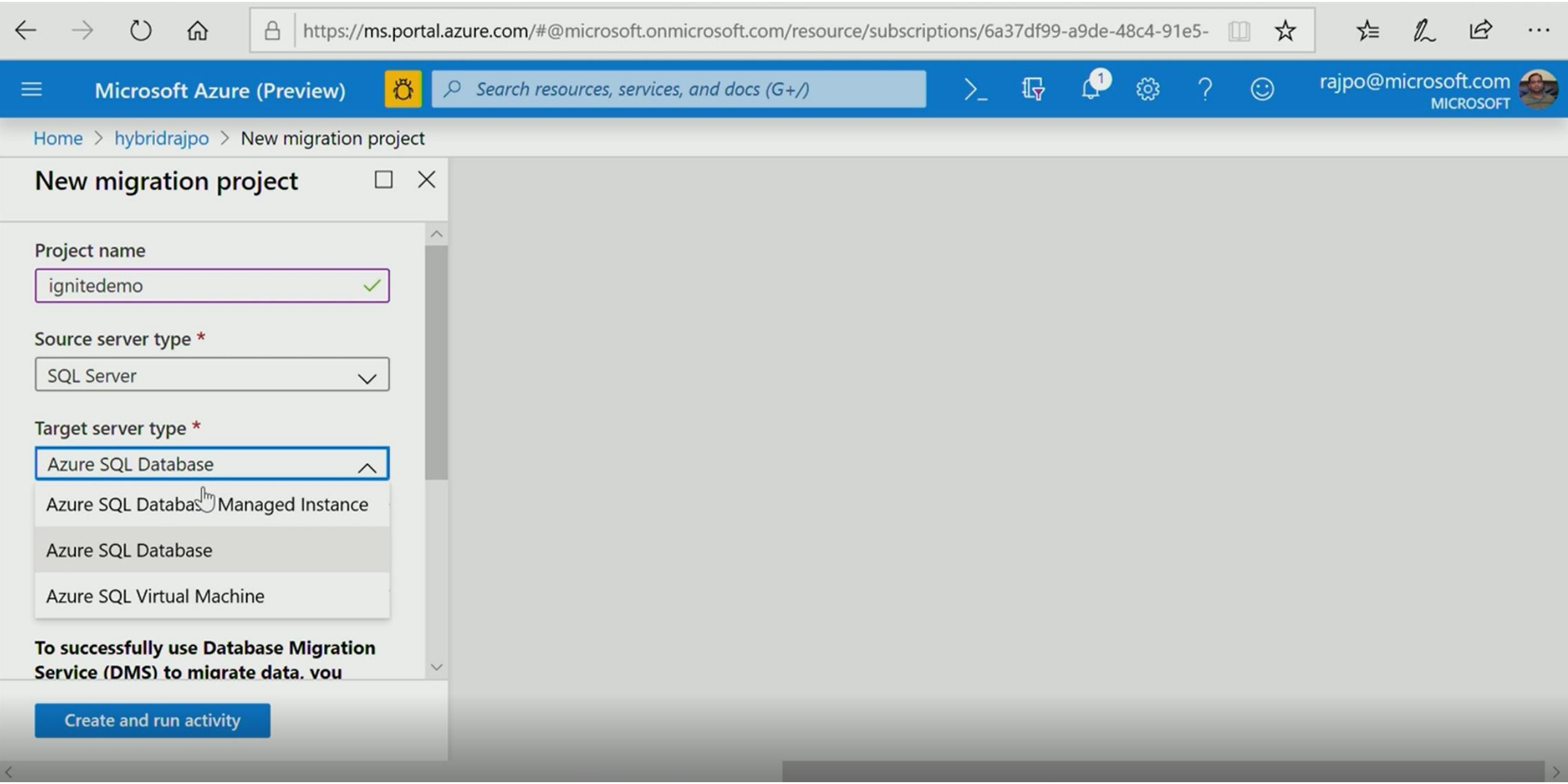
Home
hybridrajpo
New migration project
New migration project
Project name
ignitedemo
Source server type *
SQL Server
MongoDB
MySQL
AWS RDS for MySQL
PostgreSQL
AWS RDS for PostgreSQL
Oracle
AWS RDS for SQL Server
Create and run activity


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
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Home
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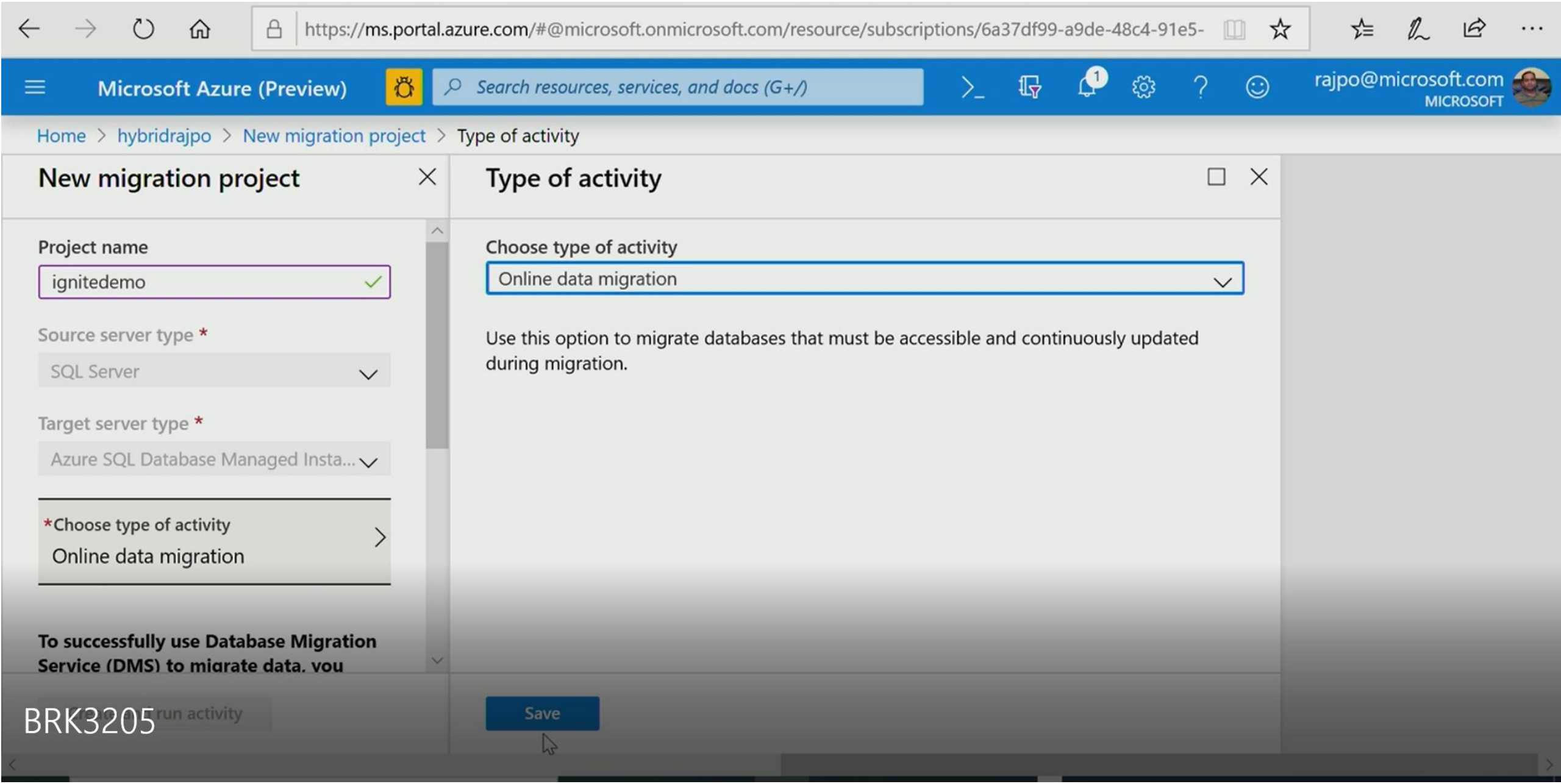
New migration project
New migration project
Project name
ignitedemo
Source server type *
SQL Server
Target server type *
Azure SQL Database
Azure SQL Database Managed Instance
Azure SQL Database
Azure SQL Virtual Machine
To successfully use Database Migration Service (DMS) to migrate data, you
Create and run activity


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
Microsoft Azure (Preview)
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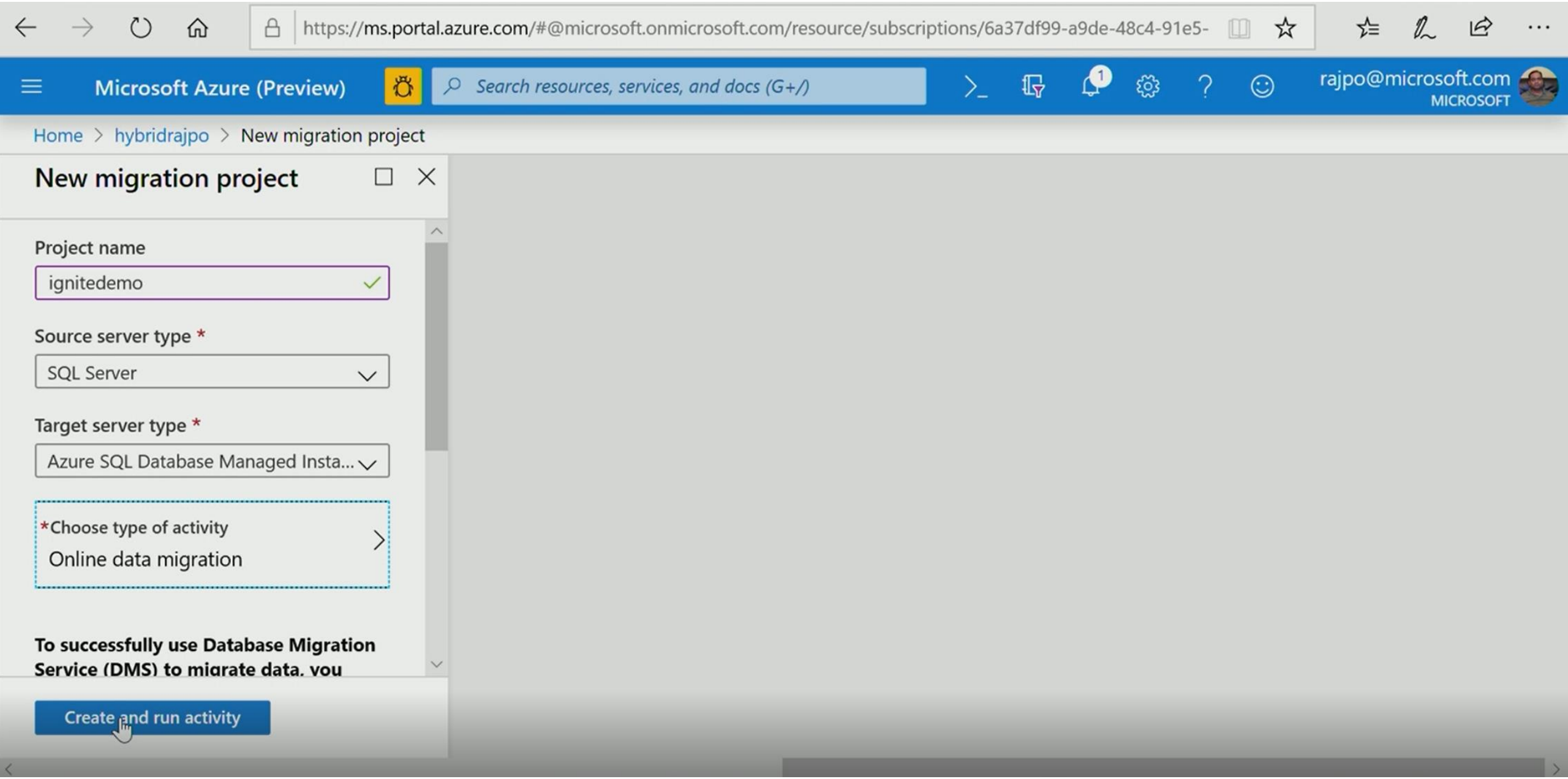
MICROSOFT
Home > hybridrajpo > New migration project > Type of activity
New migration project
Project name
ignitedemo
Source server type *
SQL Server
Target server type *
Azure SQL Database Managed Insta...
*Choose type of activity
Online data migration
To successfully use Database Migration Service (DMS) to migrate data, you
Type of activity
Choose type of activity
Online data migration
Use this option to migrate databases that must be accessible and continuously updated during migration.
Save

BRK3205


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
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Home
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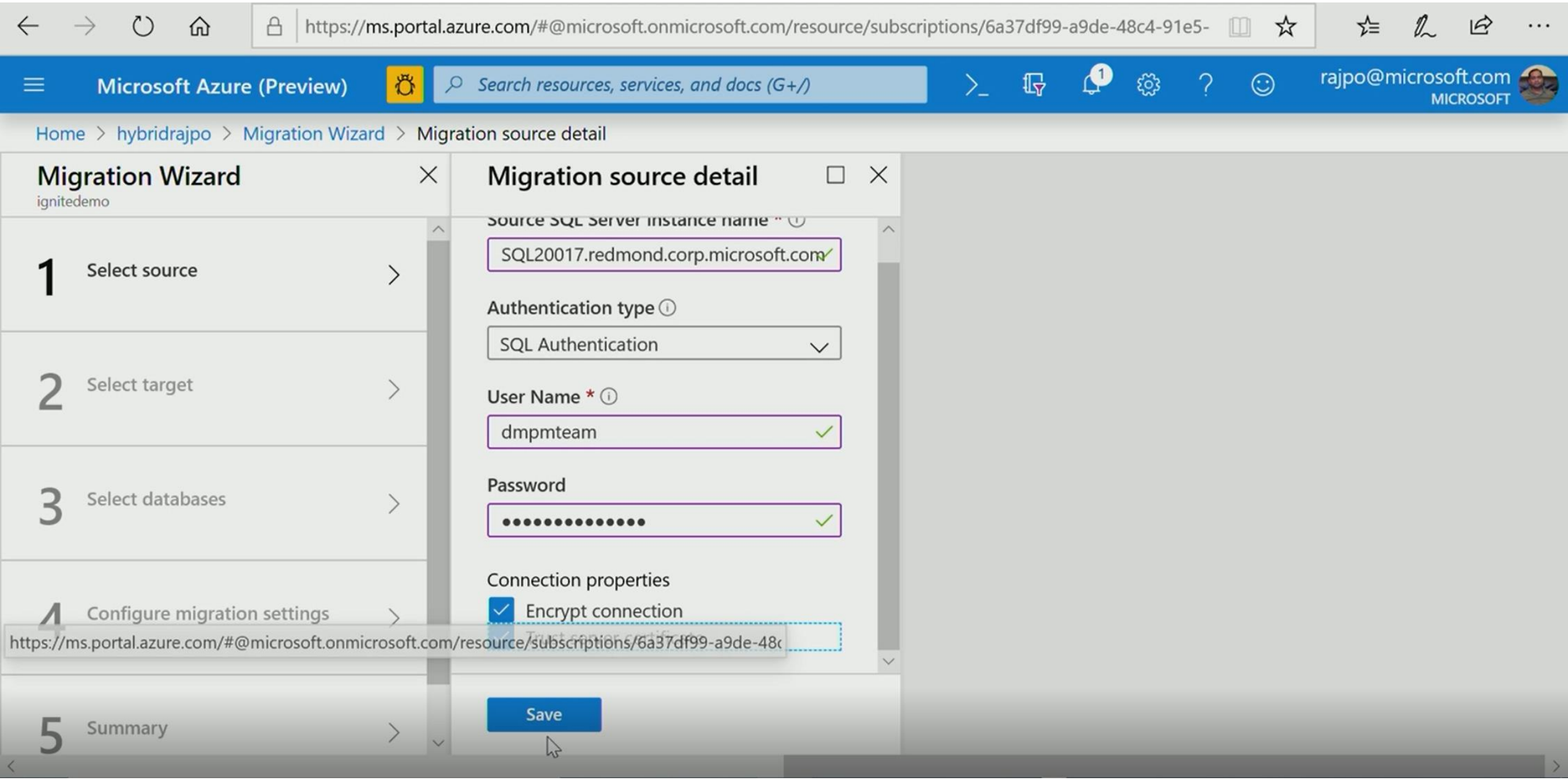
New migration project
New migration project
Project name
ignitedemo
Source server type *
SQL Server
Target server type *
Azure SQL Database Managed Insta...
*Choose type of activity
Online data migration
To successfully use Database Migration Service (DMS) to migrate data, you
Create and run activity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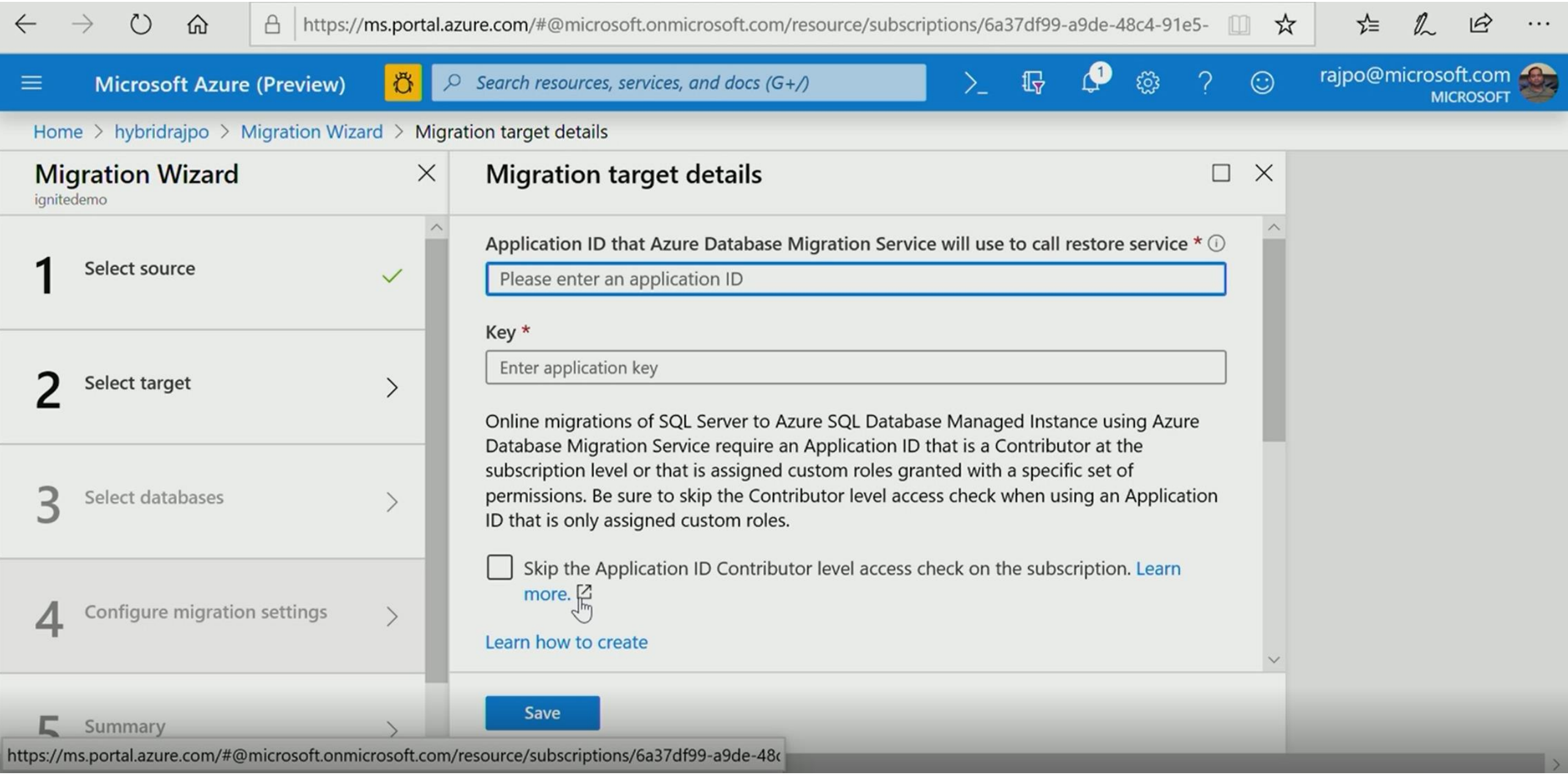
Home > hybridrajpo > Migration Wizard > Migration source detail
Migration Wizard
ignitedemo
1 Select source
2 Select target
3 Select databases
4 Configure migration settings
5 Summary
Migration source detail
Source SQL Server instance name *
SQL20017.redmond.corp.microsoft.com
Authentication type
SQL Authentication
User Name *
dmpmteam
Password
Connection properties
Encrypt connection
Save
https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
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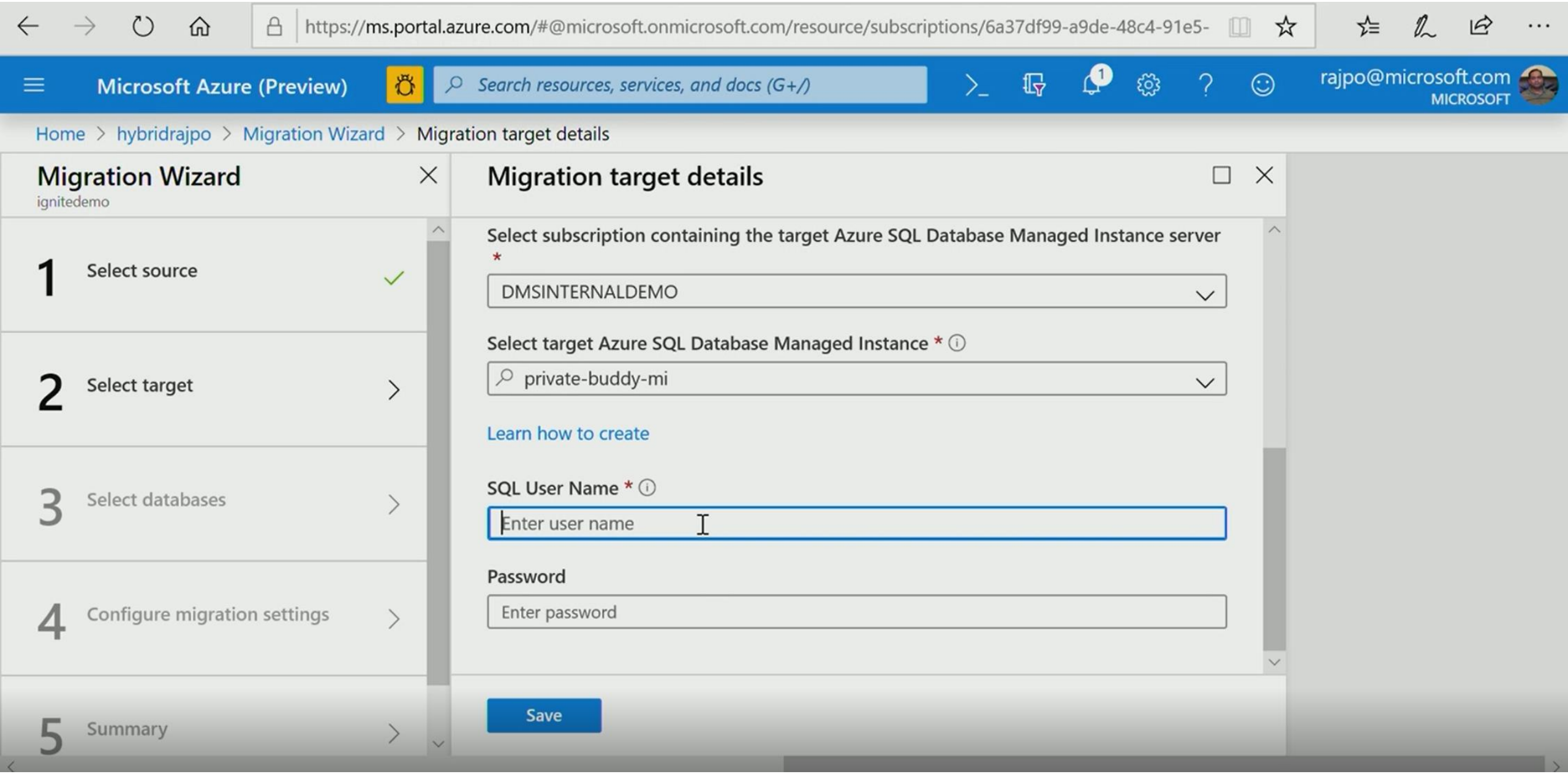
Home > hybridrajpo > Migration Wizard > Migration target details
Migration Wizard
ignitedemo
1 Select source
2 Select target
3 Select databases
4 Configure migration settings
5 Summary
Migration target details
Application ID that Azure Database Migration Service will use to call restore service *
Please enter an application ID
Key *
Enter application key
Online migrations of SQL Server to Azure SQL Database Managed Instance using Azure Database Migration Service require an Application ID that is a Contributor at the subscription level or that is assigned custom roles granted with a specific set of permissions. Be sure to skip the Contributor level access check when using an Application ID that is only assigned custom roles.
Skip the Application ID Contributor level access check on the subscription. Learn more.
Learn how to create
Save
https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c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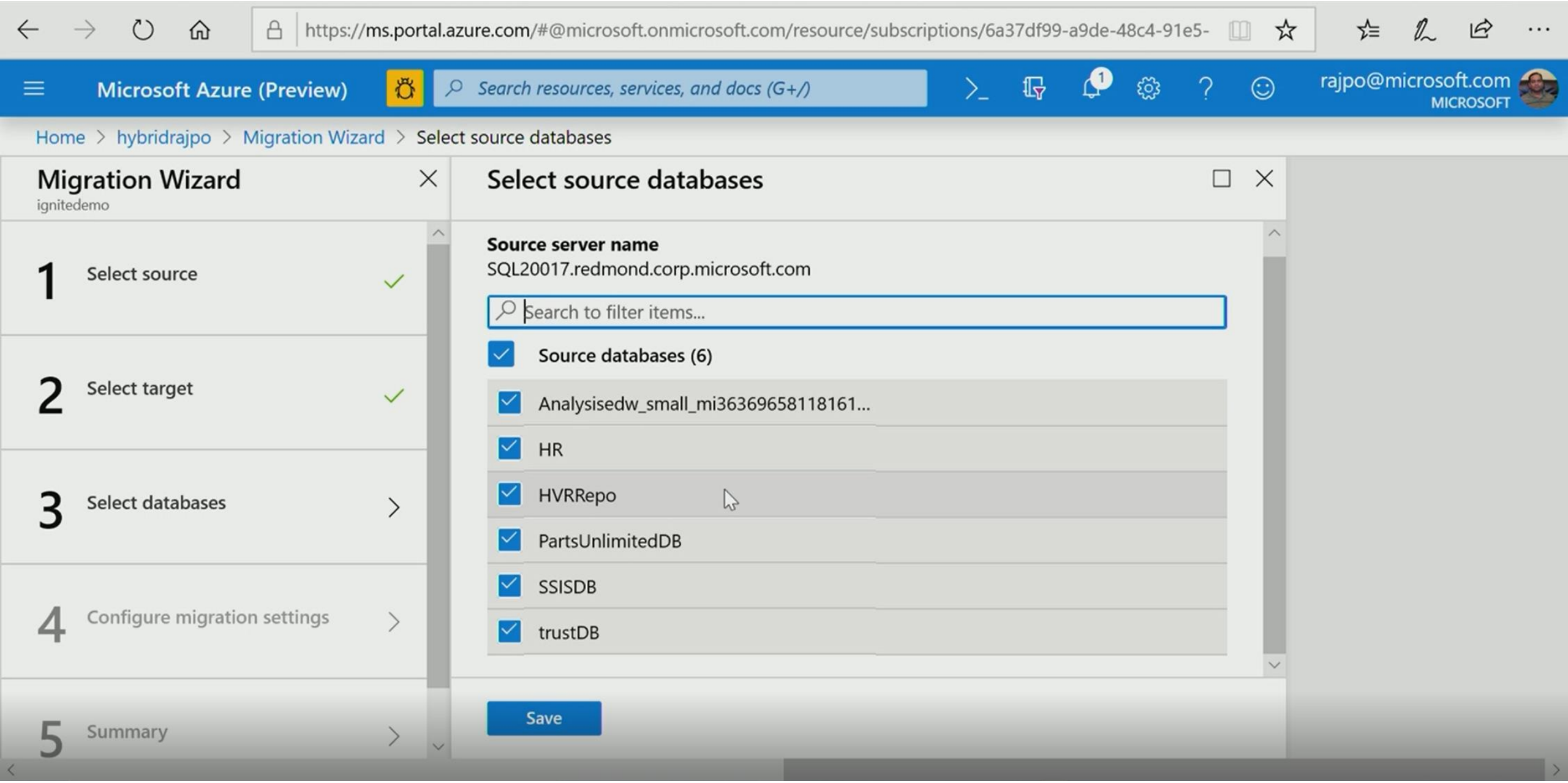
MICROSOFT
Home > hybridrajpo > Migration Wizard > Migration target details
Migration Wizard
ignitedemo
1 Select source
2 Select target
3 Select databases
4 Configure migration settings
5 Summary
Migration target details
Select subscription containing the target Azure SQL Database Managed Instance server *
DMSINTERNALDEMO
Select target Azure SQL Database Managed Instance *
private-buddy-mi
Learn how to create
SQL User Name *
Enter user name
Password
Enter password
Save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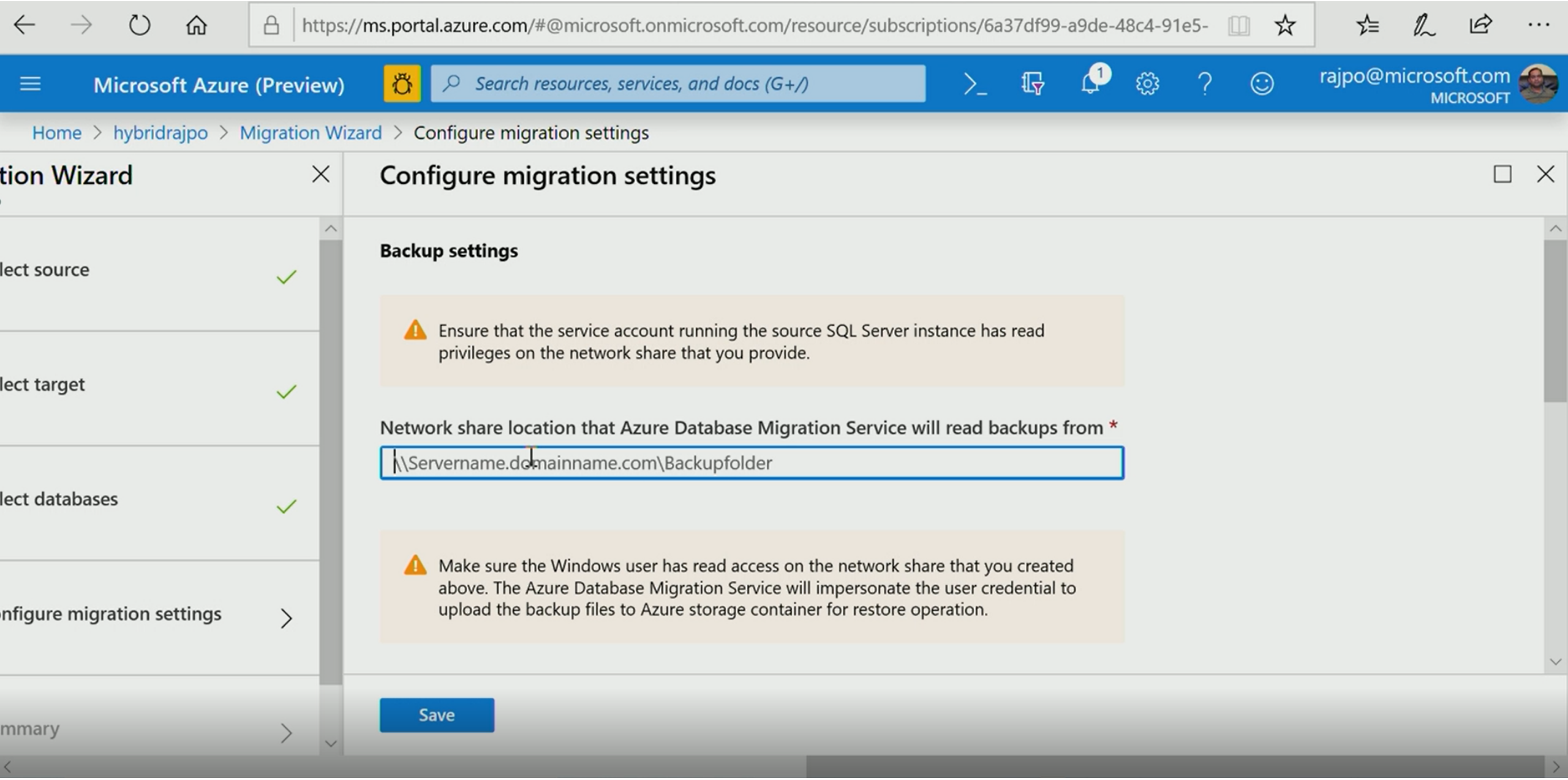
Home > hybridrajpo > Migration Wizard > Select source databases
Migration Wizard
ignitedemo
1 Select source
2 Select target
3 Select databases
4 Configure migration settings
5 Summary
Select source databases
Source server name
SQL20017.redmond.corp.microsoft.com
Search to filter items...
Source databases (6)
Analysisedw_small_mi36369658118161...
HR
HVRRepo
PartsUnlimitedDB
SSISDB
trustDB
Save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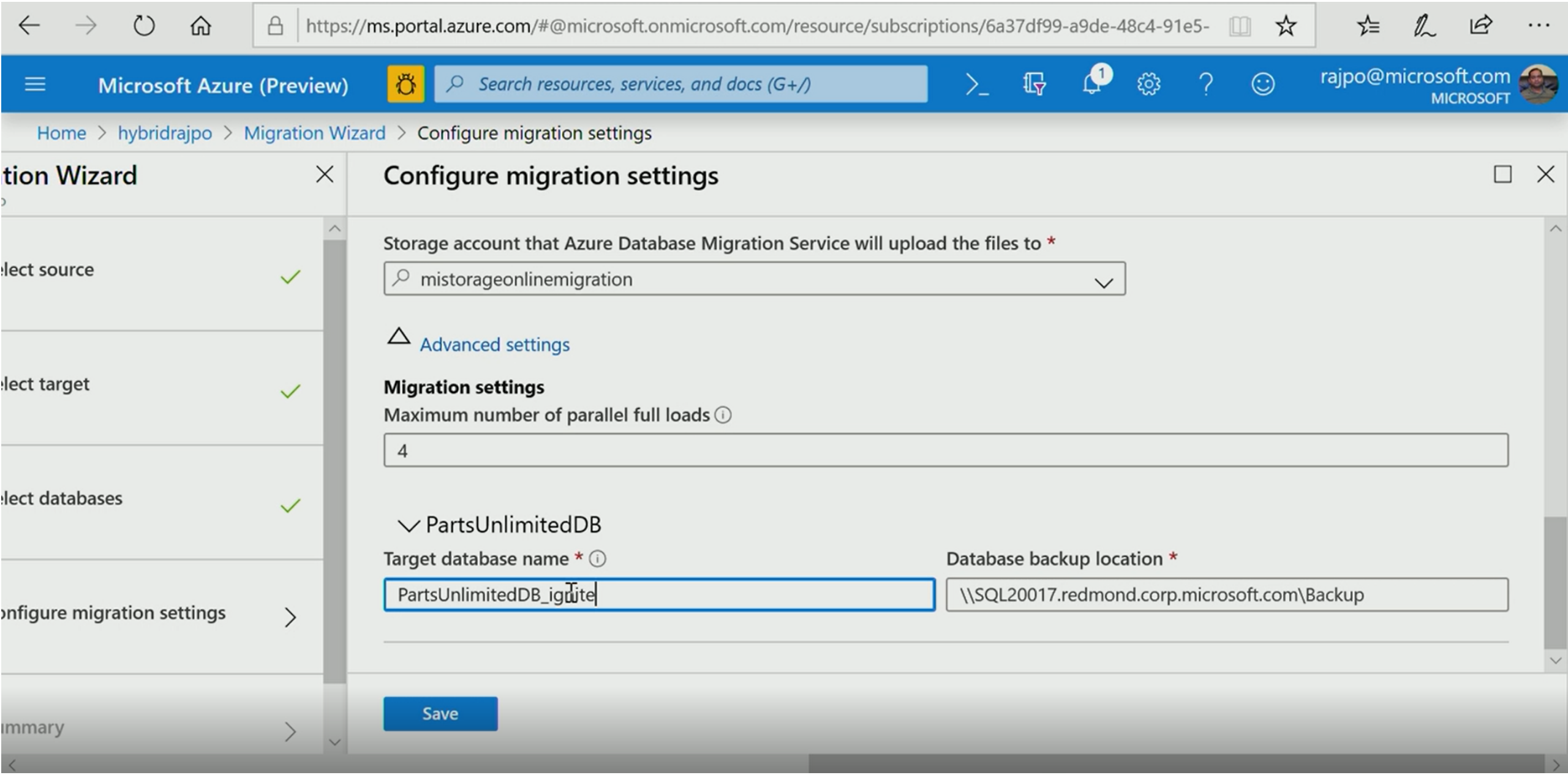
Home > hybridrajpo > Migration Wizard > Configure migration settings
tion Wizard
lect source
lect target
lect databases
nfigure migration settings
mmary
Configure migration settings
Backup settings
Ensure that the service account running the source SQL Server instance has read privileges on the network share that you provide.
Network share location that Azure Database Migration Service will read backups from *
\\Servername.domainname.com\Backupfolder
Make sure the Windows user has read access on the network share that you created above. The Azure Database Migration Service will impersonate the user credential to upload the backup files to Azure storage container for restore operation.
Save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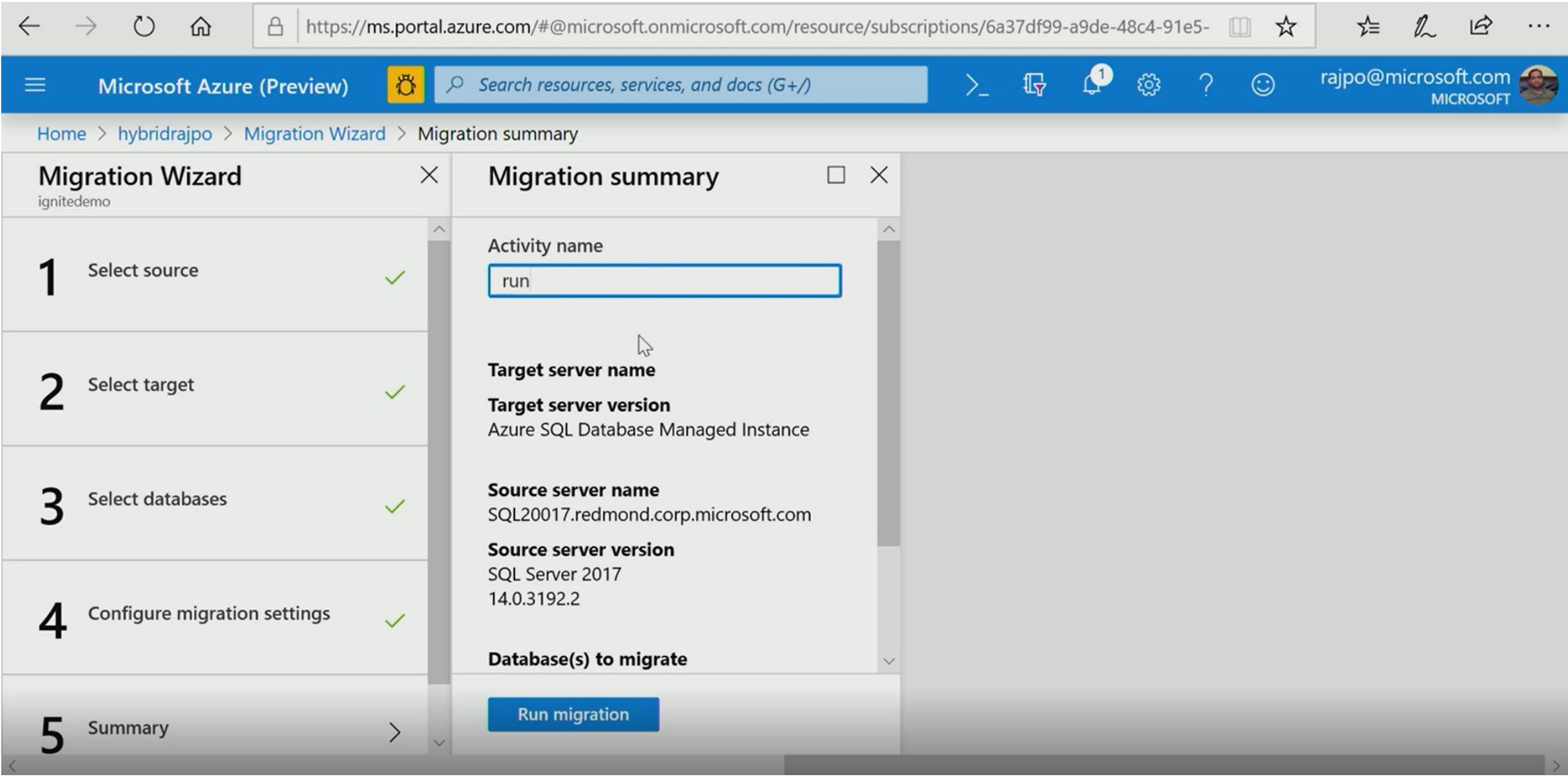
Home > hybridrajpo > Migration Wizard > Configure migration settings
tion Wizard
lect source
lect target
lect databases
nfigure migration settings
mmary
Configure migration settings
Storage account that Azure Database Migration Service will upload the files to *
mistorageonlinemigration
Advanced settings
Migration settings
Maximum number of parallel full loads
4
PartsUnlimitedDB
Target database name *
PartsUnlimitedDB_igunite
Database backup location *
\\SQL20017.redmond.corp.microsoft.com\Backup
Save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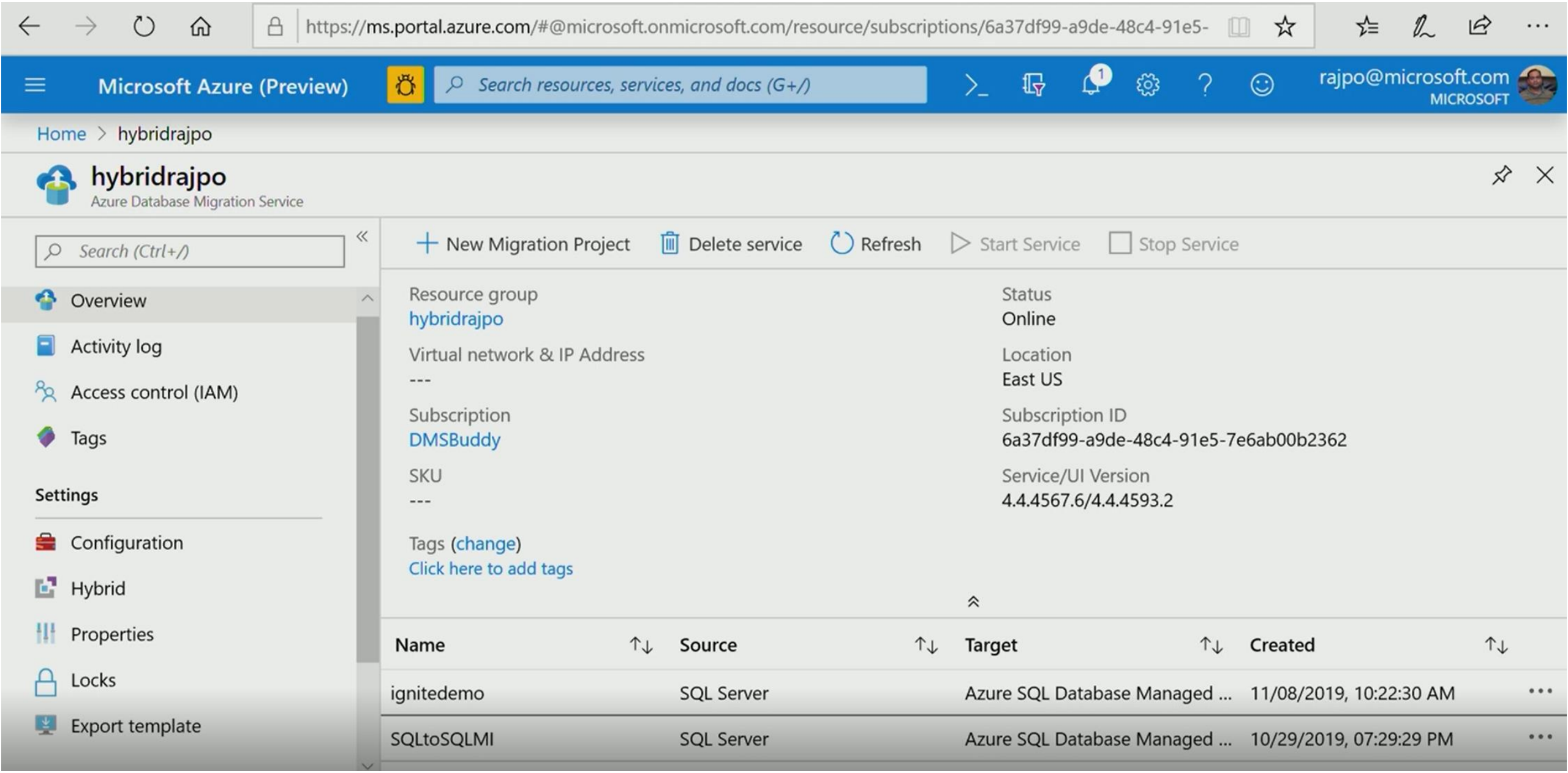
Home > hybridrajpo > Migration Wizard > Migration summary
Migration Wizard
ignitedemo
1 Select source
2 Select target
3 Select databases
4 Configure migration settings
5 Summary
Migration summary
Activity name
run
Target server name
Target server version
Azure SQL Database Managed Instance
Source server name
SQL20017.redmond.corp.microsoft.com
Source server version
SQL Server 2017
14.0.3192.2
Database(s) to migrate
Run migration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Home > hybridrajpo
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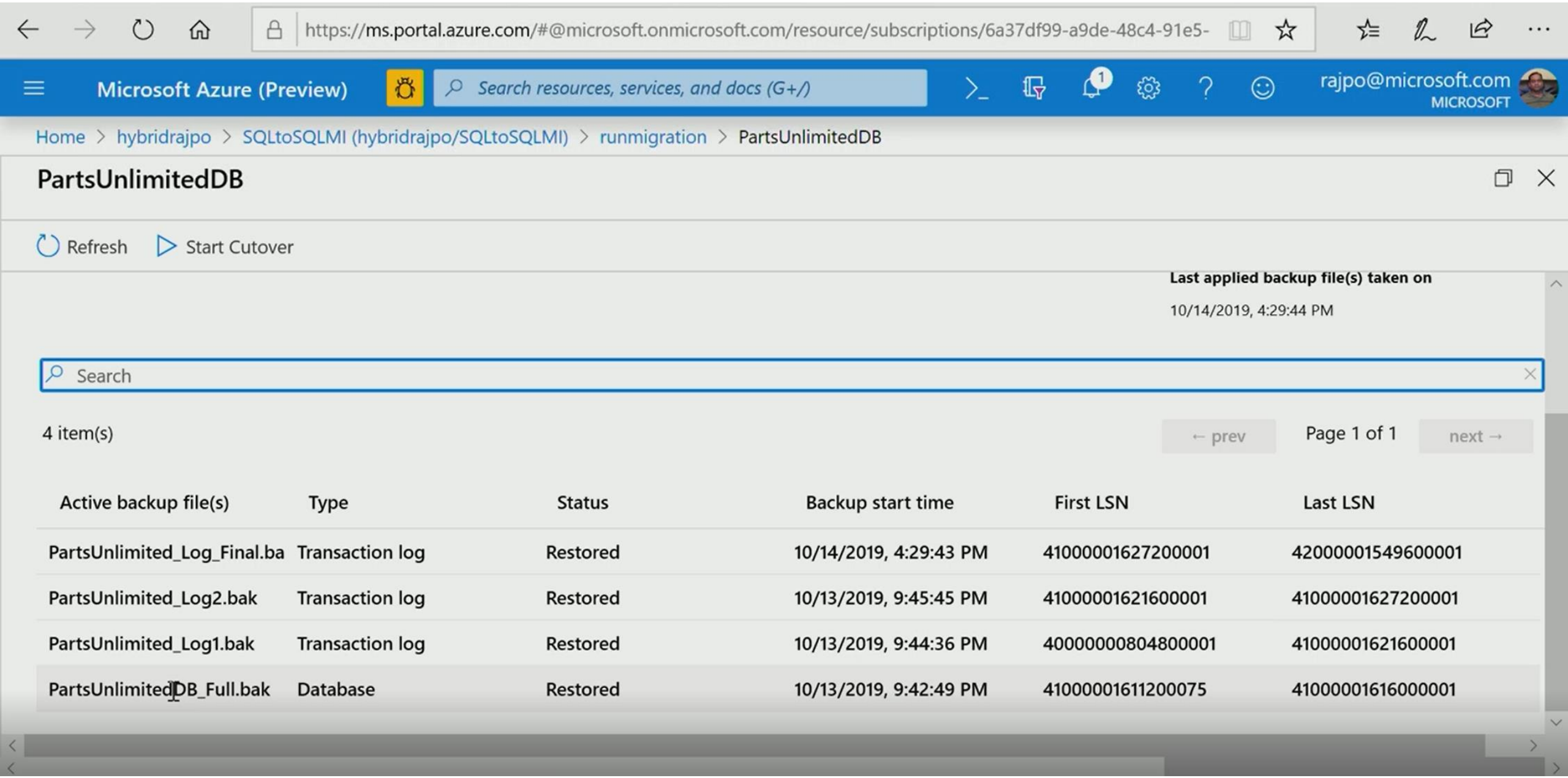
Azure Database Migration Service
Search (Ctrl+/)
Overview
Activity log
Access control (IAM)
Tags
Settings
Configuration
Hybrid
Properties
Locks
Export template
New Migration Project
Delete service
Refresh
Start Service
Stop Service
Resource group
hybridrajpo
Virtual network & IP Address

Subscription
DMSBuddy
SKU

Tags (change)
Click here to add tags
Status
Online
Location
East US
Subscription ID
6a37df99-a9de-48c4-91e5-7e6ab00b2362
Service/UI Version
4.4.4567.6/4.4.4593.2
Name
Source
Target
Created
ignitedemo
SQL Server
Azure SQL Database Managed ...
11/08/2019, 10:22:30 AM
SQLtoSQLMI
SQL Server
Azure SQL Database Managed ...
10/29/2019, 07:29:29 PM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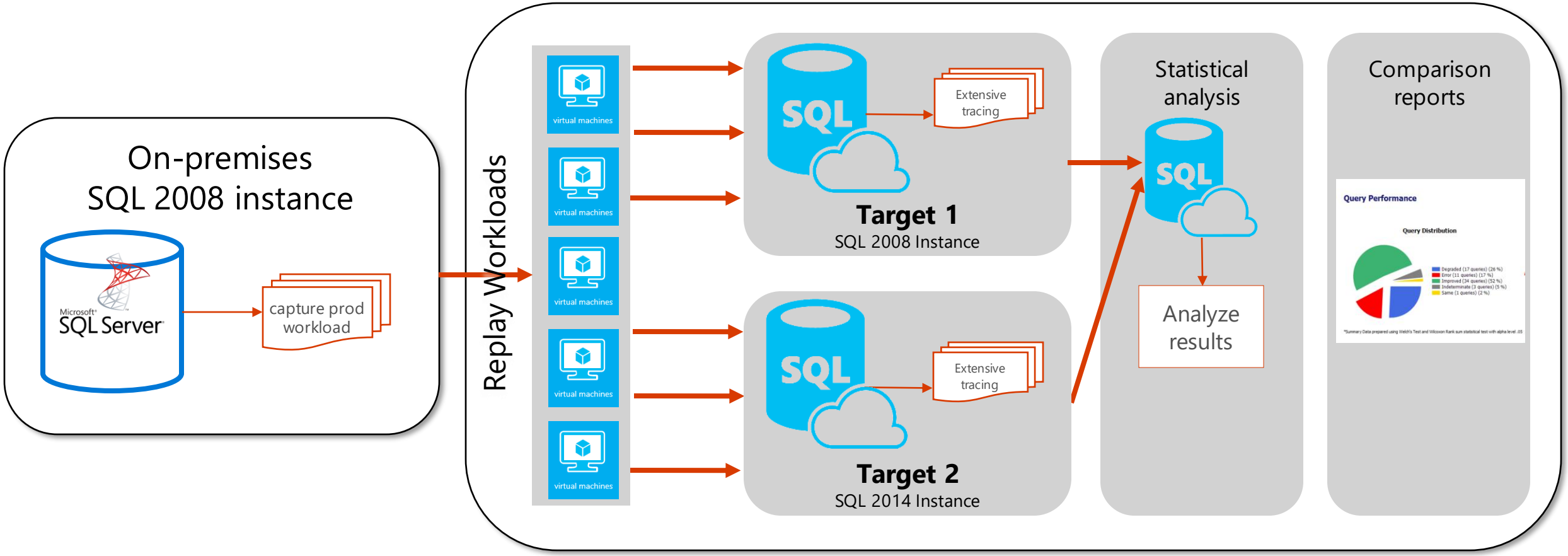
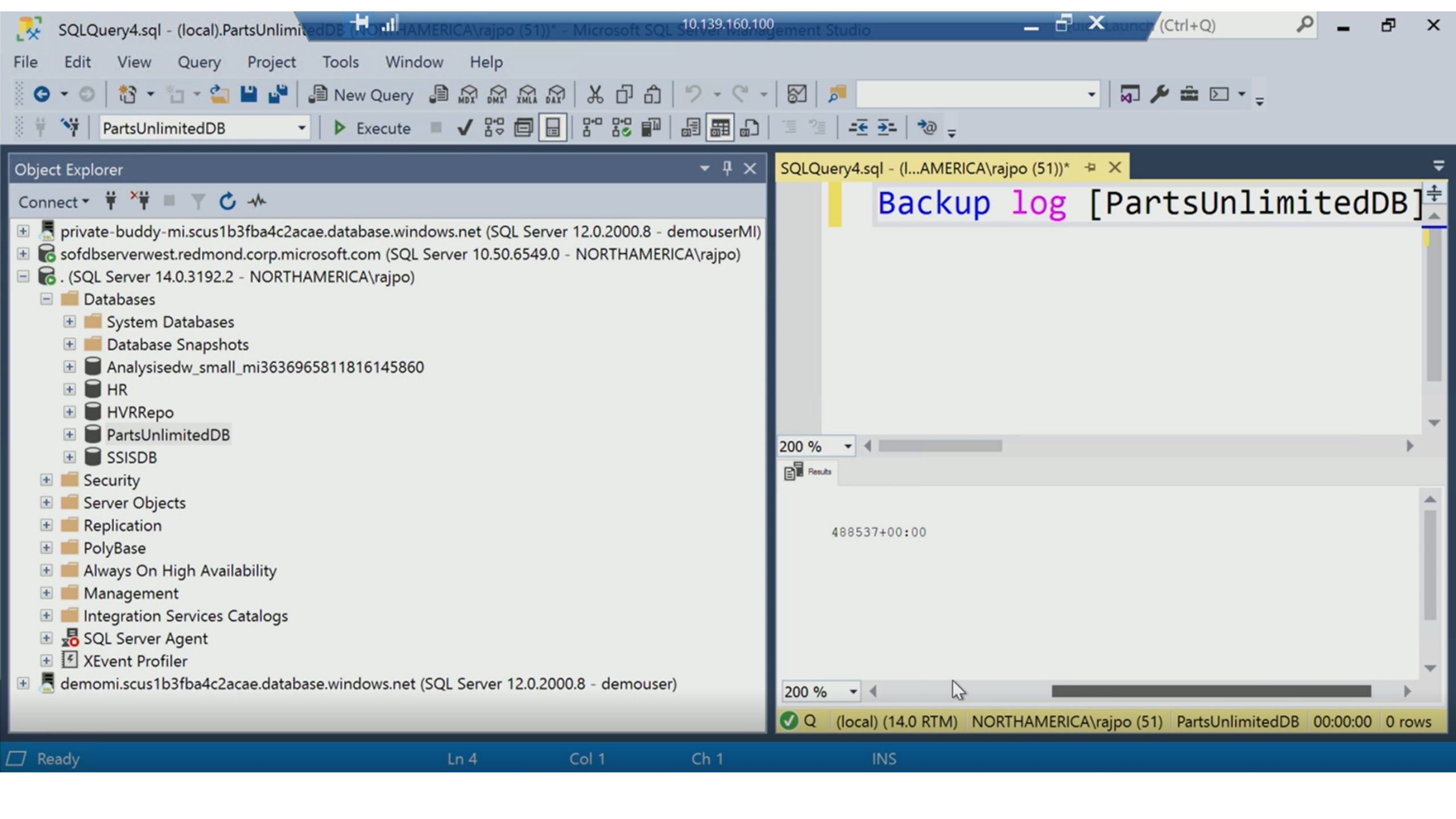
Home > hybridrajpo > SQLtoSQLMI (hybridrajpo/SQLtoSQLMI) > runmigration > PartsUnlimitedDB
PartsUnlimitedDB
Refresh
Start Cutover
Last applied backup file(s) taken on
10/14/2019, 4:29:44 PM
Search
4 item(s)
← prev
Page 1 of 1
next →
Active backup file(s) Type Status Backup start time First LSN Last LSN
PartsUnlimited_Log_Final.ba Transaction log Restored 10/14/2019, 4:29:43 PM 41000001627200001 42000001549600001
PartsUnlimited_Log2.bak Transaction log Restored 10/13/2019, 9:45:45 PM 41000001621600001 41000001627200001
PartsUnlimited_Log1.bak Transaction log Restored 10/13/2019, 9:44:36 PM 40000000804800001 41000001621600001
PartsUnlimitedDB_Full.bak Database Restored 10/13/2019, 9:42:49 PM 41000001611200075 41000001616000001

Database Experimentation Assistant

Database Experimentation Assistant (DEA)



Capture → Execute → Analyse → Compare


10.139.160.100
SQLQuery4.sql - (local).PartsUnlimitedDB (NORTHAMERICA\rajpo (51))* - Microsoft SQL Server Management Studio
(Ctrl+Q)
File Edit View Query Project Tools Window Help
New Query
PartsUnlimitedDB
Execute
Object Explorer
Connect
private-buddy-mi.scus1b3fba4c2acae.database.windows.net (SQL Server 12.0.2000.8 - demouserMI)
sofdbserverwest.redmond.corp.microsoft.com (SQL Server 10.50.6549.0 - NORTHAMERICA\rajpo)
. (SQL Server 14.0.3192.2 - NORTHAMERICA\rajpo)
Databases
System Databases
Database Snapshots
Analysisedw_small_mi3636965811816145860
HR
HVRRepo
PartsUnlimitedDB
SSISDB
Security
Server Objects
Replication
PolyBase
Always On High Availability
Management
Integration Services Catalogs
SQL Server Agent
XEvent Profiler
demomi.scus1b3fba4c2acae.database.windows.net (SQL Server 12.0.2000.8 - demouser)
SQLQuery4.sql - (l...AMERICA\rajpo (51))*
Backup log [PartsUnlimitedDB]
200 %
Results
488537+00:00
200 %
Q (local) (14.0 RTM) NORTHAMERICA\rajpo (51) PartsUnlimitedDB 00:00:00 0 rows
Ready Ln 4 Col 1 Ch 1 INS

https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-

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Home > hybridrajpo > SQLtoSQLMI (hybridrajpo/SQLtoSQLMI) > runmigration > PartsUnlimitedDB

PartsUnlimitedDB

Refresh | Start Cutover

Last applied backup file(s) taken on

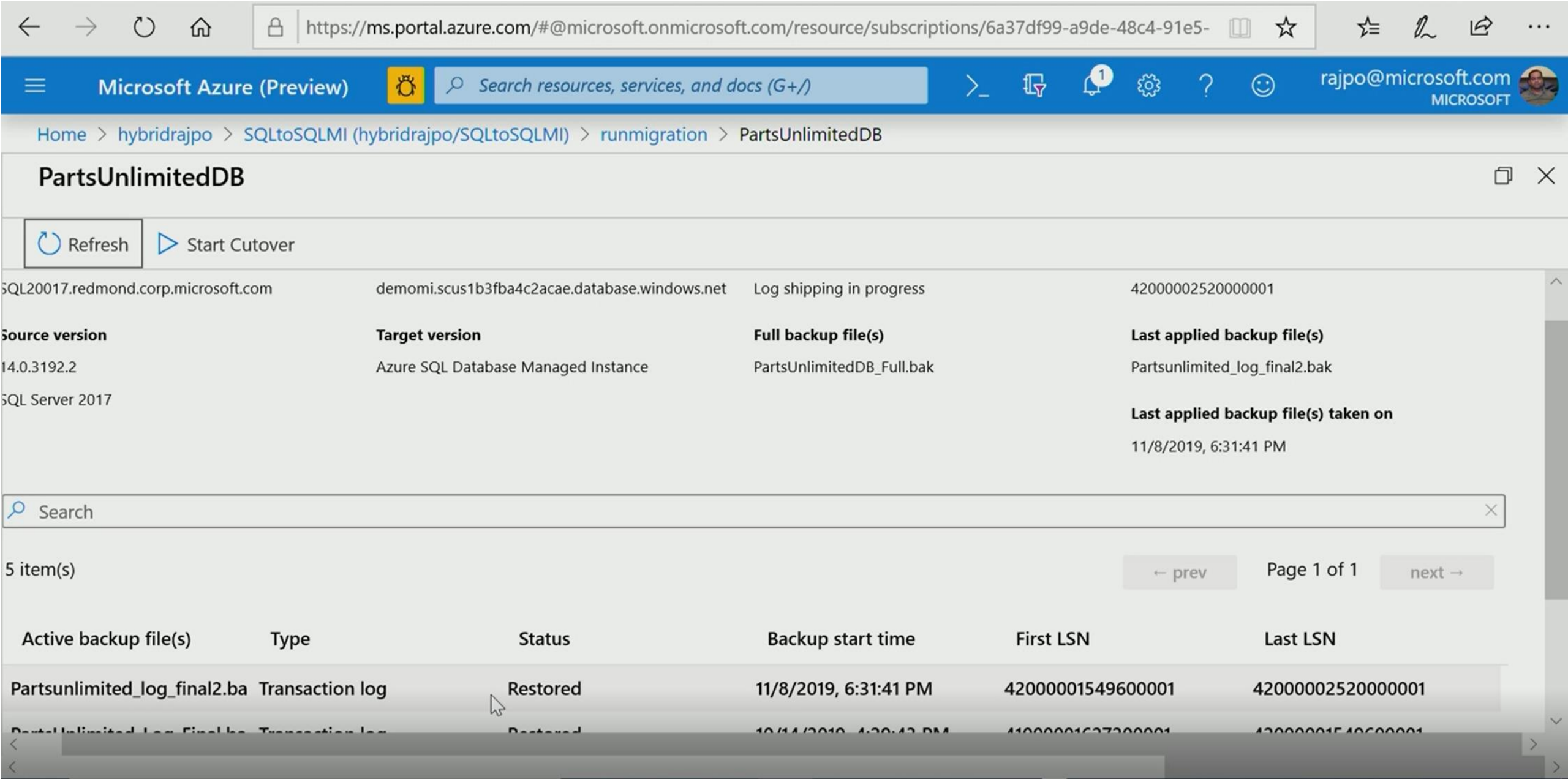
10/14/2019, 4:29:44 PM

Search

5 item(s)

← prev | Page 1 of 1 | next →

Active backup file(s)	Type	Status	Backup start time	First LSN	Last LSN
Partsunlimited_log_final2.ba	Transaction log	Uploaded	11/8/2019, 6:31:41 PM	42000001549600001	42000002520000001
PartsUnlimited_Log_Final.ba	Transaction log	Restored	10/14/2019, 4:29:43 PM	41000001627200001	42000001549600001
PartsUnlimited_Log2.bak	Transaction log	Restored	10/13/2019, 9:45:45 PM	41000001621600001	41000001627200001
PartsUnlimited_Log1.bak	Transaction log	Restored	10/13/2019, 9:44:36 PM	40000000804800001	41000001621600001
PartsUnlimitedDB_Full.bak	Database	Restored	10/13/2019, 9:42:49 PM	41000001611200075	41000001616000001


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
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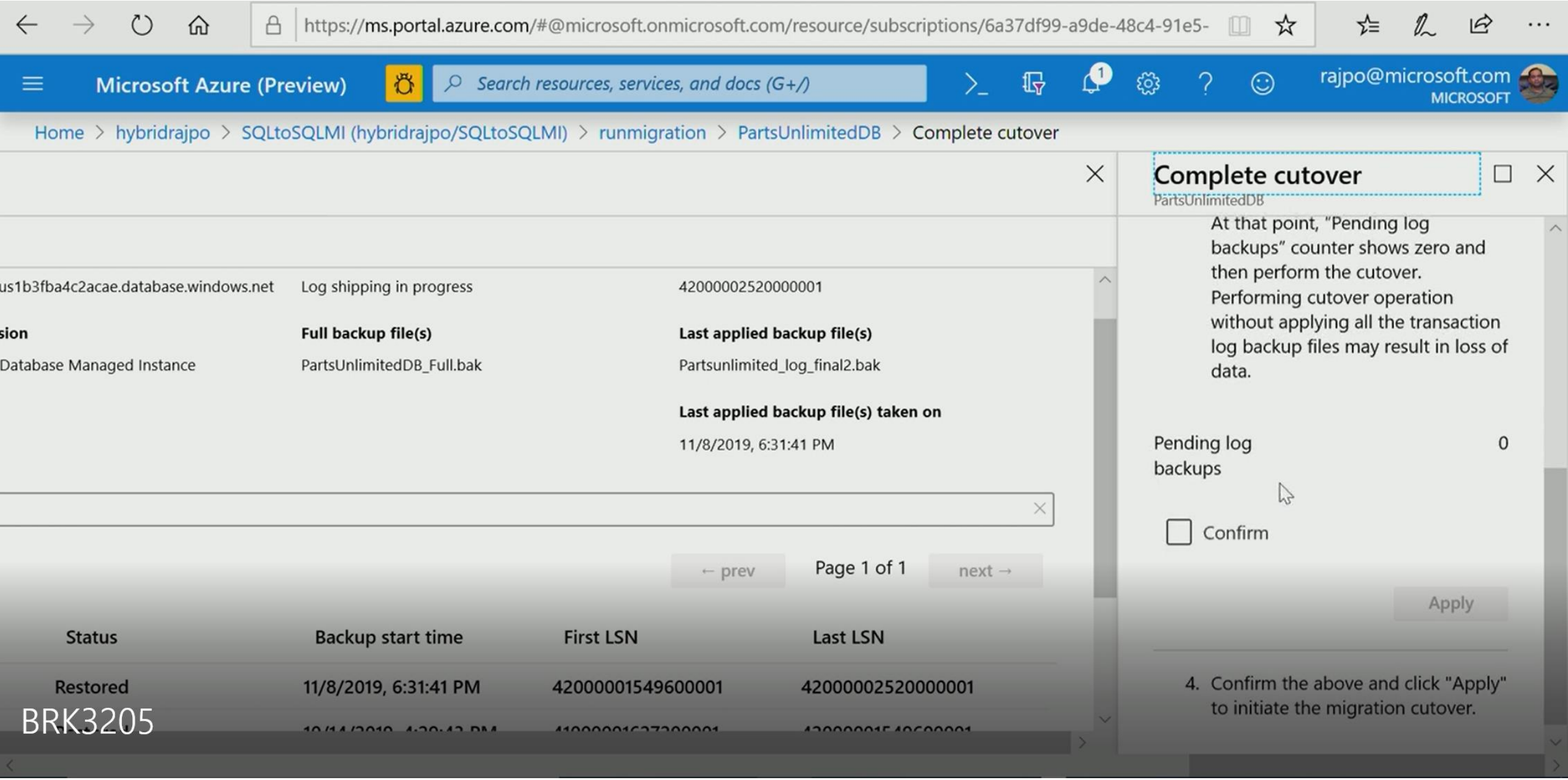
Home > hybridrajpo > SQLtoSQLMI (hybridrajpo/SQLtoSQLMI) > runmigration > PartsUnlimitedDB
PartsUnlimitedDB
Refresh
Start Cutover
SQL20017.redmond.corp.microsoft.com
demomi.scus1b3fba4c2acae.database.windows.net
Log shipping in progress
42000002520000001
Source version
14.0.3192.2
SQL Server 2017
Target version
Azure SQL Database Managed Instance
Full backup file(s)
PartsUnlimitedDB_Full.bak
Last applied backup file(s)
Partsunlimited_log_final2.bak
Last applied backup file(s) taken on
11/8/2019, 6:31:41 PM
Search
5 item(s)
← prev
Page 1 of 1
next →
Active backup file(s)
Type
Status
Backup start time
First LSN
Last LSN
Partsunlimited_log_final2.ba
Transaction log
Restored
11/8/2019, 6:31:41 PM
42000001549600001
42000002520000001


https://ms.portal.azure.com/#@microsoft.onmicrosoft.com/resource/subscriptions/6a37df99-a9de-48c4-91e5-
Microsoft Azure (Preview)
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rajpo@microsoft.com
MICROSOFT
Home > hybridrajpo > SQLtoSQLMI (hybridrajpo/SQLtoSQLMI) > runmigration > PartsUnlimitedDB > Complete cutover
us1b3fba4c2acae.database.windows.net
Log shipping in progress
42000002520000001
sion
Database Managed Instance
Full backup file(s)
PartsUnlimitedDB_Full.bak
Last applied backup file(s)
Partsunlimited_log_final2.bak
Last applied backup file(s) taken on
11/8/2019, 6:31:41 PM
← prev
Page 1 of 1
next →
Status
Backup start time
First LSN
Last LSN
Restored
11/8/2019, 6:31:41 PM
42000001549600001
42000002520000001
Complete cutover
PartsUnlimitedDB
At that point, "Pending log backups" counter shows zero and then perform the cutover. Performing cutover operation without applying all the transaction log backup files may result in loss of data.
Pending log backups
0
Confirm
Apply
4. Confirm the above and click "Apply" to initiate the migration cutover.

Azure Migration Program

Accéssible à tous les clients Azure ou via nos partenaires spécialisés

Best practice guidance

Offers and incentives

Technical skill building

Infrastructure and data foundations

Migration planning and execution

Digital resources

Free tools (Azure Migrate)

Azure trainers

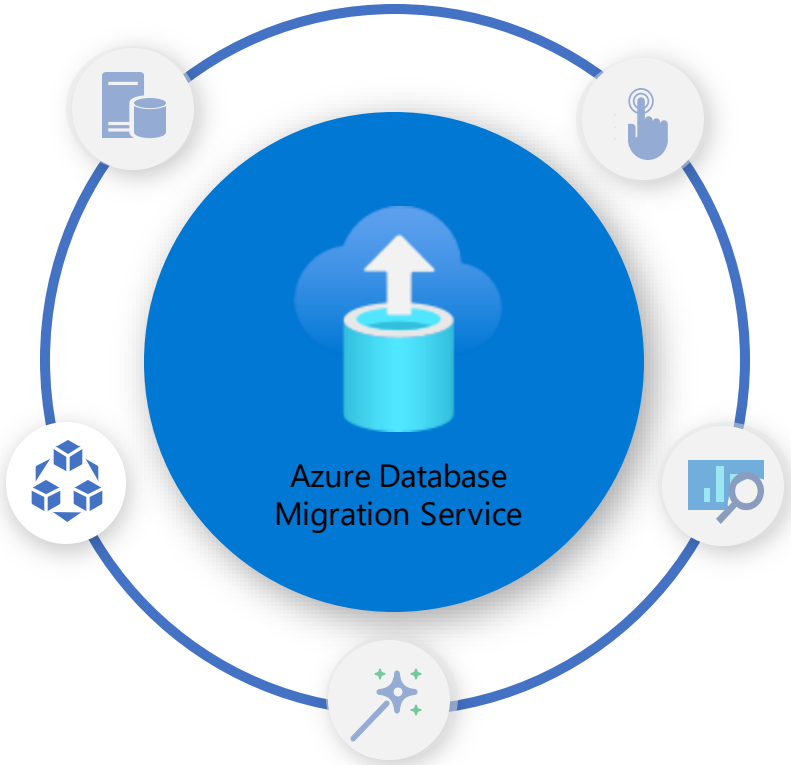
Azure engineering (FastTrack)

Specialized partners

Reduce cost and risk | Accelerate migration velocity | Deliver customer success

Learn more | Azure.com/AMP

Recap: Azure Migrate – Expérience complète



Disponible maintenant

Database assessments
- SQL Server database assessments
- Target readiness and size assessments
- SSIS package assessmnets
- Application data layer assessments
- Oracle/ Sybase/ DB2 assessments and schema conversion
- Assessment for SQL databases using DMA in Azure Migrate

Migrations
- Windows and SQL logins migrations
- SSIS package migrations

Recent updates

Assessments NEW
- .NET application assessments
- SQL Server 2019 support in DMA
- Load and save assessments in DMA

Migrations NEW
- Azure DMS Hybrid mode
- PostgreSQL hyper-scale migration

Références

- Migration Guide - https://datamigration.microsoft.com
- Azure Database Migration Service – https://aka.ms/AzureDms
- Data Migration Assistant - https://aka.ms/get-dma
- SQL Server Migration Assistant - https://aka.ms/get-ssma
- Database Experimentation Assistant - https://aka.ms/dea-tool
-
- **Preview and Feedback**
- Preview signup: https://aka.ms/dms-preview
- DMS Feedback alias: dmsfeedback@microsoft.com
- DMA Feedback alias: dmafeedback@microsoft.com
- SSMA feedback alias: ssmahelp@microsoft.com
- DEA feedback alias: deafeedback@microsoft.com
-
- Azure migration center – https://azure.com/migration

Get started today!

Web pages

Azure SQL family

- SQL Server on Azure Virtual Machines
- Azure SQL Managed Instance
- Azure SQL Database
- Azure SQL Edge

Choose Your Azure SQL database tool

Azure Hybrid Benefit for SQL Server

Azure Database Migration Service

Migration guide

3rd party studies

ESG Economic Value report on migrating to Azure SQL

GigaOM price-performance study

Forrester Consulting Total Economic Impact™ study

Other Resources - infographics

Infographic: Azure SQL family

Azure SQL Jumpstart Guide

Infographic: Forrester Consulting Total Economic Impact™ study

Introducing Azure SQL

The family of SQL cloud databases

Providing flexible options for

- Migration
- Modernization
- Development

Azure SQL

The family of SQL cloud to edge databases

SQL Server on Azure Virtual Machines

Best for lift and shift and/or workloads requiring OS-level access

Azure SQL Managed Instance

Best for modernizing existing apps

Azure SQL Database

Best for supporting modern cloud apps

Azure SQL Edge

Best for extending apps to IoT edge

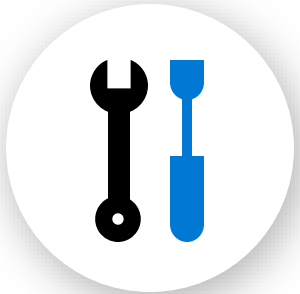
Infrastructure-as-a-Service | **Platform-as-a-Service** | **Edge Computing**

Azure is the cloud that knows SQL Server best

Azure SQL is the best choice for SQL Server workloads

Run any workload anywhere on the industry-leading SQL Server engine

Fully-managed and always up to date



Be more productive with **AI-powered features** that automate tasks and optimize performance for you

Use your existing SQL experience in the cloud

Build on what you know with a **consistent code base** and deploy it anywhere from edge to cloud

Save with the lowest total cost of ownership

Get more cloud for less with **leading price-performance** and savings up to 85% off pay-as-you-go rates with **Azure Hybrid Benefit**.

Protect your data with built-in, real-time intelligent security

Secure your data with layers of protection, built-in controls, **intelligent threat detection**, and the **broadest set of compliance offerings**

The only cloud with evergreen SQL

Software is continually updated and never requires patches

Microsoft

Partners make more possible

Microsoft Enregistrez vous dès maintenant au prochain Webinars Data AI

Event Webinar (Les jeudis de la Data & AI) - L200/300	Date	Duration (min)	Link
Azure Machine Learning pour les Data Scientists	15/09/2022	120	https://msevents.microsoft.com/event?id=2454281594
Azure Synapse	22/09/2022	120	https://msevents.microsoft.com/event?id=857781749
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	29/09/2022	120	https://msevents.microsoft.com/event?id=502366997
Déploiement et sécurisation des workspaces Azure Machine learning	06/10/2022	120	https://msevents.microsoft.com/event?id=1505714138
Azure Scale Analytics - Architectures Data Mesh dans Azure avec Azure Synapse, Microsoft Purview et Azure Data Share	13/10/2022	120	https://msevents.microsoft.com/event?id=139685175
MLOps avec Azure Machine Learning	20/10/2022	120	https://msevents.microsoft.com/event?id=1245885767
SQL Server 2022 et hybridation native avec Azure SQL Managed Instance	10/11/2022	120	https://msevents.microsoft.com/event?id=145826476
Machine Learning dans Azure Synapse Analytics	17/11/2022	120	https://msevents.microsoft.com/event?id=3637723312
Azure Cosmos DB et IA	24/11/2022	120	https://msevents.microsoft.com/event?id=2646013445
Azure et les Services Cognitifs	08/12/2022	120	https://msevents.microsoft.com/event?id=3772037220
La gouvernance de données dans Azure avec Microsoft Purview	15/12/2022	120	https://msevents.microsoft.com/event?id=1499560981
MLOps avec Azure Machine Learning	12/01/2023	120	https://msevents.microsoft.com/event?id=4115194515
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	19/01/2023	120	https://msevents.microsoft.com/event?id=1537241181
Déploiement et sécurisation des workspace Azure Synapse	26/01/2023	120	https://msevents.microsoft.com/event?id=1806467748
Azure Machine Learning pour les Citizen Data Scientists	09/02/2023	120	En cours
PowerBI - Self Service Analytics	16/02/2023	120	https://msevents.microsoft.com/event?id=1401519679
L'IA responsable avec Azure machine learning	09/03/2023	120	https://msevents.microsoft.com/event?id=2072953112
Machine Learning dans Azure Synapse Analytics	16/03/2023	120	https://msevents.microsoft.com/event?id=3413014857
Les bases de données Open Source dans le cloud Azure	23/03/2023	120	https://msevents.microsoft.com/event?id=2727487131
Hybridation des services de Machine Learning Azure	06/04/2023	120	https://msevents.microsoft.com/event?id=1624914222
La gouvernance de données dans Azure avec Microsoft Purview	13/04/2023	120	https://msevents.microsoft.com/event?id=3909342839
Les solutions SQL dans Azure (PaaS, IaaS, SaaS)	04/05/2023	120	https://msevents.microsoft.com/event?id=1162207895
Data processing dans Azure ave Azure Synapse, Azure Batch, Spark, Notebook, etc.	16/05/2023	120	https://msevents.microsoft.com/event?id=3517068442
Hybridation des services de données Azure	24/05/2023	120	https://msevents.microsoft.com/event?id=2996507398
Self Service Analytics	01/06/2023	120	En cours
Total	**25**		