Microsoft

Azure IaaS Fundamentals

Module 1

CONDITIONS AND TERMS OF USE:

Learning Units covered in this Module

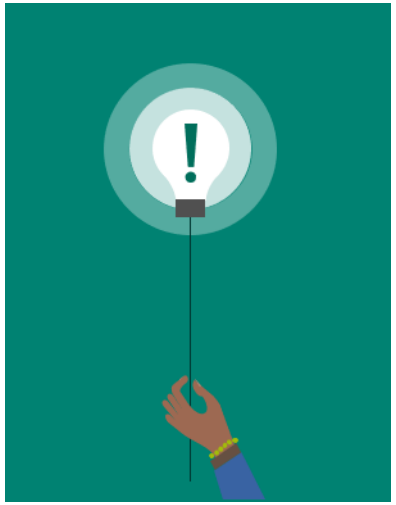
- Lesson 1: Azure Fundamentals
- Lesson 2: Azure IaaS Fundamentals
- Lesson 3: SQL Server IaaS Agent Extension

Lesson 1: Basic concepts of Azure SQL

Objectives

After completing this learning, you will be able to:

- Describe the basic concept and architecture
- Describe the difference between the purchase models.
- Describe the service tiers compute and hardware generation of the Azure SQL Database.



What is Microsoft Azure?

Microsoft Azure is Microsoft's public cloud computing platform

Over 140 countries across 60 regions worldwide

Windows and Linux

Scale globally

- Reach more locations, faster, with the performance and reliability of a vast global infrastructure.

Safeguard data

- Rely on industry-leading data security in the region and across our network.

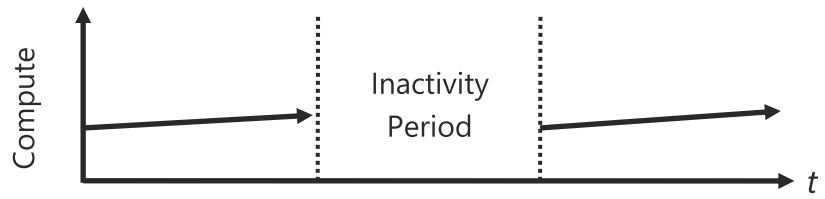
Promote sustainability

- Help build a clean-energy future and accelerate progress toward your sustainability goals.

What is Microsoft Azure?

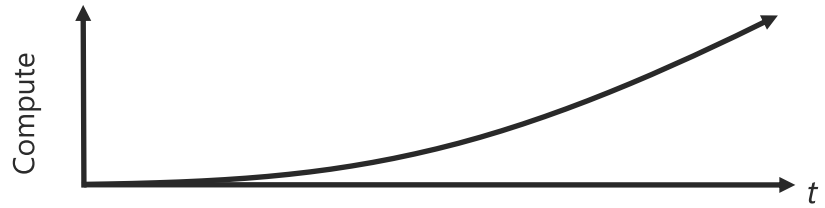
https://azure.microsoft.com/en-us/global-infrastructure/regions/

Benefits of Cloud Computing



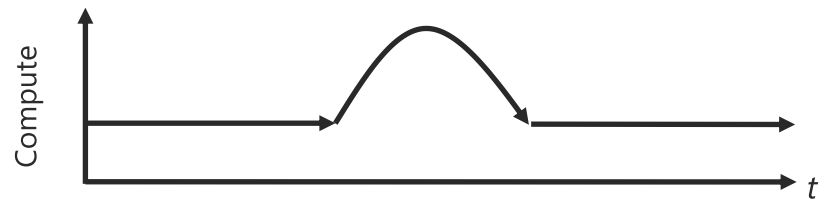
On and Off

On and off workloads (for example: batch job).
Over provisioned capacity is wasted.
Time to market can be cumbersome.



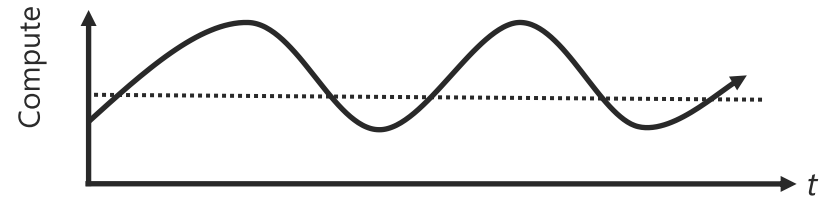
Growing Fast

Successful services needs to grow/scale.
Keeping up with growth is a big IT challenge.
Cannot provision hardware fast enough.



Unpredictable Bursting

Unexpected/unplanned peak in demand.
Sudden spike impacts performance.
Cannot over provision for extreme cases.



Predictable Bursting

Services with micro seasonality trends.
Peaks due to periodic increased demand.
IT complexity and wasted capacity.

Hosting Models

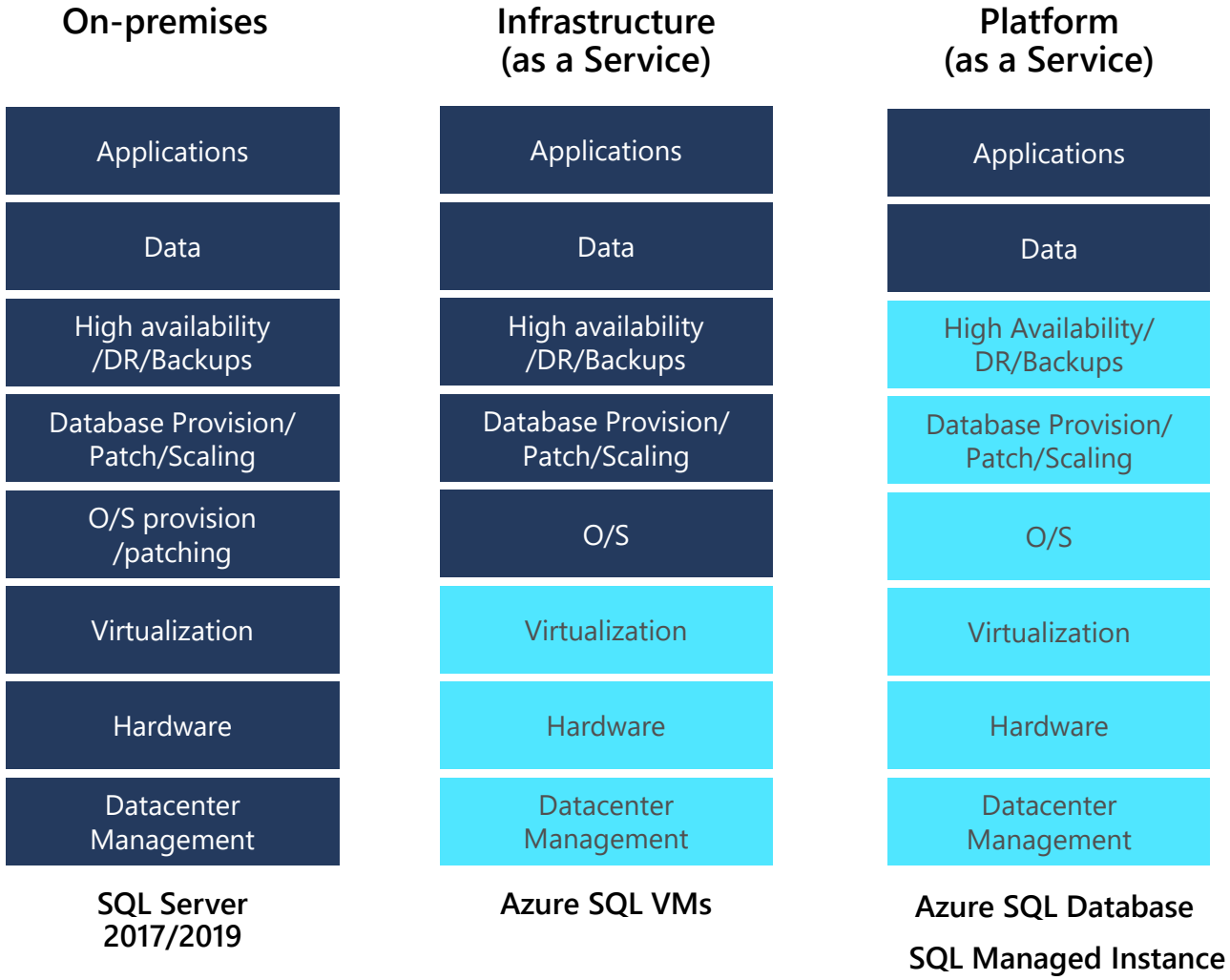
Managed by customer | Managed by Microsoft

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

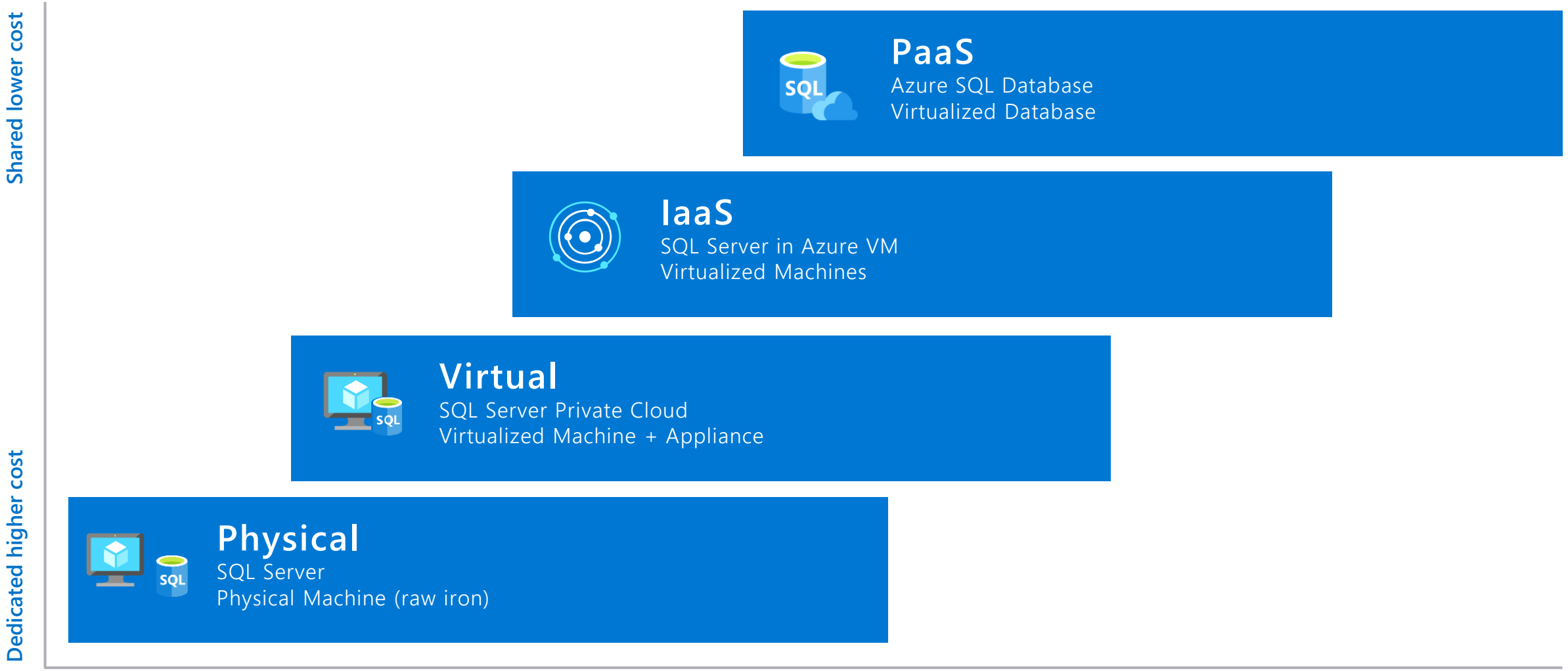
Infrastructure-as-a-Service reduces cost categories related to data center and compute

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



Data platform continuum



Azure SQL Family

Explore Azure SQL database services

SQL Server on Azure Virtual Machines

Migrate your SQL workloads to Azure with ease while maintaining complete SQL Server compatibility and operating system-level access

Learn more >

Azure SQL Managed Instance

Modernize your existing SQL Server applications at scale with an intelligent, fully managed service

Learn more >

Azure SQL Database

Support modern cloud applications on an intelligent, fully managed service that includes serverless compute

Learn more >

A closer look… Best for

SQL Server in Azure VM

- Existing applications that require fast migration to the cloud with minimal changes or no changes.
- Teams that can configure, fine tune, customize, and manage high availability, disaster recovery, and patching for SQL Server.
- You need a customized environment with full administrative rights.
- SQL Server instances with up to 64 TB of storage. The instance can support as many databases as needed.

Managed Instance

- New applications or existing on-premises applications that want to use the latest stable SQL Server features and that are migrated to the cloud with minimal changes.
- Teams that need built-in high availability, disaster recovery, and upgrade for the database.
- Teams that do not want to manage the underlying operating system and configuration settings.
- Databases of up to 8 TB, or larger databases that can be horizontally or vertically partitioned using a scale-out pattern.

Azure SQL Datababase

- New cloud-designed applications that want to use the latest stable SQL Server features and have time constraints in development and marketing.
- Teams that need built-in high availability, disaster recovery, and upgrade for the database.
- Teams that do not want to manage the underlying operating system and configuration settings.
- Databases of up to 4 TB, or larger databases that can be horizontally or vertically partitioned using a scale-out pattern.

Azure SQL Virtual Machines — Everything Configurable

- Business continuity
- High availability
- Automated backups
- Long term backup retention
- Geo-replication
- Scale
- Advanced security
- Automatic tuning
- Built-in monitoring
- Built-in intelligence

Azure Hybrid Benefit

Achieve significant savings in Azure for Windows Server and SQL Server

Azure Hybrid Benefit for Windows Server

Convert, or re-use Windows licensing with active Software Assurance in Azure for IaaS.

Significantly reduce costs with deep savings.

Azure Hybrid Benefit for SQL Server

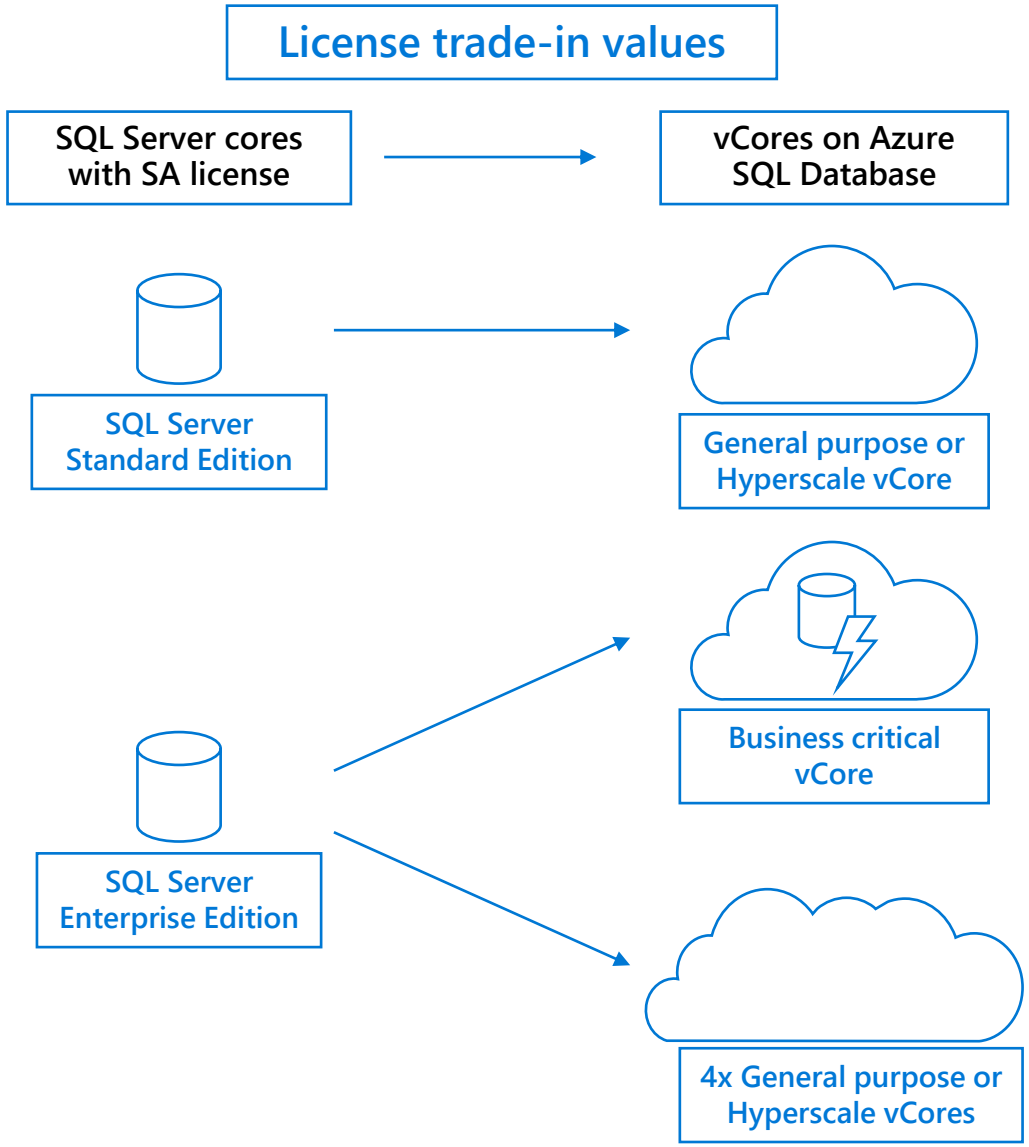
Convert SQL Server licensing with active Software Assurance to save in Azure for IaaS and PaaS.

Use licenses on-premises and under the Hybrid Benefit simultaneously for 180 days.

Azure Hybrid Benefit for SQL Server

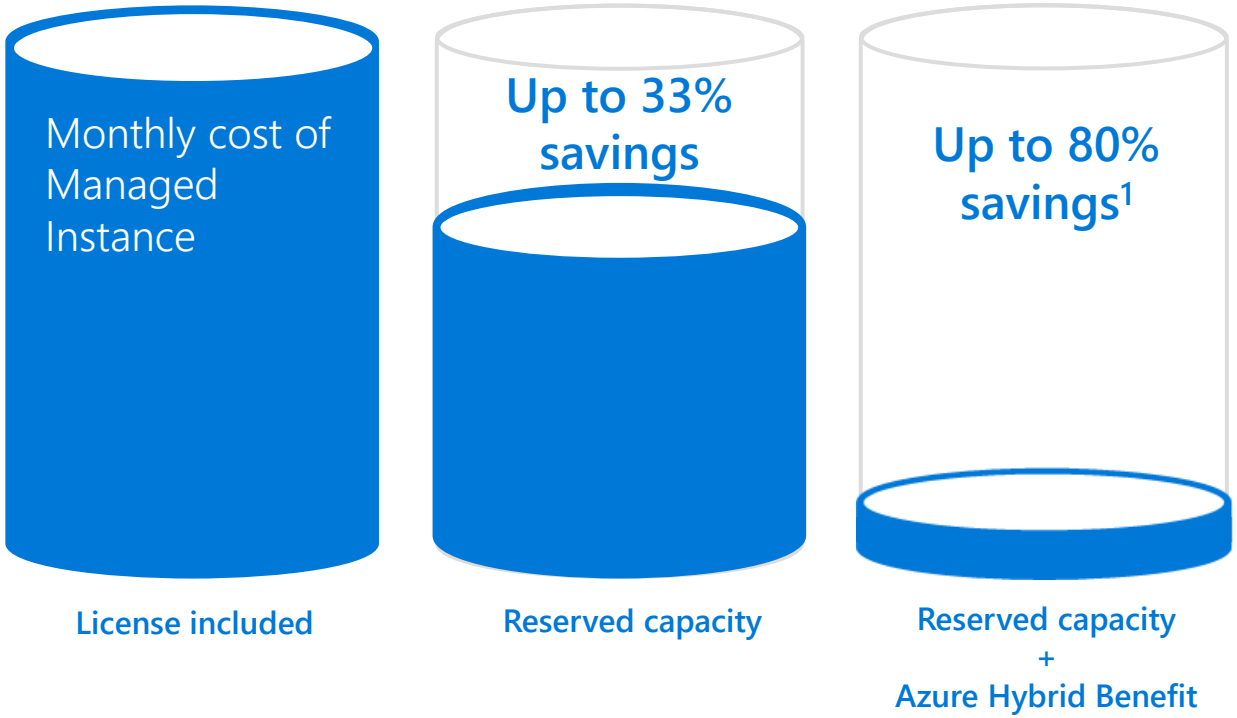
Take an inventory of on-premises licenses to determine potential for conversion. Convert on-premises cores to vCores to maximize value of investments.

- 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).



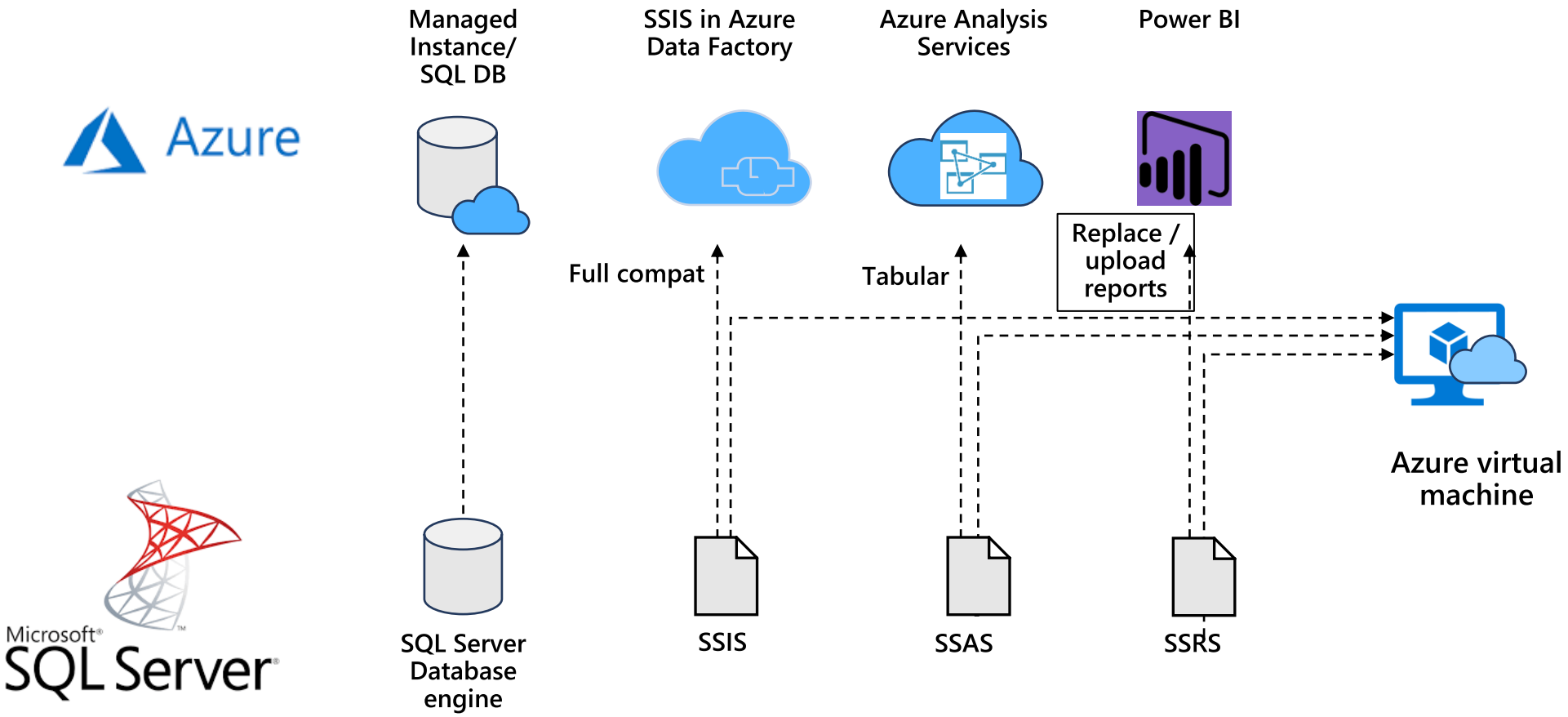
Save up to 80% with Azure SQL reserved capacity combined with AHB

- **Up to 33%** savings by pre-paying compute resources for 1 or 3 years
- **Up to 80%** when combined with AHB
- Single reservation for one or multiple subscriptions
- Reservation applies to any number of databases, elastic pools or managed instances in the same service tier



[1] Savings based on three-year commitment. Savings do not account for SA costs which may vary based on terms of the EA. Savings vary depending on the service tier, and region.

Migrate full SQL Server stack to Azure

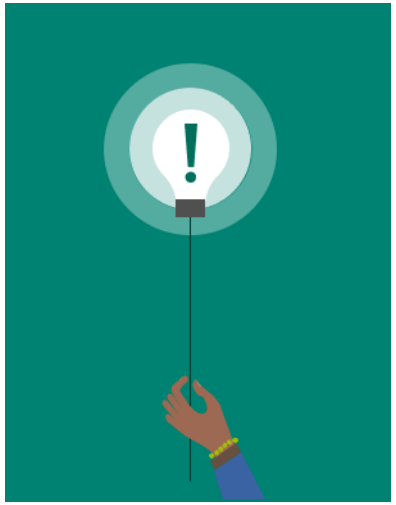


Lesson 2: Azure IaaS Fundamentals

Objectives

After completing this learning, you will be able to:

- Explain the basic aspects of the Azure architecture that can affect the performance of SQL Server on IaaS.
- Learn Azure Storage Services.
- Understand the basics of Azure Virtual Machines storage.



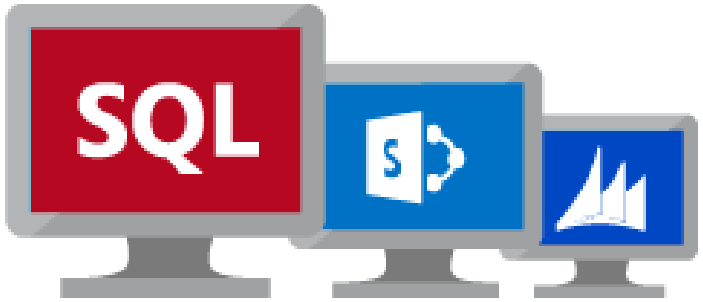
Resource Groups

Resource Group is collection of resources with the same lifecycle.

Every resource belongs to only one resource group.

Resources have types defined by resource providers.

Azure Virtual Machines

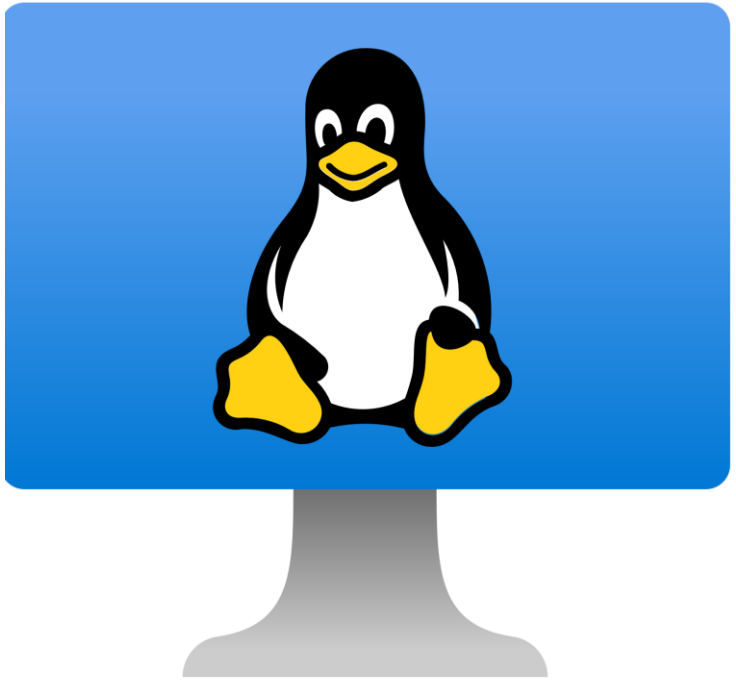


An Azure Virtual Machine gives you the flexibility of virtualization without having to buy and maintain the physical hardware that runs the virtual machine.

You still need to maintain the virtual machine: configuring, patching, and maintaining the software that runs on the virtual machine.

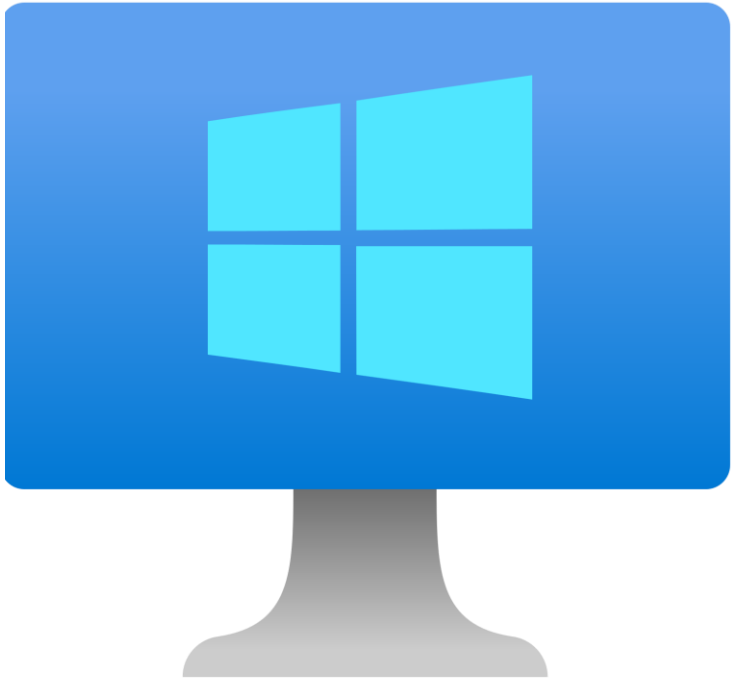
Variety of VM series for all application needs.

Azure Virtual Machine (VM)



Linux Options

SQL Server on Azure SQL VM



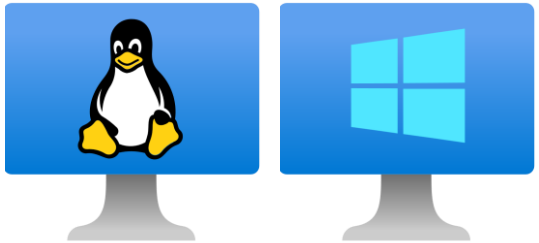
Windows Options

Overview of SQL Server on Azure Windows Virtual Machines - SQL Server on Azure VM | Microsoft Docs

Virtual machines in Azure - Azure Virtual Machines | Microsoft Docs

VM sizes - Azure Virtual Machines | Microsoft Docs

Azure - VM Naming Convention (1)



- **Family** and Sub-family - Indicates the VM Family Series and specialized variations
- # of **vCPUs** - Denotes the number of vCPUs of the VM
- **Features:**
  - a - AMD-based processor
  - d - disk (local temp disk is present); this is for newer Azure VMs
  - m - the most amount of memory in a particular size
  - s - Premium Storage capable
  - i - isolated size
  - h - hibernation capable
  - l - low memory; a lower amount than the memory intensive size
  - t - tiny memory; the smallest amount of memory in a particular size
  - r - RDMA capable
- Accelerator Type - Denotes the type of hardware accelerator in the specialized/GPU SKUs.
- Version - Denotes the version of the VM Family Series

Azure VM sizes naming conventions - Azure Virtual Machines | Microsoft Docs

Azure VM - Naming Convention (2)

[Family] + *[Sub-family]* + **[# of vCPUs]** + **[Additive Features]** + *[Accelerator Type]** + **[Version]**

Virtual Machine: E80ids_v4	
Value	**Details**
Family	E
# of vCPUs	80
Additive Features	i = isolated size d = local temp disk is present s = Premium Storage capable

Azure VM sizes naming conventions - Azure Virtual Machines | Microsoft Docs

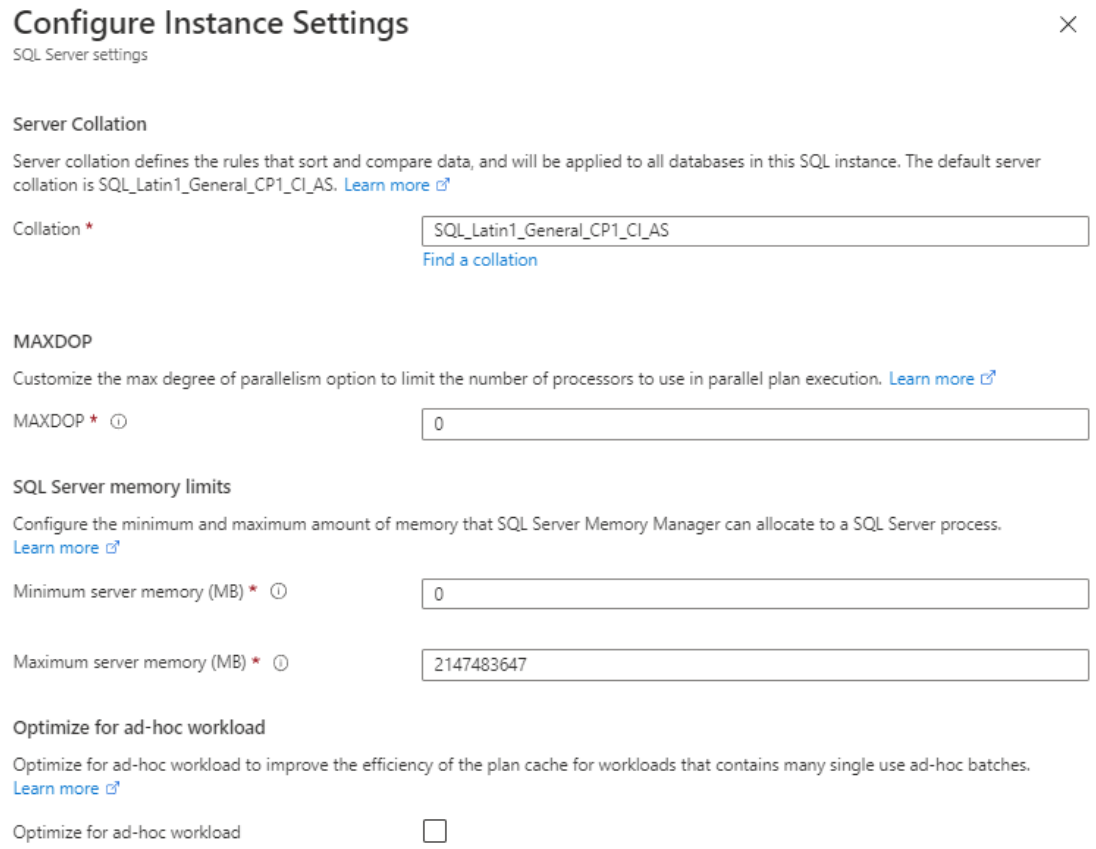
Azure SQL VM - Deployment

Azure Marketplace images come with prebuilt SQL Server default configurations

Often customers must configure their instance after the deployment

Configuration options available during deployment:

- Move system databases to a data disk
- Configure tempdb data and log files
- Ability to change collation from default collation
- Configure Maximum Degree of Parallelism
- Configure Min Server Memory and Max Server Memory
- Configure Optimize for Adhoc Workloads



Demonstration

- Get familiar with the Microsoft Azure portal and see the services Microsoft Azure provides.
- Get familiar with the process of creating an Azure Virtual Machine.

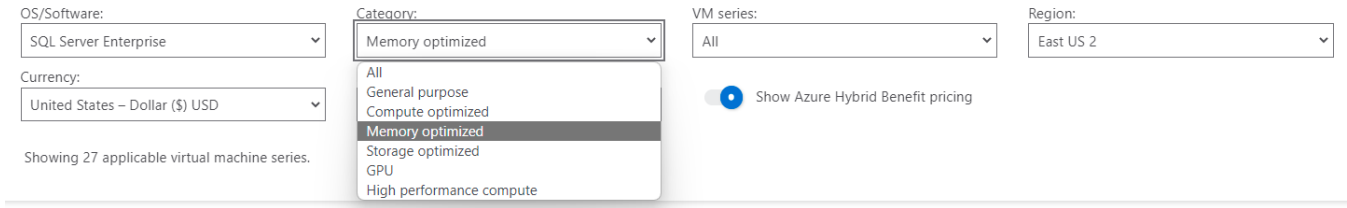
Azure Virtual Machine Sizing

Each series have different capabilities such as SSD local drives or support for Premium Storage.

The size affects the processing, memory, and storage capacity and pricing of the virtual machine.

Type of Computing	Sizes	Description
General	B, Dsv3, Dv3, Dasv4, Dav4, DSv2, Dv2, Av2, DC, DCv2	Balanced CPU-to-memory ratio. Ideal for testing and development, small to medium databases, and low to medium traffic web servers.
Compute Optimized	Fsv2	High CPU-to-memory ratio. Good for medium traffic web servers, network appliances, batch processes, and application servers.
Memory Optimized	Esv3, Ev3, Easv4, Eav4, Mv2, M, DSv2, Dv2	High memory-to-CPU ratio. Great for **relational database servers**, medium to large caches, and in-memory analytics.
Storage Optimized	Lsv2	High disk throughput and IO. Ideal for Big Data, SQL, NoSQL databases, data warehousing and large transactional databases.
GPU	NC, NCv2, NCv3, ND, NDv2 (Preview), NV, NVv3, NVv4	Heavy graphic rendering and video editing.
High Performance Optimized	HB, HBv2, HC, H	Our fastest and most powerful CPU virtual machines.

Azure VM – Explore Pricing Options



Instance	vCPU(s)	RAM	Temporary storage	Pay as you go with AHB	Pay as you go with Azure Hybrid Benefit for SQL Server	1 year reserved with AHB	3 year reserved with AHB	3 year reserved with AHB for SQL Server and Windows Server
E4ds v5	4	32 GiB	150 GiB	$1,305.2400/month	$344.5600/month ~76% savings	$1,218.9978/month ~6% savings	$1,174.8912/month ~9% savings	$79.8912/month ~94% savings
E8ds v5	8	64 GiB	300 GiB	$2,610.4800/month	$689.1200/month ~76% savings	$2,438.0832/month ~6% savings	$2,349.7751/month ~9% savings	$159.7751/month ~94% savings
E16ds v5	16	128 GiB	600 GiB	$5,220.9600/month	$1,378.2400/month ~76% savings	$4,876.1664/month ~6% savings	$4,699.5575/month ~9% savings	$319.5575/month ~94% savings
E20ds v5	20	160 GiB	750 GiB	$6,526.2000/month	$1,722.8000/month ~76% savings	$6,095.1642/month ~6% savings	$5,874.4414/month ~9% savings	$399.4414/month ~94% savings
E32ds v5	32	256 GiB	1,200 GiB	$10,441.9200/month	$2,756.4800/month ~76% savings	$9,752.3328/month ~6% savings	$9,399.1369/month ~9% savings	$639.1369/month ~94% savings
E48ds v5	48	384 GiB	1,800 GiB	$15,662.8800/month	$4,134.7200/month ~76% savings	$14,628.4992/month ~6% savings	$14,098.6944/month ~9% savings	$958.6944/month ~94% savings

Pricing - SQL Server Enterprise Virtual Machines | Microsoft Azure

Azure VM – Explore Series Options

Size	vCPU	Memory: GiB	Temp storage (SSD) GiB	Max data disks	Max temp storage throughput: IOPS/MBps*	Max uncached disk throughput: IOPS/MBps	Max burst uncached disk throughput: IOPS/MBps[5]	Max NICs	Max network bandwidth (Mbps)
Standard_E4ds_v5	4	32	150	8	19000/250	6400/145	20000/1200	2	12500
Standard_E8ds_v5	8	64	300	16	38000/500	12800/290	20000/1200	4	12500
Standard_E16ds_v5	16	128	600	32	75000/1000	25600/600	40000/1200	8	12500
Standard_E20ds_v5	20	160	750	32	94000/1250	32000/750	64000/1600	8	12500
Standard_E32ds_v5	32	256	1200	32	150000/2000	51200/865	80000/2000	8	16000
Standard_E48ds_v5	48	384	1800	32	225000/3000	76800/1315	80000/3000	8	24000

Edv5 and Edsv5-series - Azure Virtual Machines | Microsoft Docs

Azure VM – Explore Storage Options

	Disk Size	Price per month	1-Year Reserved Price Per Month	Max IOPS (Max IOPS w/ bursting)	Max throughput (Max throughput w/ bursting)	Price per mount per month (Shared Disk)
P30	1 TiB	$122.88	$116.75	5,000 (30,000)	200 MB/second (1,000 MB/second)	$6.57
P40	2 TiB	$235.52	$223.75	7,500 (30,000)	250 MB/second (1,000 MB/second)	$13.14
P50	4 TiB	$450.56	$428	7,500 (30,000)	250 MB/second (1,000 MB/second)	$25.55
P60	8 TiB	$860.16	$817.17	16,000 (30,000)	500 MB/second (1,000 MB/second)	$51.10
P70	16 TiB	$1,638.40	$1,556.50	18,000 (30,000)	750 MB/second (1,000 MB/second)	$109.50
P80	32 TiB (32767 GiB)	$3,276.80	$3,113	20,000 (30,000)	900 MB/second (1,000 MB/second)	$219

Pricing - Managed Disks | Microsoft Azure

Checklist: Best practices for SQL Server on Azure VMs

VM Size

- The new Ebdsv5-series provides the highest I/O throughput-to-vCore ratio in Azure along with a memory-to-vCore ratio of 8. This series offers the best price-performance for SQL Server workloads on Azure VMs. Consider this series first for most SQL Server workloads.
- Use VM sizes with 4 or more vCPUs like the E4ds_v5 or higher

Storage

- To optimize storage performance, plan for highest uncached IOPS available and use data caching as a performance feature for data reads while avoiding virtual machine and disks capping/throttling.
- For the data drive, use premium P30 and P40 or smaller disks to ensure the availability of cache support
- Place tempdb on the local ephemeral SSD (default) drive

Checklist: Best practices & guidelines - SQL Server on Azure VMs | Microsoft Learn

Demonstration

Overview of Service Tiers available for Azure SQL VM

- Review the different Service Tiers, Compute and Hardware options available while creating an Azure SQL VM

Azure Storage Services

Durable and highly available

- Redundancy ensures that your data is safe in the event of transient hardware failures. You can also opt to replicate data across datacentres or geographical regions for additional protection from local catastrophe or natural disaster.

Secure

- All data written to an Azure storage account is encrypted by the service.

Scalable

- Azure Storage is designed to be massively scalable to meet the data storage and performance needs of today's applications.

Managed

- Azure handles hardware maintenance, updates, and critical issues for you.

Azure Storage Services

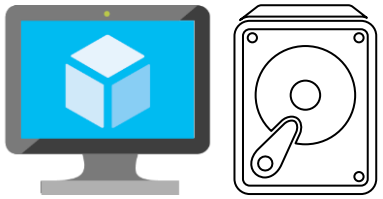
Feature	Description	When to use
Azure Files *Managed file shares for cloud or on-premises deployments.*	Offers fully managed cloud file shares that you can access from anywhere via the industry standard Server Message Block (SMB) protocol. You can mount Azure file shares from cloud or on-premises deployments of Windows, Linux, and macOS.	You want to "lift and shift" an application to the cloud that already uses the native file system APIs to share data between it and other applications running in Azure. You want to replace or supplement on-premises file servers or NAS devices.
Azure Blobs *A massively scalable object store for text and binary data. Also includes support for big data analytics through Data Lake Storage Gen2.*	Allows unstructured data to be stored and accessed at a massive scale in block blobs. Also supports Azure Data Lake Storage Gen2 for enterprise big data analytics solutions.	You want your application to support streaming and random-access scenarios. You want to be able to access application data from anywhere. You want to build an enterprise data lake on Azure and perform big data analytics.
Azure Disks *Block-level storage volumes for Azure VMs.*	Allows data to be persistently stored and accessed from an attached virtual hard disk.	You want to "lift and shift" applications that use native file system APIs to read and write data to persistent disks. You want to store data that is not required to be accessed from outside the virtual machine to which the disk is attached.
Azure Queues *A messaging store for reliable messaging between application components.*	Allows for asynchronous message queueing between application components.	You want to decouple application components and use asynchronous messaging to communicate between them.
Azure Tables *A NoSQL store for schema less storage of structured data.*	Allow you to store structured NoSQL data in the cloud, providing a key/attribute store with a schema less design.	You want to store flexible datasets like user data for web applications, address books, device information, or other types of metadata your service requires.

Azure VM - Disks

Block-level storage volumes for Azure VMs

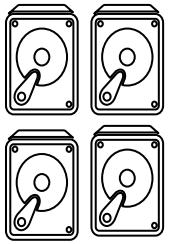
Operating System Disk

- Every virtual machine has one attached operating system disk
- The OS disk has a pre-installed OS, which was selected when the VM was created
- This disk contains the boot volume
- This disk has a maximum capacity of 2,048 GiB



Temporary disk

- Provides short-term storage
- Intended to only store data such as page or swap files
- Data may be lost during a maintenance event or when you redeploy a VM
- During a successful standard reboot of the VM, the data on the temporary disk will persist



Data disks

- A managed disk to store application data, or other data
- Registered as SCSI drives and are labeled with a letter that you choose
- Each data disk has a maximum capacity of 32,767 gibibytes (GiB)
- The size of the VM determines how many data disks you can attach to it and the type of storage you can use to host the disks

Azure Disk Storage overview - Azure Virtual Machines | Microsoft Docs

Basics – Azure Managed Disks

Block-level storage volumes that are managed by Azure

Just like physical disk in an on-premises server but, virtualized

Need to only specify the disk size and the disk type to provision the disk

Benefits of managed disks:

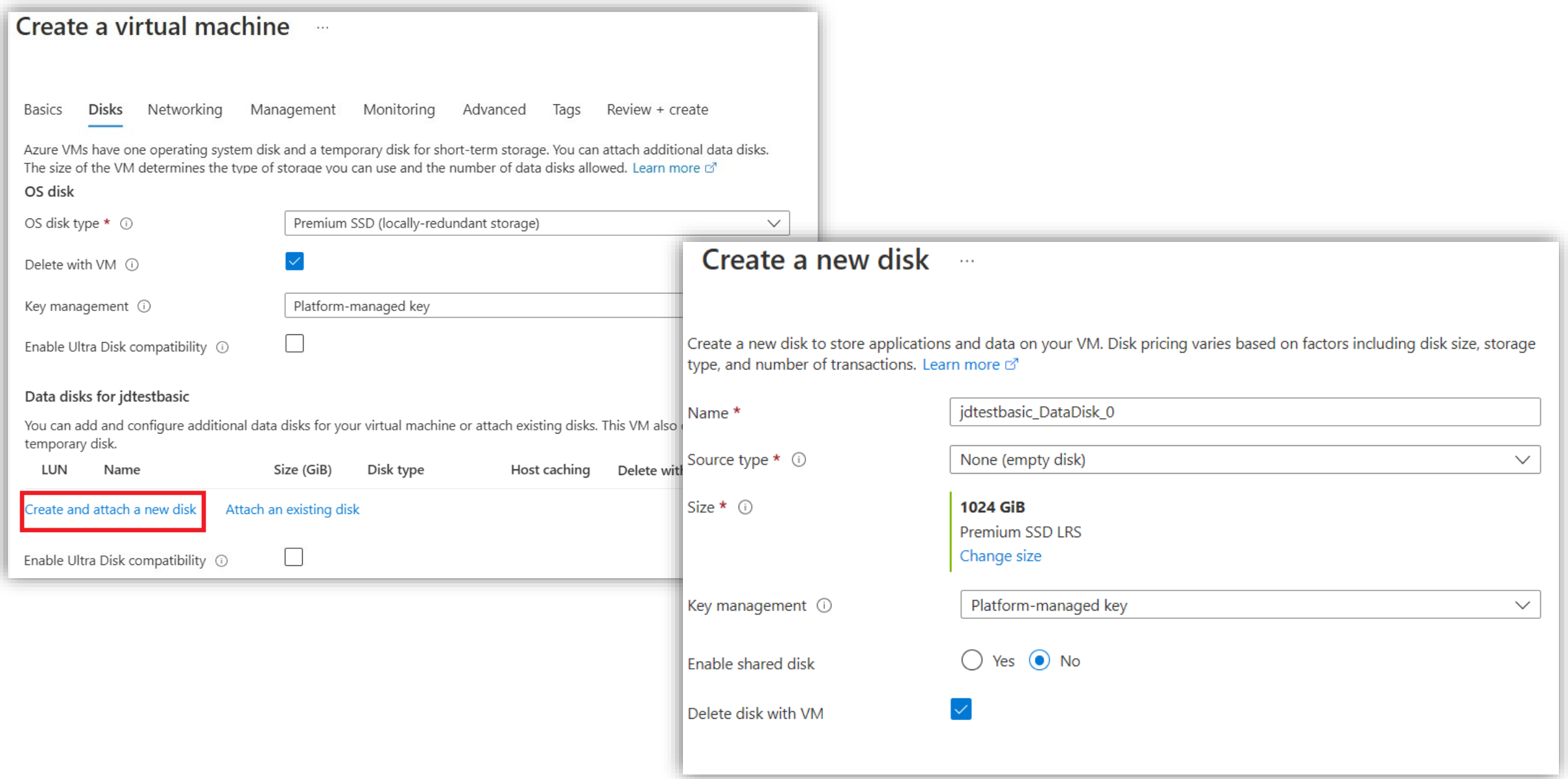
- Highly durable and available
- Simple and scalable VM deployment
- Integration with Availability Sets
- Integration with Availability Zones
- Azure Backup support
- Granular access control
- Upload your VHD
- Encryption

Azure Disk Storage overview - Azure Virtual Machines | Microsoft Docs

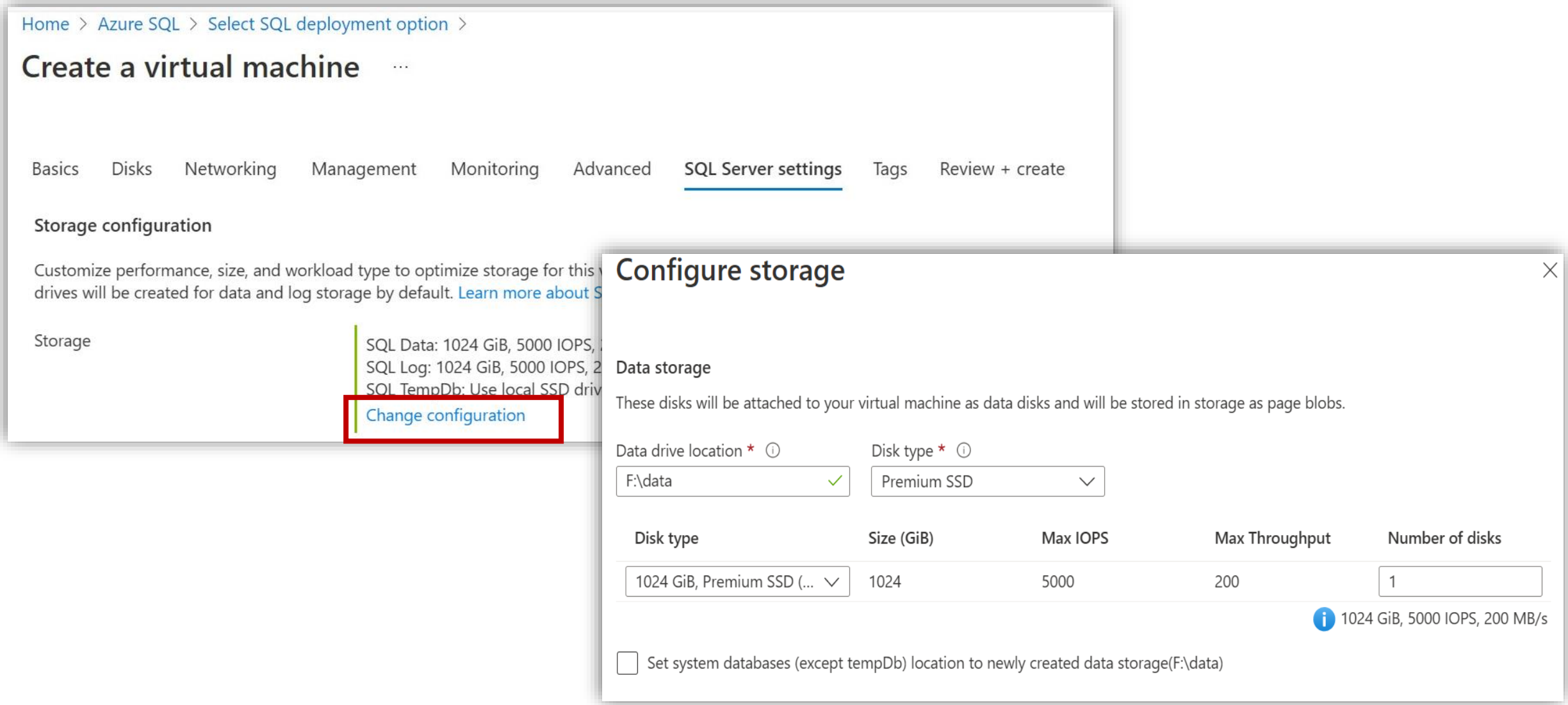
Basics – Azure Disk Types

	Ultra SSD	Premium SSD	Standard SSD	Standard HDD
Disk type	SSD	SSD	SSD	HDD
Scenario	IO-intensive workloads such as SAP HANA, top tier databases (for example, SQL, Oracle), and other transaction-heavy workloads	Production and performance sensitive workloads To get IOPS and Bandwidth higher than the maximum value of a single premium storage disk, use multiple premium disks striped together	Web servers, lightly used enterprise applications and dev/test	Backup, non-critical, infrequent access
Max disk size	65,536 gibibyte (GiB)	32,767 GiB	32,767 GiB	32,767 GiB
Max throughput	2,000 MiB/s	900 MiB/s	750 MiB/s	500 MiB/s
Max IOPS	160,000	20,000	6,000	2,000

Adding a new disk: Non-SQL image



Adding a new disk: With SQL image



Basics - Azure Storage Redundancy

Redundancy in the Primary region

- Locally redundant storage (**LRS**)
- Zone-redundant storage (**ZRS**)

Redundancy in a Secondary region

- Geo-redundant storage (**GRS**) / Read-access geo-redundant storage (**RA-GRS**)
- Geo-zone-redundant storage (**GZRS**) / Read-access geo-zone-redundant storage (**RA-GZRS**)

Outage scenario	LRS	ZRS	GRS/RA-GRS	GZRS/RA-GZRS
A node within a data center becomes unavailable	Yes	Yes	Yes	Yes
An entire data center (zonal or non-zonal) becomes unavailable	No	Yes	Yes	Yes
A region-wide outage occurs in the primary region	No	No	Yes	Yes
Read access to the secondary region is available if the primary region becomes unavailable	No	No	Yes (with RA-GRS)	Yes (with RA-GZRS)
Copies of data	3	3	6	6

Disaster recovery and storage account failover - Azure Storage | Microsoft Docs

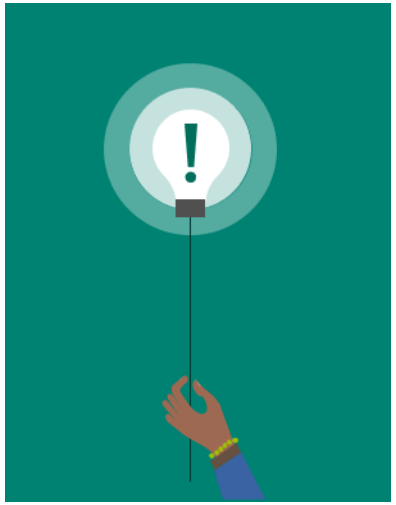
Questions?

Lesson 3: SQL Server IaaS Agent Extension

Objectives

After completing this learning, you will be able to:

- Understand what is SQL Server IaaS Agent Extension.
- Understand the different options available to register a SQL Server VM in Azure with the SQL Server IaaS agent extension
- Understand the steps to register a SQL VM in Azure with the SQL Server IaaS agent extension



What is the SQL Server IaaS Agent Extension?

Features

- The SQL Server IaaS Agent Extension runs on Azure VMs.
- Automates task like Backups and Patching.
- Unified experience in managing all of Azure SQL family.
- Enables customers to adopt PaaS-like capabilities with IaaS-based SQL Servers at no additional charge.

Registration

- Deploying a SQL Server VM Azure Marketplace image through the Azure portal automatically registers the SQL Server VM with the resource provider
- Self-installs of SQL Server on an Azure virtual machine will need to register the SQL Server VM to install the SQL Server IaaS Agent Extension.

Licensing

- Self-installed VMs with IaaS extensions can be easily converted to PayGo images.
- Save money by converting variable workloads with Software Assurance to PayGo images.

Compliance

- Self-installed VMs with IaaS extension automatically indicate usage of Azure Hybrid Benefit.
- Ensure compliance with Azure terms and conditions without any extra effort.

PaaS features for Azure SQL VMs

Features of SQL IaaS Extensions	Extensions enabled	
	Lightweight mode	Full mode
Visibility of SQL editions and configuration state via Portal Management	✓	✓
Visibility to the licensing of SQL Server instances	✓	✓
SQL IaaS/PaaS deployments managed in one location	✓	✓
SQL Server integration with Azure Key Vault		✓
Automatic configuration of Always On for High Availability		✓
Automated Patching (for critical updates)		✓
Automated Backup (with Point-in-Time Restore)		✓
Disk Scaling and Utilization view		✓

Management Modes

If the **SQL Server IaaS Agent Extension** has not already been installed, registering with the SQL Server IaaS Agent Extension automatically installs the SQL Server IaaS agent extension in one of three management modes, specified during the registration process. Not specifying the management mode will install the SQL IaaS agent extension in full management mode.

Lightweight

- Does not require the restart of SQL Server
- Supports only changing the license type and edition of SQL Server
- Use this option for SQL Server VMs with multiple instances, or participating in a failover cluster instance (FCI)
- No impact to memory or CPU
- No associated cost
- It is recommended to register your SQL Server VM in lightweight mode first, and then upgrade to Full mode during a scheduled maintenance window.

Full

- Requires a restart of the SQL Server and system administrator permissions
- Supports all functionality
- Use it for managing a SQL Server VM with a single instance
- Installs two windows services that have a minimal impact to memory and CPU
- No associated cost

NoAgent

- Dedicated only for SQL Server 2008 and SQL Server 2008 R2 installed on Windows Server 2008
- No associated cost

Automatic Azure SQL VM registration

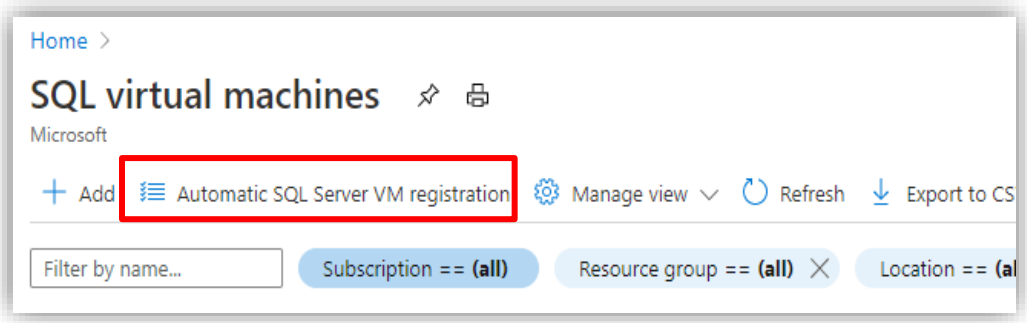
Automatic SQL Server VM registration button enables SQL IaaS Extensions features for all SQL VMs within a given subscription automatically.

Activation will require consent of the person who performs activation.

Microsoft will not use this data for licensing audits without customer's advance consent.

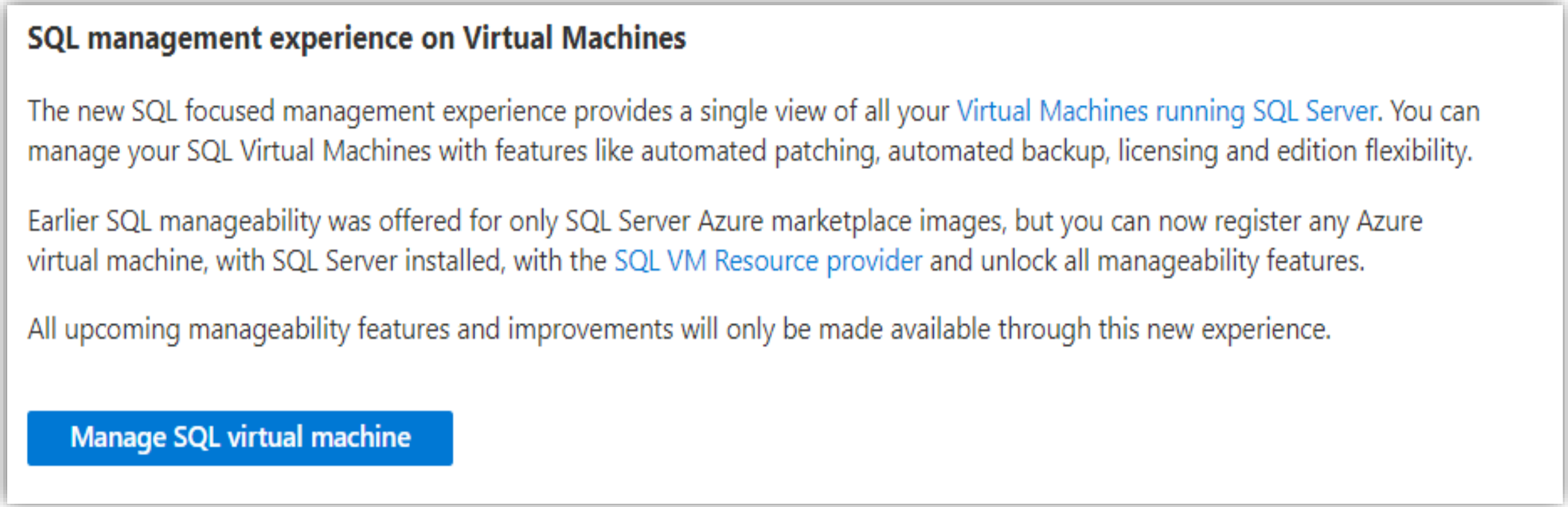
The SQL IaaS extensions will become active for all SQL Server VMs, and the features of lightweight mode will be activated within 24 hours after the activation.

Registering extension in full mode does not require restart of the server.



SQL VM Management Experience

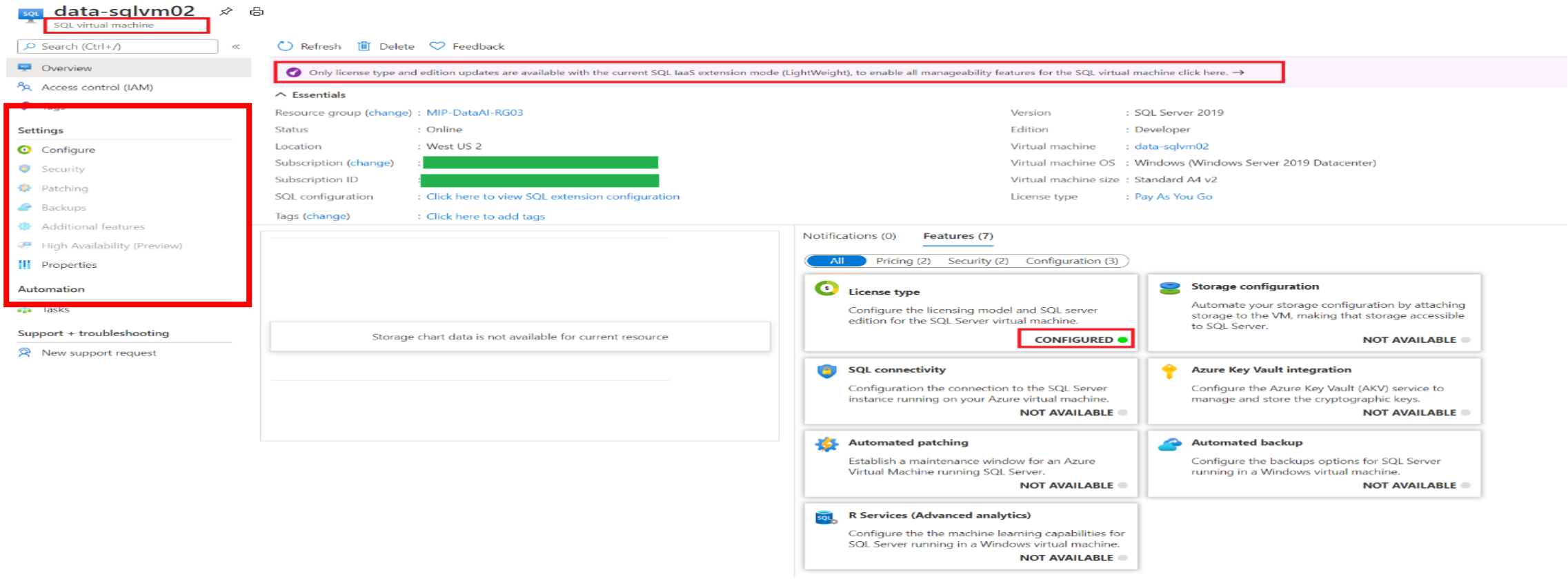
Manage SQL Server configuration under the Virtual Machine blade.



Manageability options

Lightweight Mode

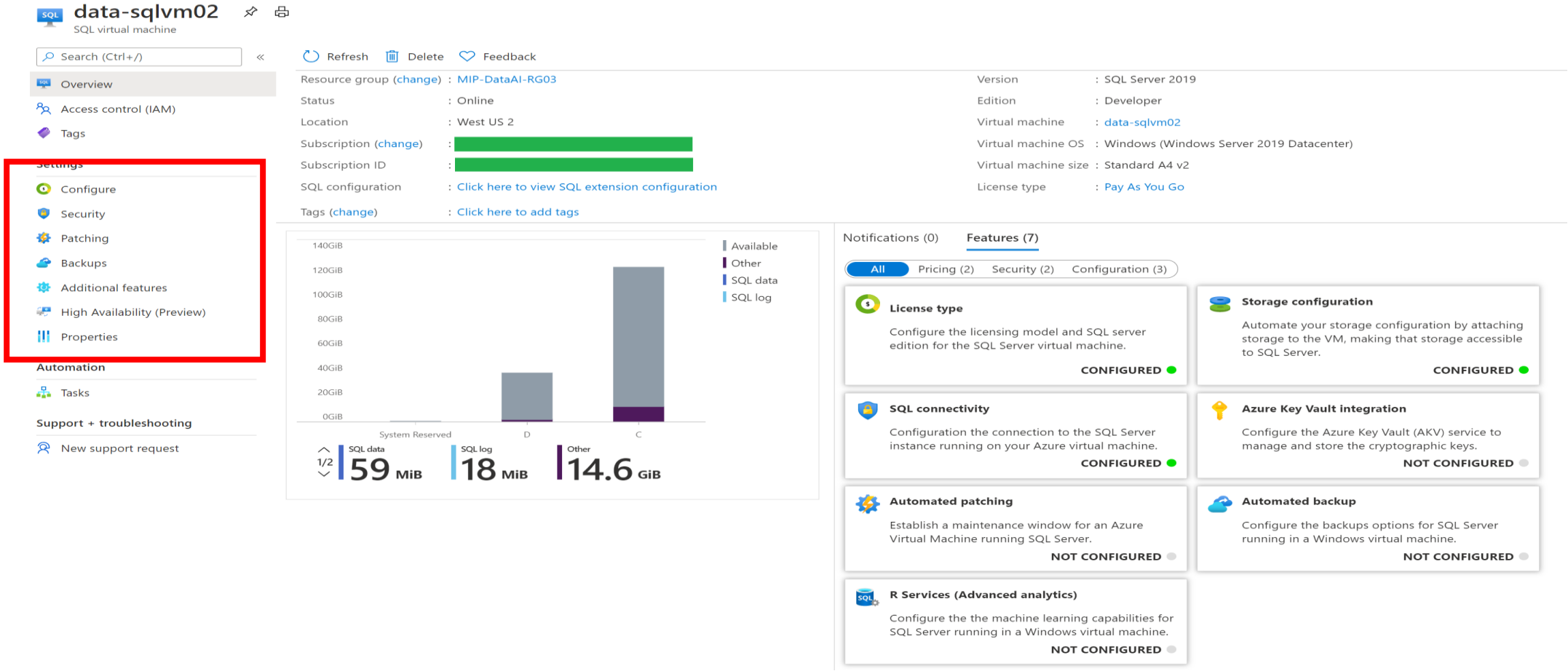
- Different manageability options that are enabled when the SQL Server IaaS extension is enabled



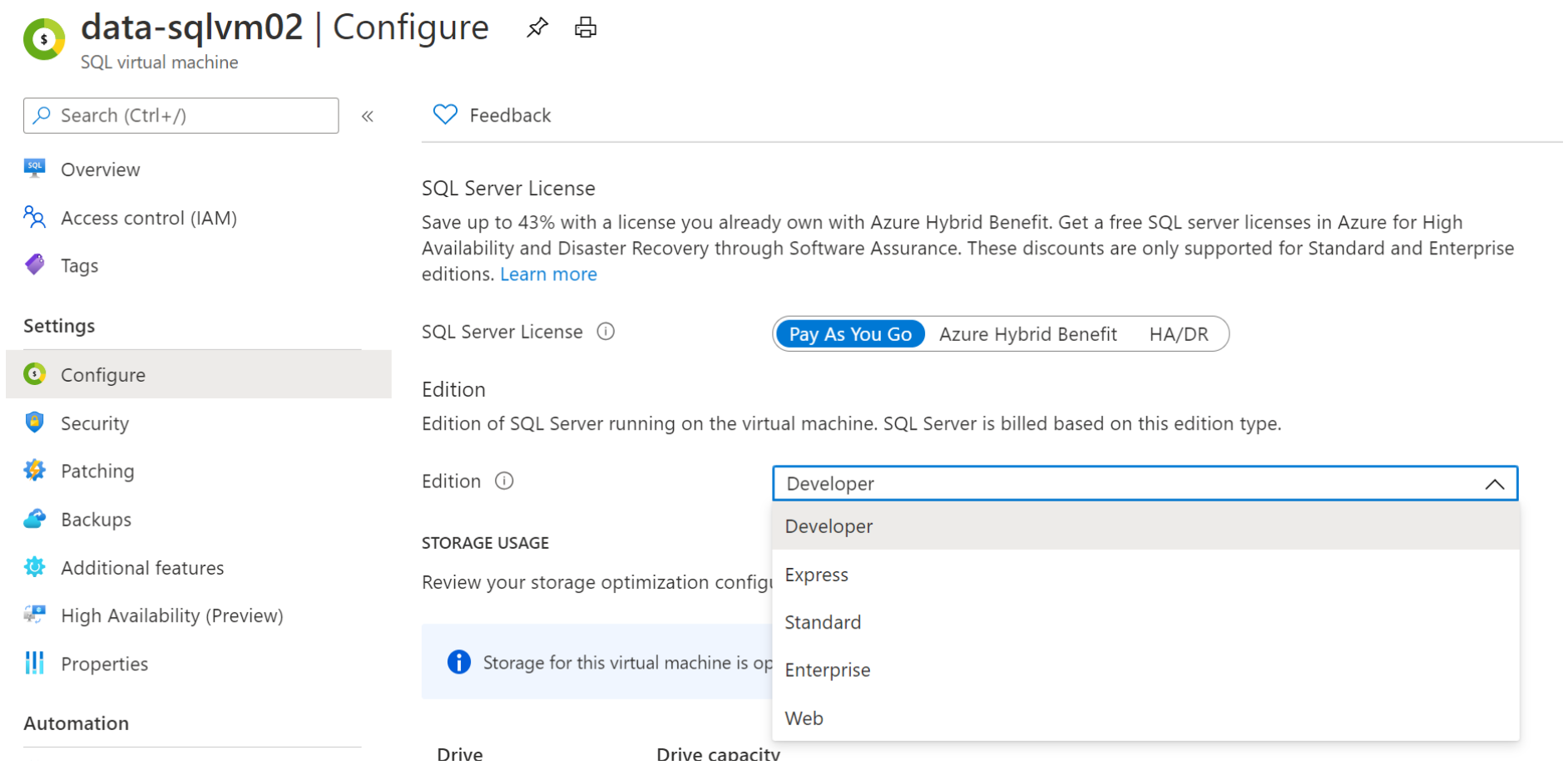
Manageability options

Full Mode

- Different manageability options that are enabled when the SQL Server IaaS extension is enabled

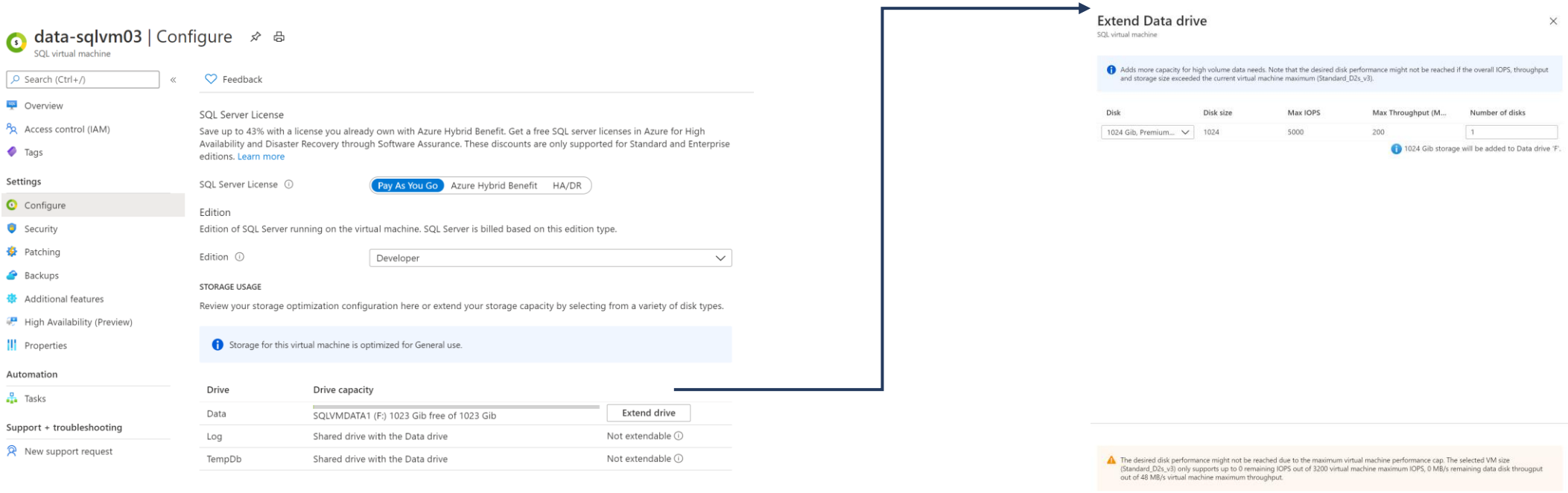


Simplify License Management



Storage Configuration

- Once the SQL Server virtual machine is running, you have the option of increasing the storage capacity of your disks and the wizard will help you determine if you are picking a configuration setting which could be the victim of a capacity limit.
- Extending drives adds more storage capacity but does not add more IOPS and throughput capacity. If you need more IOPS and throughput, you will need to build a new storage pool and migrate the data to the new pool.



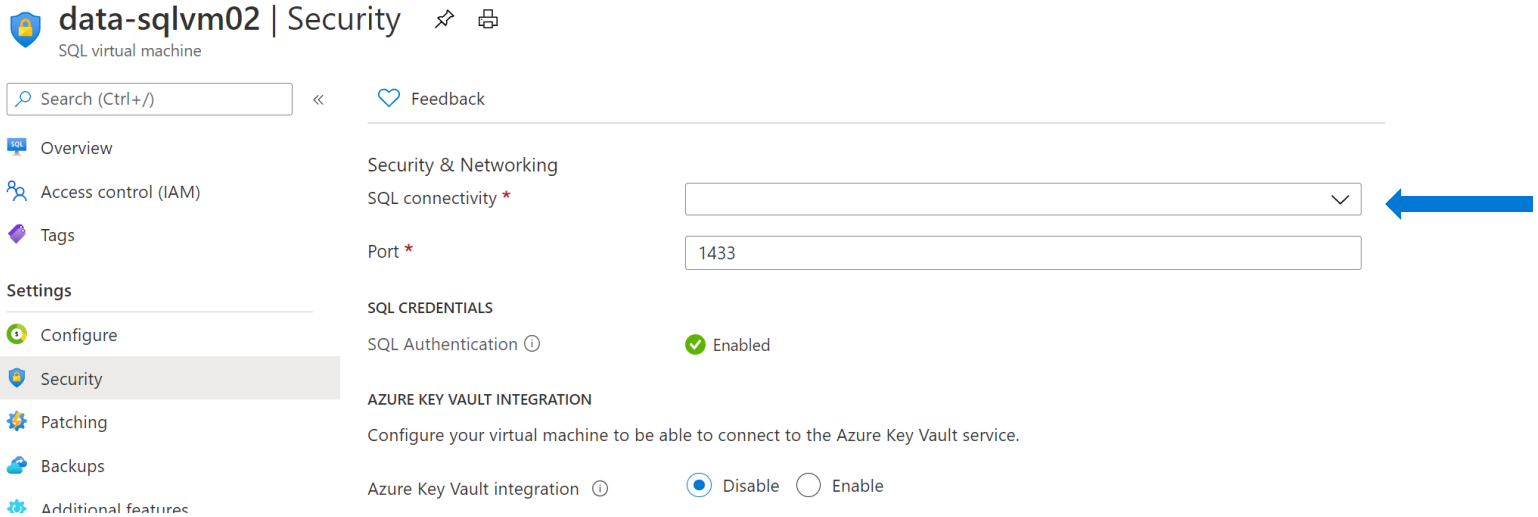
SQL Connectivity

Set the port for the SQL Server instance to ensure that you are able to listen on another port other than a well-known port.

Configure the connectivity rules to make it as restrictive like allowing local connectivity only or opening it up to public internet for external applications and clients to connect to the SQL Server instance (see screenshot below).

Enable SQL Authentication for the SQL Server instance if your applications and users require this authentication method.

Configure Azure Key Vault for the SQL Server instance to leverage Key Vault for Transparent Database Encryption, Column Level Encryption and Always Encrypted features of SQL Server to enable encryption of data at rest and in motion.



SQL Connectivity Options:

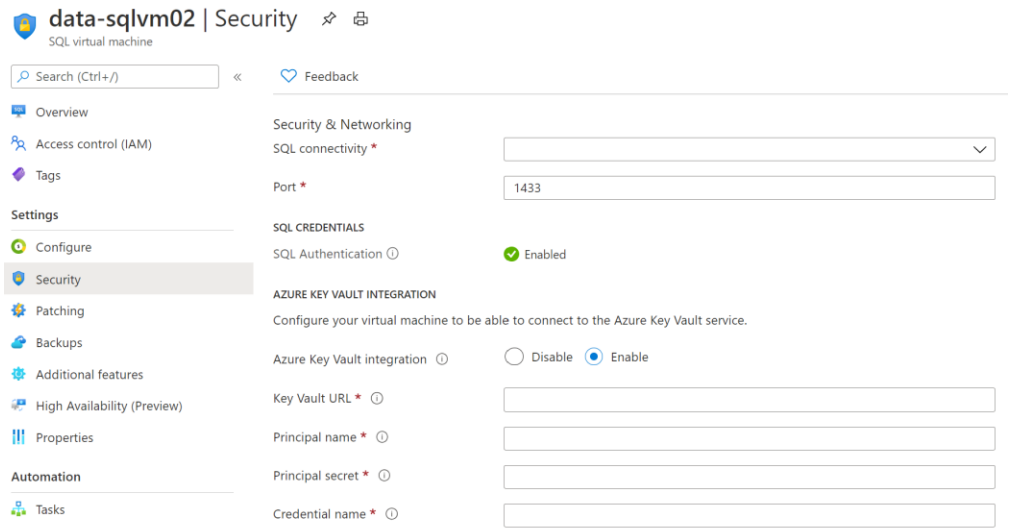
- Private (within Virtual Network)
- Local (inside VM only)
- Public (Internet)

Azure Key Vault Integration

Different SQL Server encryption features, such as transparent data encryption (TDE), column level encryption (CLE), and backup encryption, require you to manage and store the cryptographic keys you use for encryption.

The Azure Key Vault service is designed to improve the security and management of these keys in a secure and highly available location.

When this feature is enabled, it automatically installs the SQL Server Connector, configures the EKM provider to access Azure Key Vault, and creates the credential to allow you to access your vault.

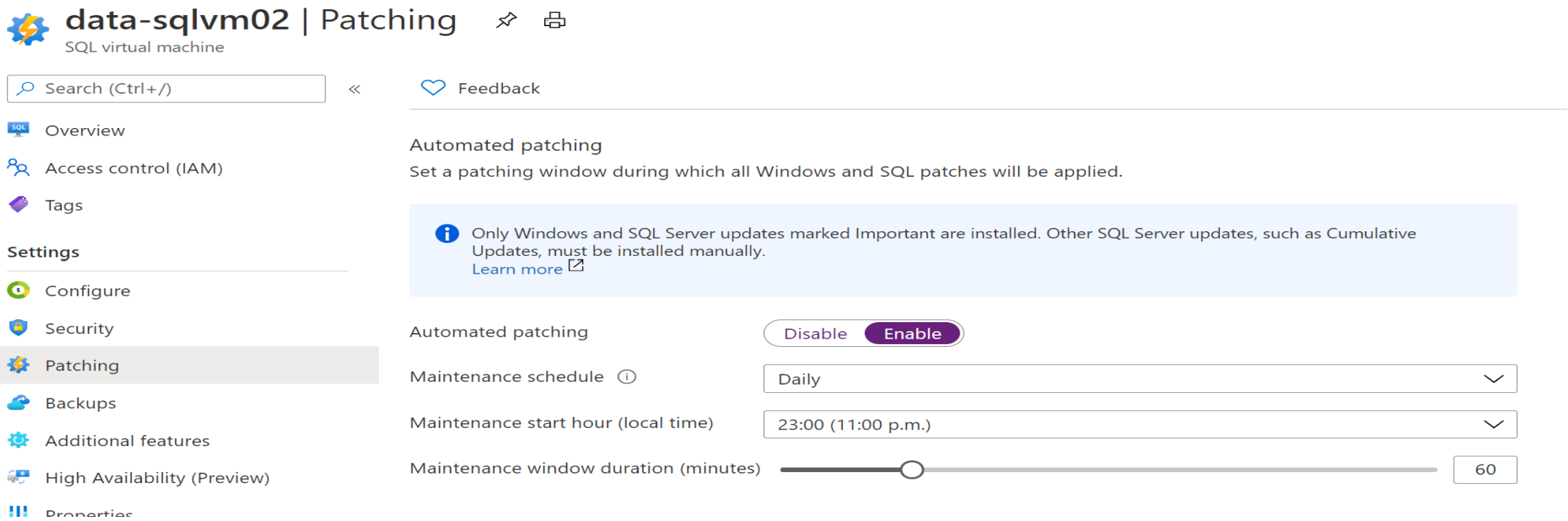


Steps:

- Create a new key vault using **New-AzKeyVault** command. It will return **vaultUri** property, which is the **key vault URL**.
- After key vault is created, add your keys to the key vault.

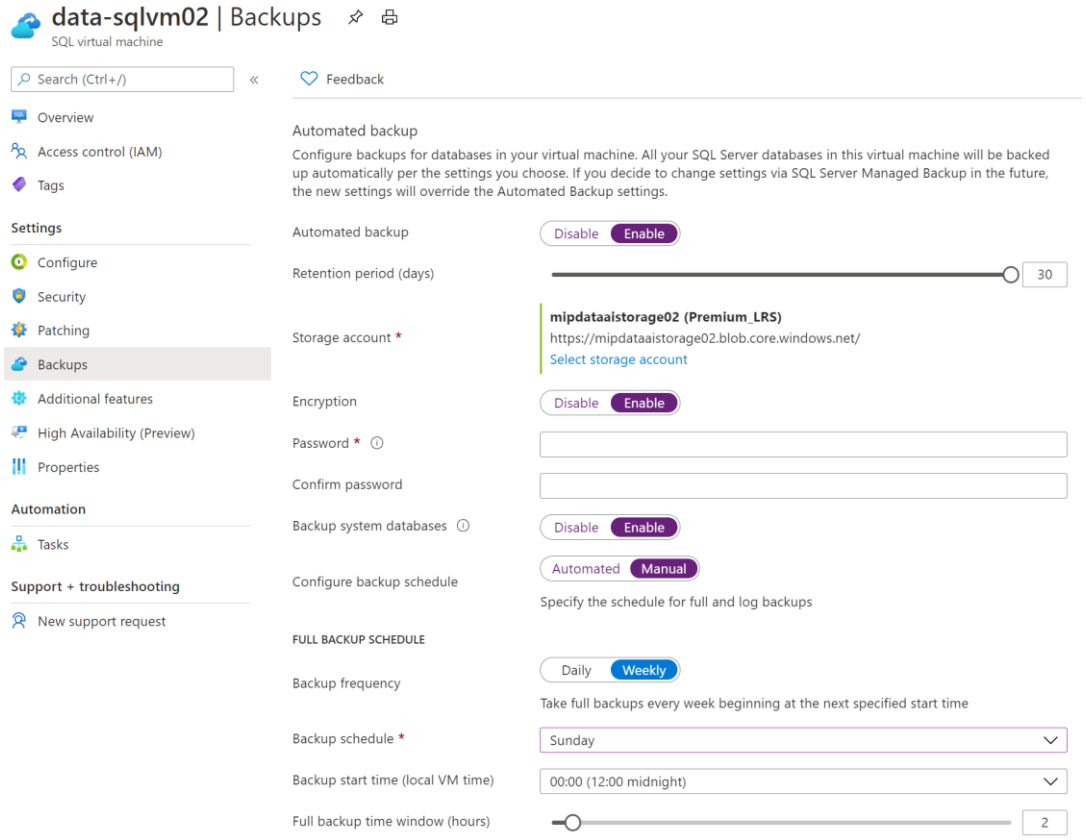
Automated Patching Feature

- The **Automated Patching** feature allows a SQL Server administrator to select a maintenance window schedule for applying Important Windows Server and SQL Server updates that are distributed through the Windows Update channel.



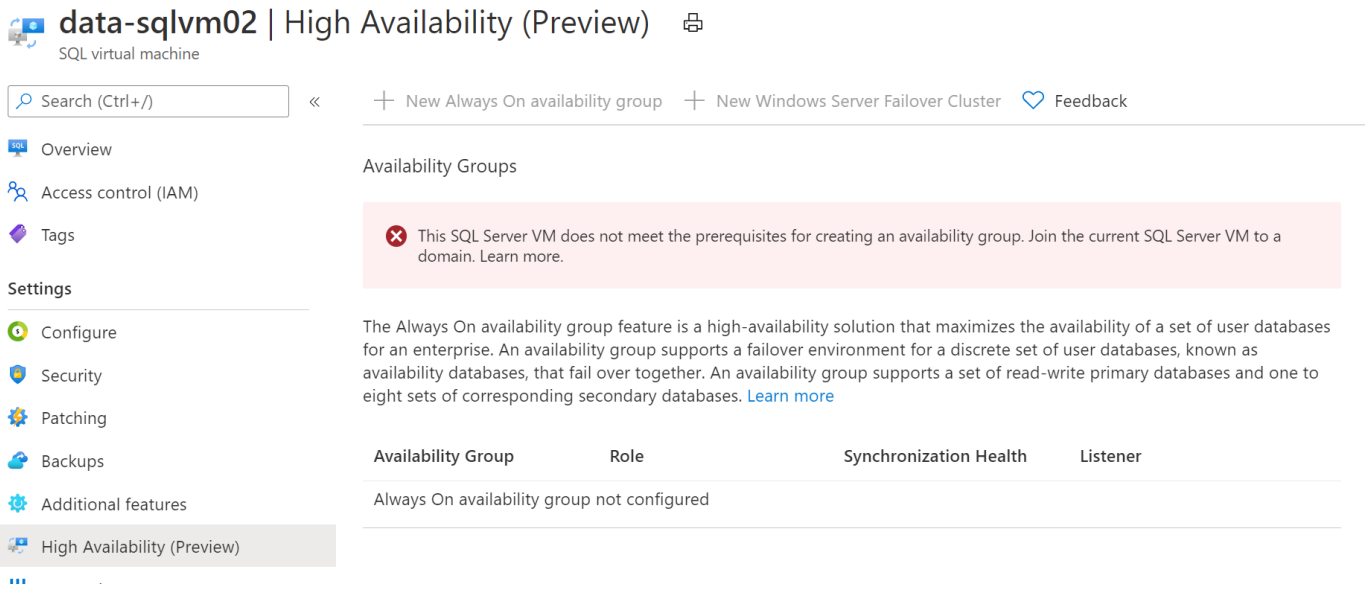
Automated Backup

- The **Automated Backup** feature allows you to setup SQL Server backups with various options like encrypting backups, set a retention period, backup system databases, configuring a manual backup schedule or setting up an automated backup.



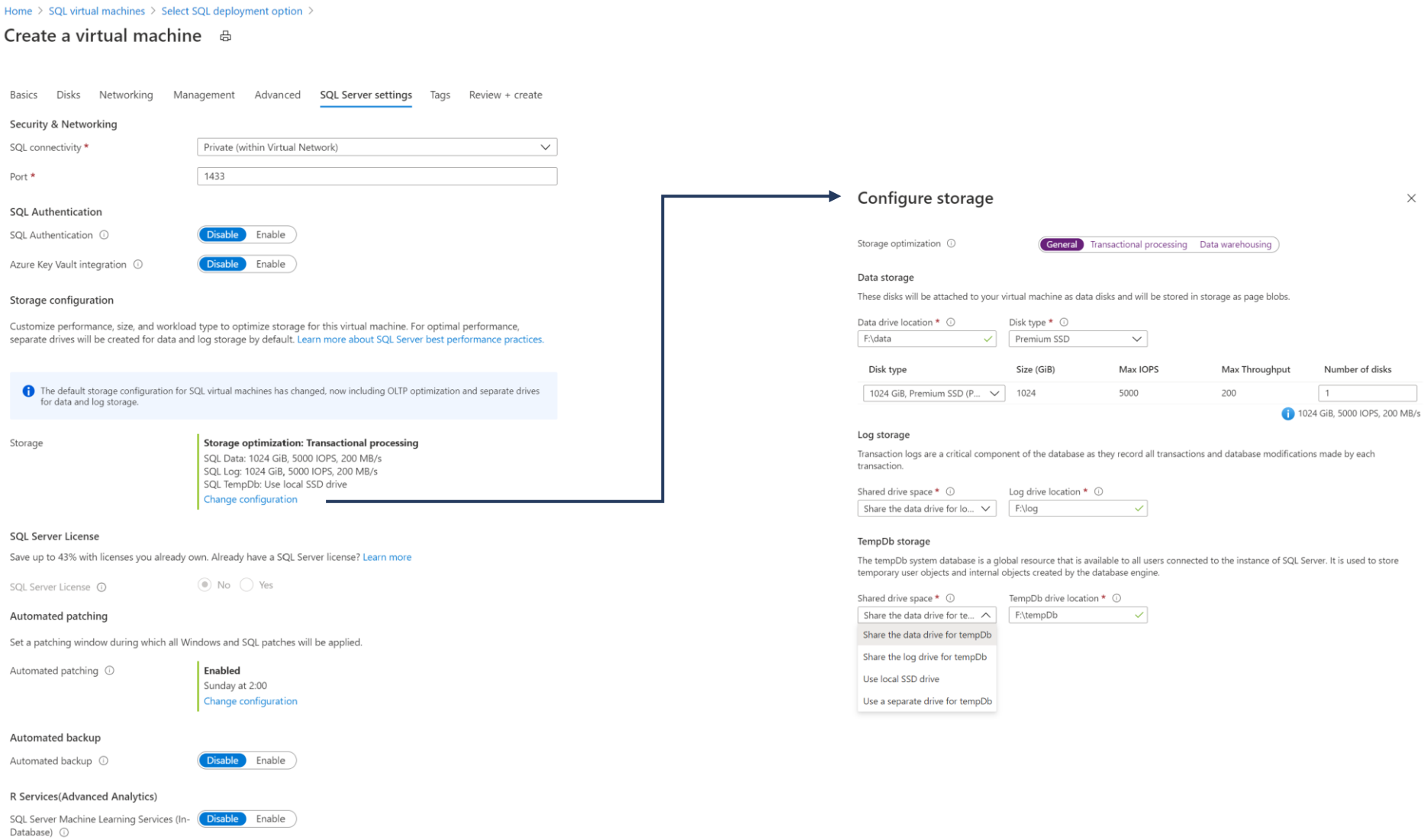
High Availability Feature

- The new **High Availability** feature allows you to create a new cluster or onboard an existing cluster, and then create the availability group, listener, and internal load balancer.



IaaS Agent Extension Options

Configuring the options while creating the SQL Virtual Machine from Marketplace



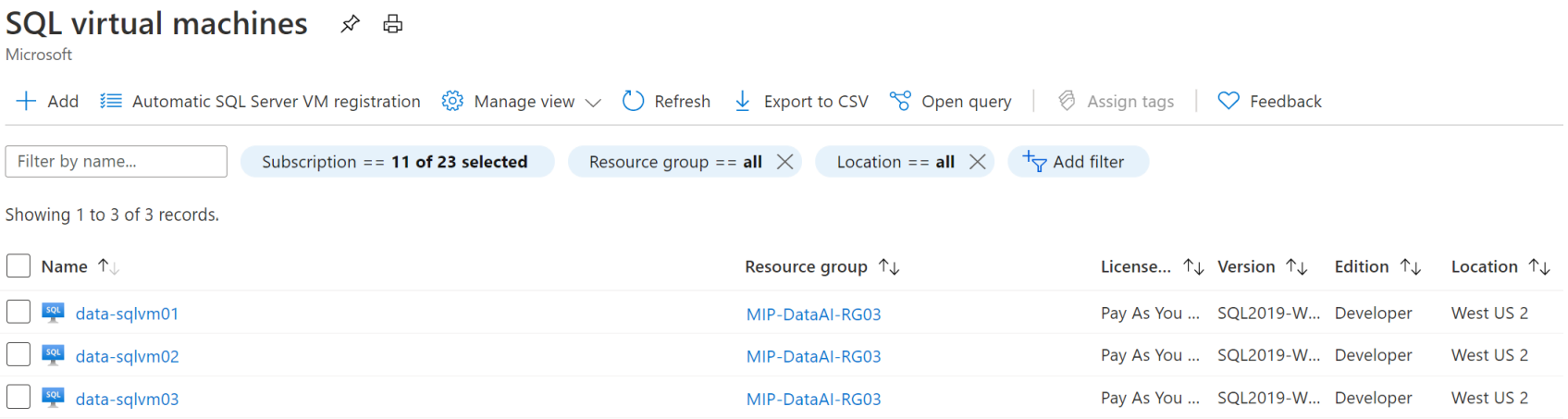
Discover Azure VMs running SQL Server

Azure Marketplace SQL Server Images

- Microsoft Certified Images
- Provision SQL VM in ~5 min
- Choose PAYG or AHB licensing models
- SQL VM IaaS extension is enabled by default

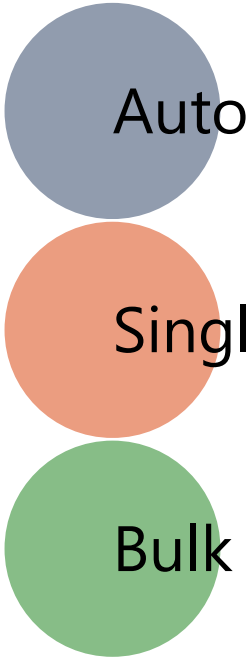
Custom installed SQL Server instances

- SQL Server installation is owned by you
- Requires indicating AHB usage to Microsoft
- Enables only Virtual Machine services
- **You should register with SQL VM IaaS extension to access free SQL Server Manageability**



Register a SQL Server VM in Azure with the SQL Server IaaS Agent extension

Registration methods



Automatic Registration

Single VM Registration

Bulk register multiple VMs

Automatic Registration

The automatic registration feature allows customers to automatically register all current and future SQL Server VMs in their Azure subscription with the SQL VM IaaS Agent Extension.

Automatic registration registers your SQL Server VMs in lightweight mode which does not touch the SQL Server service or databases at all, it's simply a lightweight background agent.

You need to manually upgrade to full manageability mode to take advantage of the full feature set. Once it is upgraded to FULL mode, SQL Server is restarted simply to grant access to the agent login.

Automatic Registration - Enable

Automatic registration of your SQL Server VMs

Sign into the Azure portal.

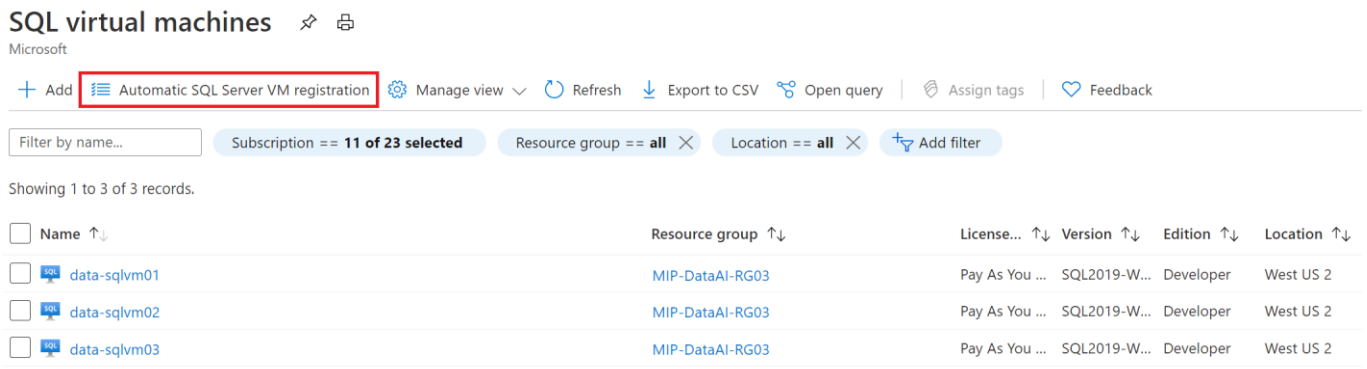
Navigate to the **SQL virtual machines** resource page.

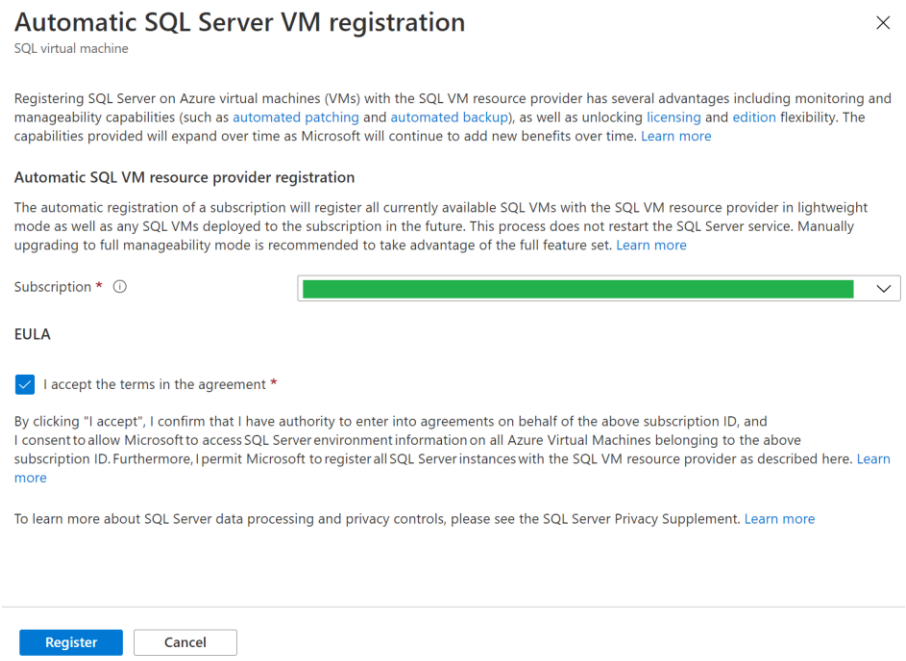
Select **Automatic SQL Server VM registration** to open the Automatic registration page.

Choose your subscription from the drop-down.

Read through the terms and if you agree, select **I accept**.

Select **Register** to enable the feature and automatically register all current and future SQL Server VMs with the SQL VM IaaS agent extension. This will not restart the SQL Server service on any of the VMs.





Automatic Registration - Disable

- Use the Azure CLI or Azure PowerShell to disable the automatic registration feature. When the automatic registration feature is disabled, SQL Server VMs added to the subscription need to be manually registered with the SQL VM IaaS agent extension.
- This will not unregister existing SQL Server VMs that have already been registered.

Azure CLI

```
az feature unregister --namespace Microsoft.SqlVirtualMachine --name BulkRegistration
```

PowerShell

```
Unregister-AzProviderFeature -FeatureName BulkRegistration -ProviderNamespace Microsoft.SqlVirtualMachine
```

Automatic Registration

Enable for multiple subscriptions

- You can enable the automatic registration feature for multiple Azure subscriptions by using PowerShell. Follow the steps:
  - Save this script to a .ps1 file, such as **EnableBySubscription.ps1**.
  - Navigate to where you saved the script by using an administrative Command Prompt or PowerShell window.
  - Connect to Azure (az login).
  - Execute the script, passing in SubscriptionIds as parameters such as

    ```
    .\EnableBySubscription.ps1 -SubscriptionList SubscriptionId1,SubscriptionId2
    ```

    For example:

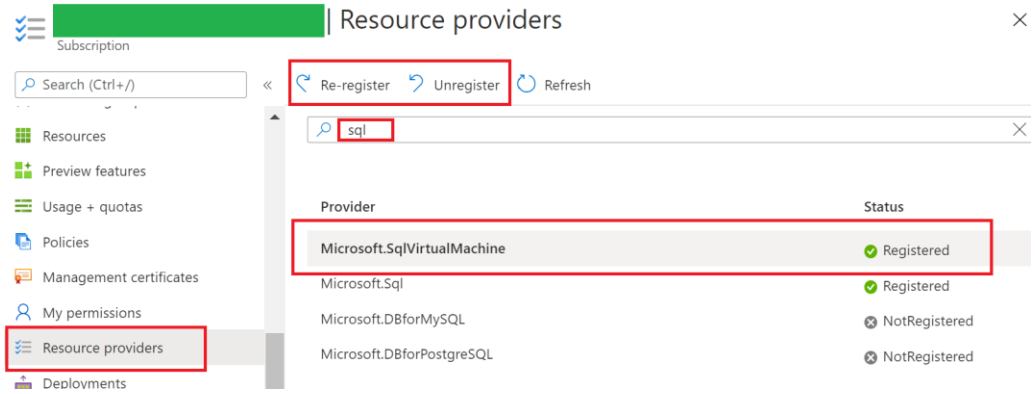
    ```
    .\EnableBySubscription.ps1 -SubscriptionList a1a1a-aa11-11aa-a1a1-a11a111a1,b2b2b2-bb22-22bb-b2b2-b2b2b2bb
    ```

  - **Note**: Failed registration errors are stored in **RegistrationErrors.csv** located in the same directory where you saved and executed the .ps1 script from.

Single VM Registration

Register Subscription with the SQL Server IaaS Agent Extension

- To register your SQL Server VM with the SQL Server VM IaaS agent extension, you must first register your subscription with the SQL IaaS agent extension. This gives the SQL IaaS agent extension the ability to create resources within your subscription.
- Azure Portal
  - Open the Azure portal and go to **All Services**.
  - Go to **Subscriptions** and select the subscription of interest.
  - On the **Subscriptions** page, go to **Resource providers**.
  - Enter **sql** in the filter to bring up the SQL-related resource providers.
  - Select **Register**, **Re-register**, or **Unregister** for the **Microsoft.SqlVirtualMachine** provider, depending on your desired action.



- Command Line
  - **Azure CLI**

```
# Register the SQL VM resource provider to your subscription
az provider register --namespace Microsoft.SqlVirtualMachine
```

  - **PowerShell**

```
# Register the SQL VM resource provider to your subscription
Register-AzResourceProvider -ProviderNamespace Microsoft.SqlVirtualMachine
```

Single VM Registration

Lightweight management mode using Command Line

If the SQL Server IaaS Agent Extension has not been installed on the virtual machine, then the recommendation is to register with the SQL VM resource provider in lightweight mode.

This will install the SQL IaaS extension in lightweight mode and prevent the SQL Server service from restarting. You can then upgrade to full mode at any time but doing so will restart the SQL Server service, so it is recommended to wait until a scheduled maintenance window.

- **Azure CLI**

```
# Register Enterprise or Standard self-installed VM in Lightweight mode
az sql vm create --name <vm_name> --resource-group <resource_group_name> --location <vm_location> --license-type PAYG
```

- **PowerShell**

```
# Get the existing compute VM
$vm = Get-AzVM -Name <vm_name> -ResourceGroupName <resource_group_name>

# Register SQL VM with 'Lightweight' SQL IaaS agent
New-AzSqlVM -Name $vm.Name -ResourceGroupName $vm.ResourceGroupName -Location $vm.Location ` -LicenseType PAYG -
SqlManagementType LightWeight
```

Single VM Registration

Full management mode using Command Line

Registering the SQL VM in full mode will install the SQL IaaS extension and restart the SQL Server service. Please proceed with caution.

- **PowerShell**

```
# Get the existing Compute VM
$vm = Get-AzVM -Name <vm_name> -ResourceGroupName <resource_group_name>

# Register with SQL VM resource provider in full mode
New-AzSqlVM -Name $vm.Name -ResourceGroupName $vm.ResourceGroupName -SqlManagementType Full
```

Single VM Registration

Upgrade to full using Azure Portal

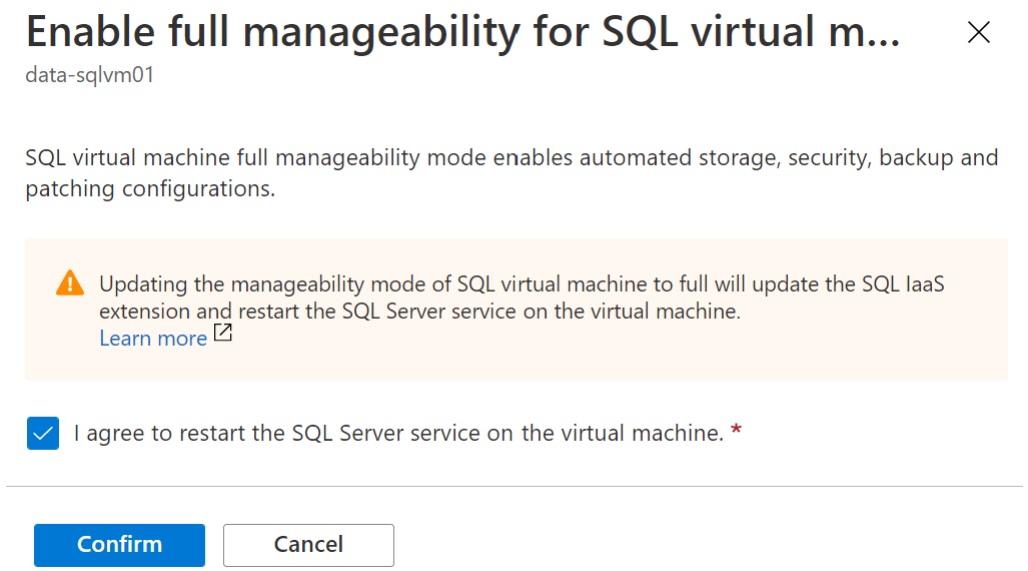
Sign into the Azure portal.

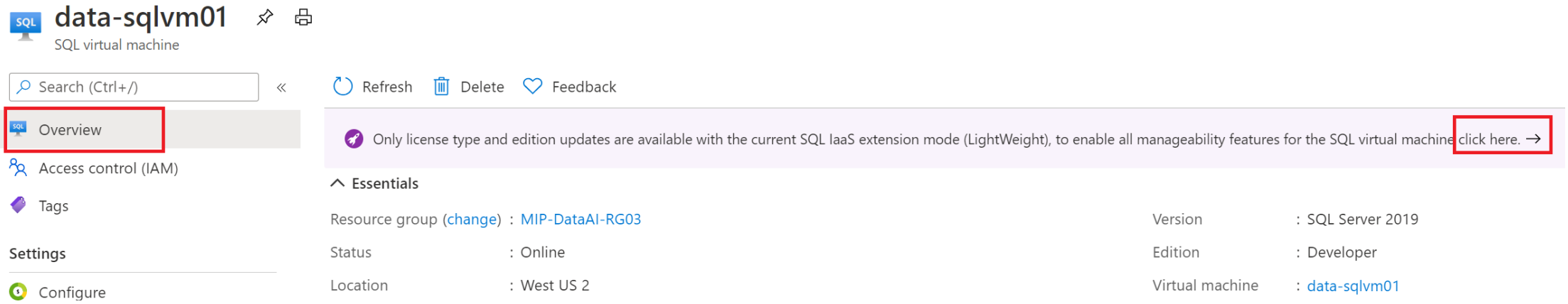
Go to your SQL virtual machines resource.

Select your SQL Server VM, and select Overview.

For SQL Server VMs with the NoAgent or lightweight IaaS mode, select the Only license type and edition updates are available with the SQL IaaS extension message.

Select the I agree to restart the SQL Server service on the virtual machine check box, and then select Confirm to upgrade your IaaS mode to full.





Single VM Registration

Upgrade to full using Command Line

- **Azure CLI**

```
# Update to full mode
az sql vm update --name <vm_name> --resource-group <resource_group_name> --sql-mgmt-type full
```

- **PowerShell**

```
# Get the existing Compute VM
$vm = Get-AzVM -Name <vm_name> -ResourceGroupName <resource_group_name>

# Register with SQL VM resource provider in full mode
Update-AzSqlVM -Name $vm.Name -ResourceGroupName $vm.ResourceGroupName -SqlManagementType Full
```

Verify Status

Using Azure Portal

- Sign into the Azure portal.
- Go to your SQL Server VMs.
- Select your SQL Server VM from the list. If your SQL Server VM is not listed here, it likely hasn't been registered with the SQL VM resource provider.
- View the value under Status. If Status is **Online**, then the SQL Server VM has been registered with the SQL VM resource provider successfully.

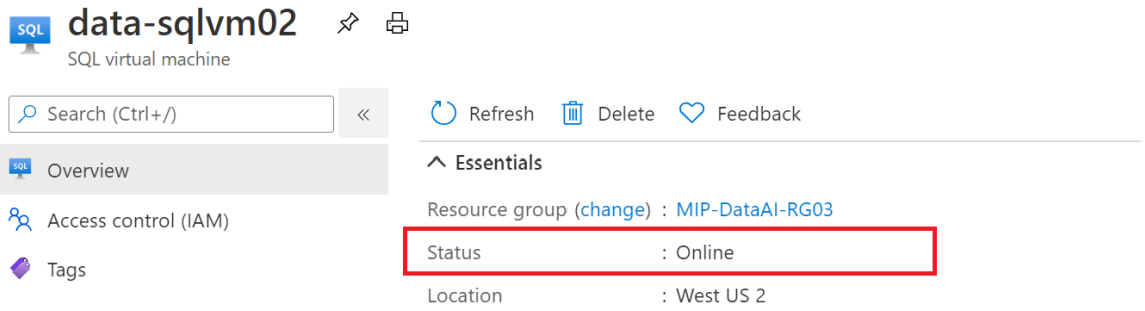
Using Command Line

- Azure CLI

```
az sql vm show -n <vm_name> -g <resource_group>
```

- PowerShell

```
Get-AzSqlVM -Name <vm_name> -ResourceGroupName
<resource_group>
```



Unregister Azure SQL Virtual Machine

Using Azure Portal

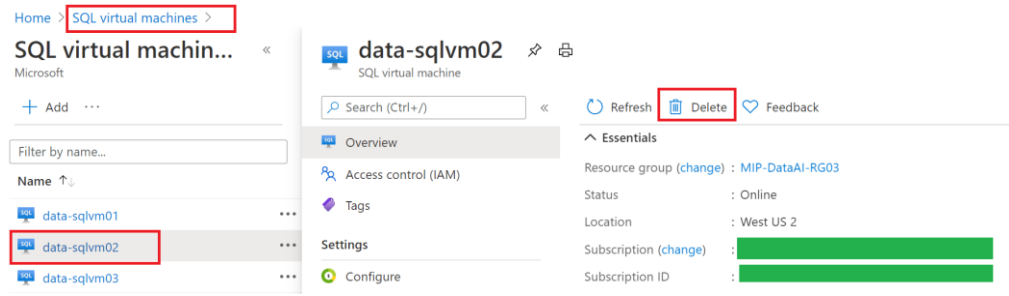
Sign into the Azure portal.

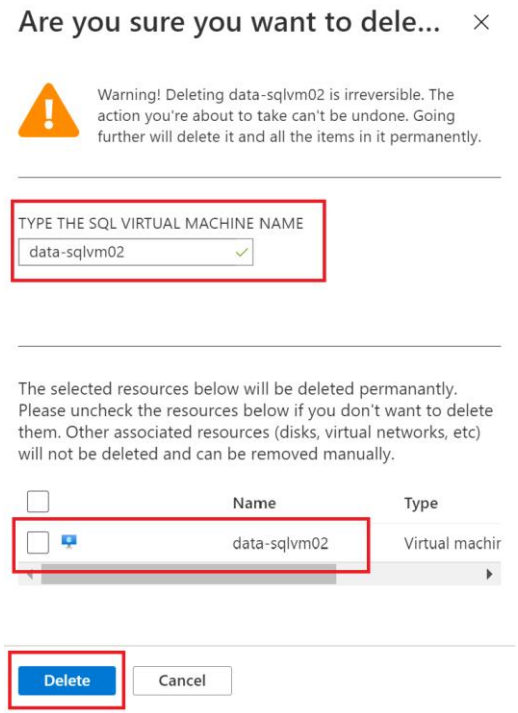
Navigate to the SQL VM resource.

Select **Delete**

Type the name of the SQL virtual machine and **clear the check box next to the virtual machine**.

Select **Delete** to confirm the deletion of the SQL virtual machine resource, and not the SQL Server VM.





NOTE: Failure to clear the checkbox next to the virtual machine name will *delete* the virtual machine entirely.
Clear the checkbox to unregister the SQL Server VM from the resource provider but *not delete the actual virtual machine*.

Unregister Azure SQL Virtual Machine

Using Command Line

- **Azure CLI**
  - To unregister your SQL Server VM from the resource provider with Azure CLI, use the az sql vm delete command. This will remove the SQL Server VM resource but will not delete the virtual machine.

```
az sql vm delete --name <SQL VM resource name> | --resource-group <Resource group name> | --yes
```

- **PowerShell**
  - To unregister your SQL Server VM from the resource provider with PowerShell, use the Remove-AzSqlVM command. This will remove the SQL Server VM resource but will not delete the virtual machine.

```
Remove-AzSqlVM -ResourceGroupName <resource_group_name> -Name <VM_name>
```

Bulk Register Multiple VMs

- The **Register-SqlVMs** cmdlet can be used to register all virtual machines in a given list of subscriptions, resource groups, or a list of specific virtual machines.
- The cmdlet will register the virtual machines in *lightweight* management mode and then generate both a report and a log file.
- The registration process carries no risk, has no downtime, and will not restart SQL Server or the virtual machine.
- The script to perform this operation can be found here.
- **Examples**:

```
Register-SqlVMs -SubscriptionList SubscriptionId1,SubscriptionId2

Register-SqlVMs -Subscription SubscriptionId1 -ResourceGroupList ResourceGroup1,ResourceGroup2

Register-SqlVMs -Subscription SubscriptionId1 -ResourceGroupName ResourceGroup1 -VmList VM1,VM2,VM3
```

Questions?