

SQL Server Modernization on Azure

Microsoft training



APRENDER IT

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Introduction

Welcome to the SQL Server Migration and Modernization Course in Azure. This course was created by [Pablo Ariel Di Loreto](#), and will allow you to learn the basics of SQL Server in the Microsoft Azure cloud, including IaaS and PaaS services.

Keep in mind that this course requires some knowledge of technology and general concepts of software development, which are not covered in it.

The Contents of this course are optimized to prepare you in the best possible way to learn in a practical way. Likewise, in addition to having access to this course, you will be participating in the Microsoft Workshop with the same name for 2 days of 3 hours each.

Thank you for your participation!



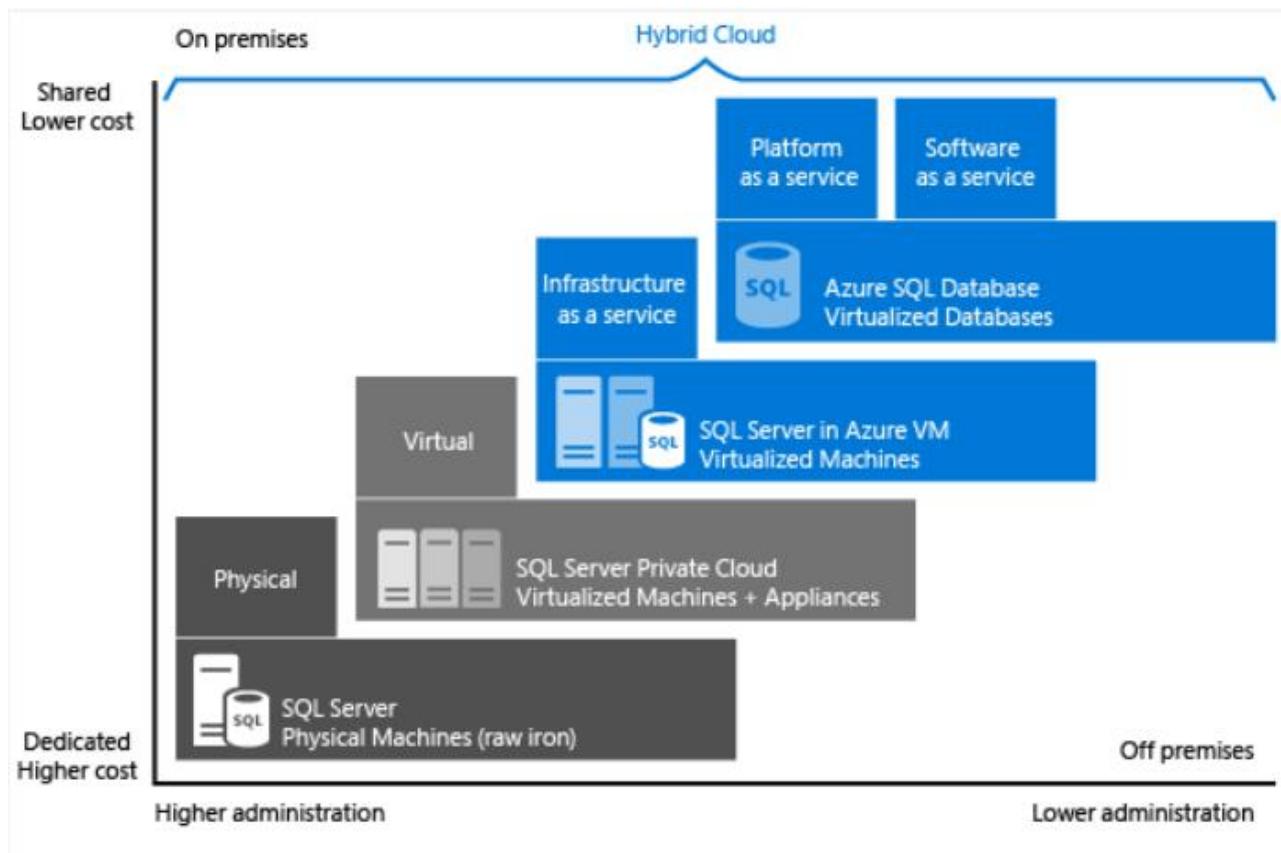
About Azure SQL

Azure SQL is a family of intelligent, secure, and managed products that use the Azure cloud SQL Server database engine. The options currently present are:

- Azure SQL Database – Support modern cloud applications in an intelligent, managed database service that includes serverless compute.
- Azure SQL Managed Instance – Modernize your existing SQL Server applications at scale with an intelligent fully managed instance as a service, which has near 100% feature parity with the SQL Server database engine. the best option for most cloud migrations.
- SQL Server on Azure Virtual Machines: Lift-and-shift your SQL Server workloads with ease and retain 100% SQL Server compatibility and OS-level access.

Azure SQL is built on the familiar SQL Server engine, so you can easily migrate applications and continue to use the tools, languages, and resources you're familiar with. Your skills and experience move to the cloud, so you can get more done with what you already have.

As seen in the diagram, each service offer can be characterized by the level of administration that is given over the infrastructure and the degree of cost-effectiveness.



In Azure, you can have SQL Server workloads run on a hosted service (PaaS) or on a hosted infrastructure (IaaS). In PaaS, you have multiple product options and service levels within each option. The key question to ask when deciding between PaaS or IaaS is whether you want to manage your database, patch, and perform backups, or delegate these operations to Azure.

Exercise 1: SQL Virtual Machines

Introduction to the exercise

In this section we will make the first experience together. This experience requires you to have a Microsoft Azure subscription set up and available and consumes any credits you have on it. Please review this topic to avoid charges on subscriptions where you don't want them to exist.

In this experience we will:

- Create a SQL Server on Virtual Machine with Windows.
- Learn how to check images available in Azure for VMs with integrated SQL Server.
- Access administration tools that we will use throughout the course.
- Know what is the IaaS agent for virtual machines with SQL Server.

About SQL Server Virtual Machines

SQL Server on Azure Virtual Machines allows us to use full versions of SQL Server in the cloud without having to manage all the local hardware. SQL Server on Azure Virtual Machines is an IaaS option that also simplifies license costs when you pay as you go through a consistent experience that we'll cover in this experience.

Let's explore some points about Licensing, Availability and Management.

SQL Server Licensing on Azure Virtual Machines

SQL Server software on an Azure VM must be licensed. There are automatic mechanisms to detect that a computer is running SQL Server, so one of the following models must be chosen.

Pay Per Use License

There are virtual machine images that implement SQL Server on a pay-as-you-go model. The scope is for both Enterprise, Standard, Web, Developer and Express editions (depending on the version of SQL Server). This will cause the cost of the license to be charged to the monthly price of the virtual machine (or virtual machines).

BYOL license

You can also bring your own license (BYOL). In this scenario, you only pay for the virtual machine without any additional SQL Server license charges in the monthly price. Bringing your own license can save money over time in ongoing production workloads.

To use your own license, you can convert an existing pay-as-you-go SQL Server virtual machine, or deploy an image with {BYOL} as a prefix.

Managing SQL Server on Azure Virtual Machines

Updates

SQL Server on Azure Virtual Machines provides facilities for scheduling SQL Server and Windows updates. This is possible through a special configuration panel for SQL Server on VMs. However, do not forget that being IaaS you are responsible for its maintenance.

Backups

SQL Server on Azure Virtual Machines can take advantage of Automated Backup, which regularly backs up the database to an Azure storage account, specifically in block blobs. However, do not forget that being IaaS you are responsible for its maintenance.

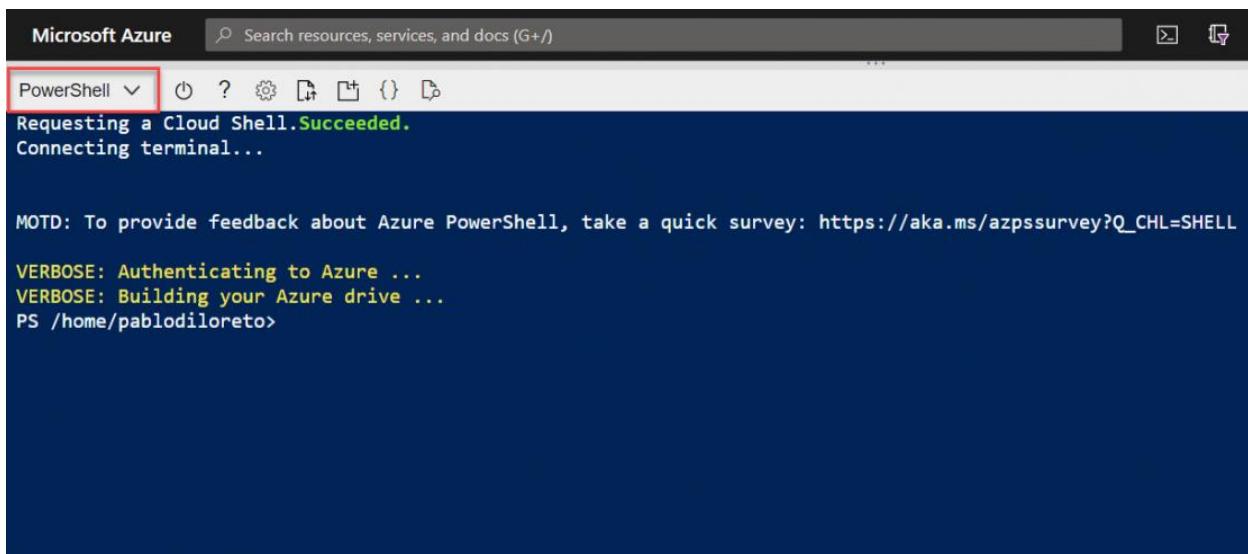
Query Available Images of Microsoft SQL Server on Azure

We are going to explore by command line what are the offers of Microsoft SQL Server in Azure (that is, in VMs). This can be done by pre-specifying an Azure location. Doing it from the command line is a simple and fast way to get the results, without exploring extensive documentation or the graphical interface.

Enter the URL <https://shell.azure.com/> and log in with your Azure user:

If you have never started Cloud Shell before, you may be prompted to create a storage account. Follow the steps to generate it.

Once you've done that, choose "PowerShell" as your scripting option:



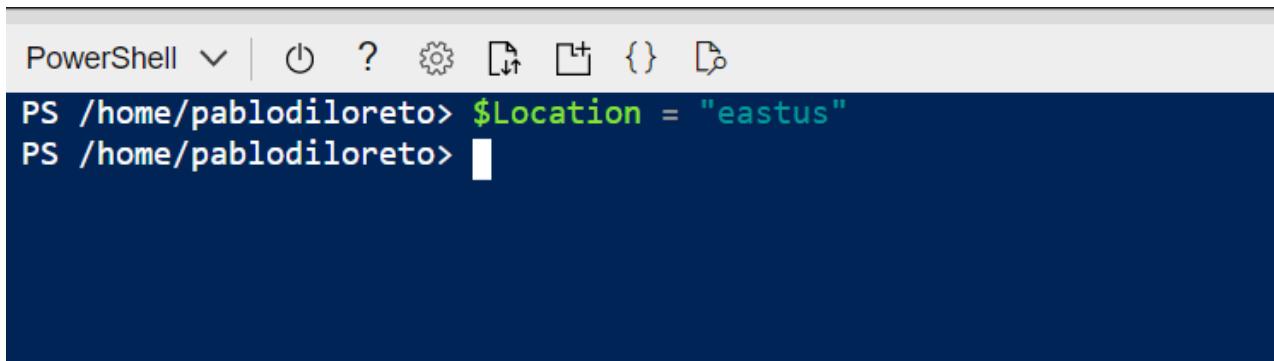
The screenshot shows the Microsoft Azure Cloud Shell interface. At the top, there's a navigation bar with the Microsoft Azure logo, a search bar labeled "Search resources, services, and docs (G+)", and some icons. Below the bar, the scripting language is set to "PowerShell". A red box highlights the "PowerShell" dropdown menu. The main area of the shell shows the following output:

```
PowerShell ▾ ⏹ ? ⚙️ 📁 🗂️ {} 🖼
Requesting a Cloud Shell. Succeeded.
Connecting terminal...

MOTD: To provide feedback about Azure PowerShell, take a quick survey: https://aka.ms/azpssurvey?Q_CHL=SHELL
VERBOSE: Authenticating to Azure ...
VERBOSE: Building your Azure drive ...
PS /home/pablodiloreto>
```

To find out about SQL Server offerings on Azure for “IaaS”, and as we said before, we must specify a location. Let's generate a variable called \$Location and store a location there: eastus:

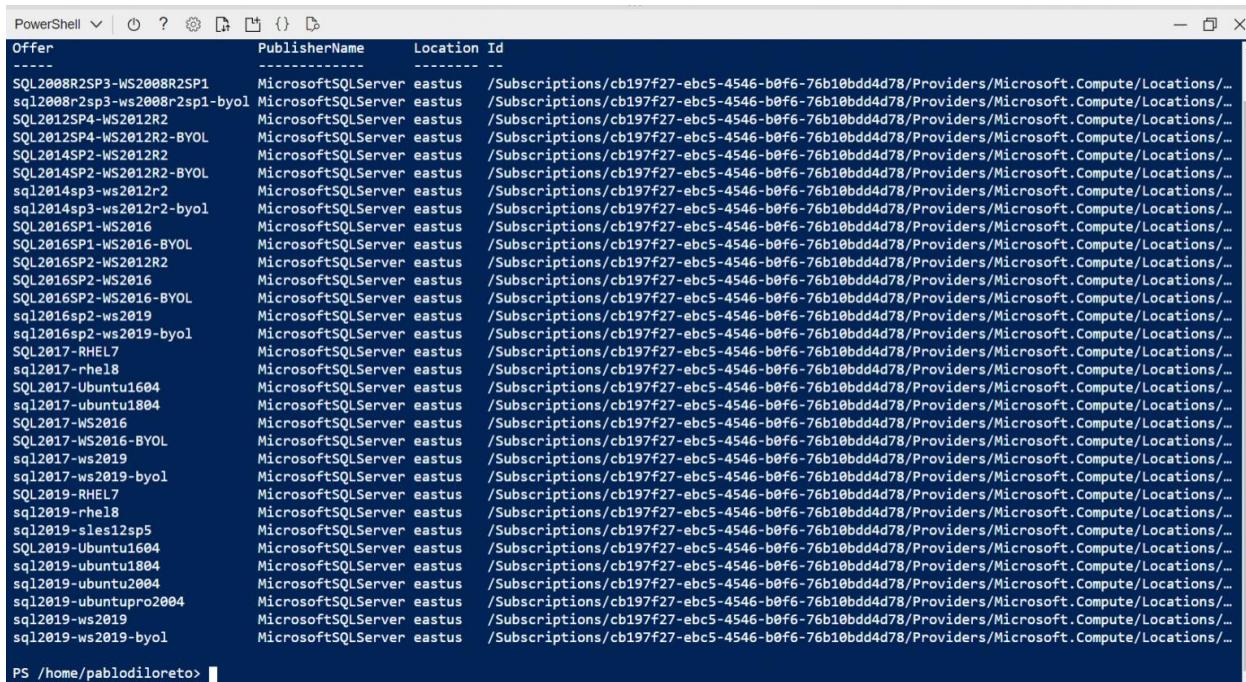
```
$Location = "eastus"
```



```
PowerShell | ⚡ ? ⚙️ ⚡ {} ⚡
PS /home/pablodiloreto> $Location = "eastus"
PS /home/pablodiloreto> [REDACTED]
```

You will run the following command to find out the offers, reusing the "Location" variable and specifying the Publisher in MicrosoftSQLServer:

Get-AzVMImageOffer -Location \$Location -Publisher 'MicrosoftSQLServer'



Offer	PublisherName	Location	Id
SQL2008R2SP3-WS2008R2SP1	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2008r2sp3-ws2008r2sp1-byol	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2012SP4-WS2012R2	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2012SP4-WS2012R2-BYOL	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2014SP2-WS2012R2	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2014SP2-WS2012R2-BYOL	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2014sp3-ws2012r2	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2014sp3-ws2012r2-byol	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2016SP1-WS2016	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2016SP1-WS2016-BYOL	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2016SP2-WS2012R2	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2016SP2-WS2016	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2016SP2-WS2016-BYOL	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2016sp2-ws2019	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2016sp2-ws2019-byol	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2017-RHEL7	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2017-rhel8	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2017-Ubuntu1604	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2017-ubuntu1804	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2017-WS2016	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2017-WS2016-BYOL	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2017-ws2019	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2017-ws2019-byol	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2019-RHEL7	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-rhel8	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-sles12sp5	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
SQL2019-Ubuntu1604	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-ubuntu1804	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-ubuntu2004	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-ubuntu2004	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-ws2019	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...
sql2019-ws2019-byol	MicrosoftSQLServer	eastus	/Subscriptions/cb197f27-ebc5-4546-b0f6-76b10bdd4d78/Providers/Microsoft.Compute/Locations/...

You are welcome to build queries using the \$Location variable with other locations. The list of current locations can be obtained with the following PowerShell command:

Get-AzLocation | select displayname,location

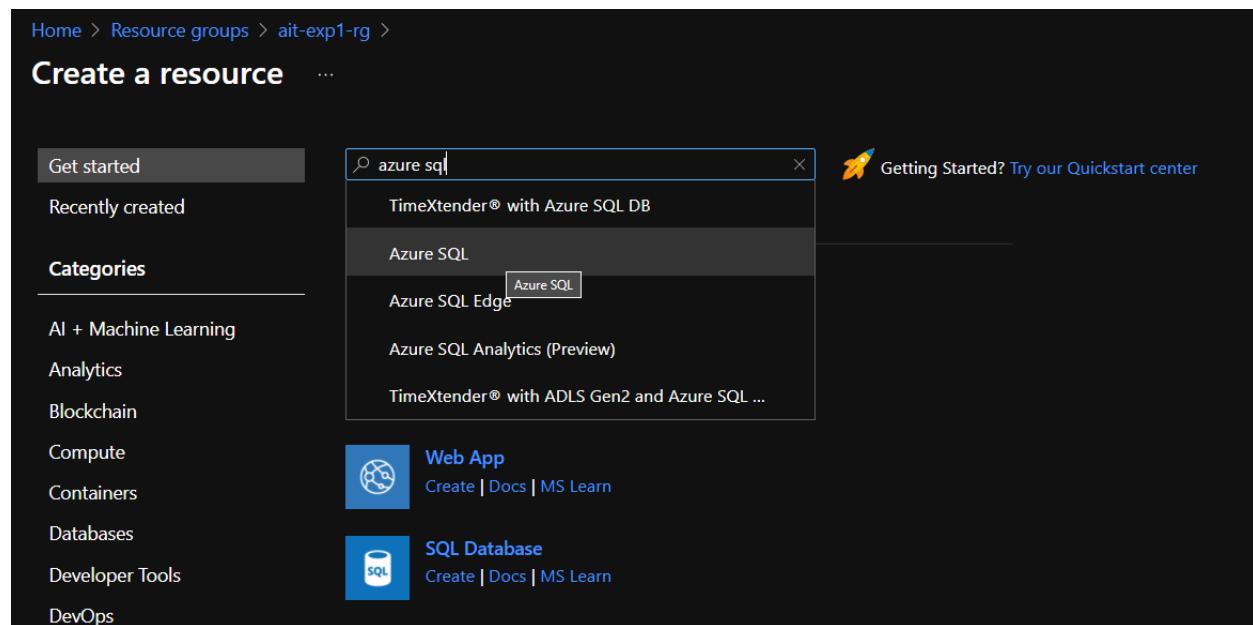
Creating a Windows VM with SQL Server

Let's create our first VM in Azure with Integrated SQL. In this case we are going to use a virtual computer with Windows operating system. Remember that you also have Linux options.

Selecting the IaaS Deployment Method

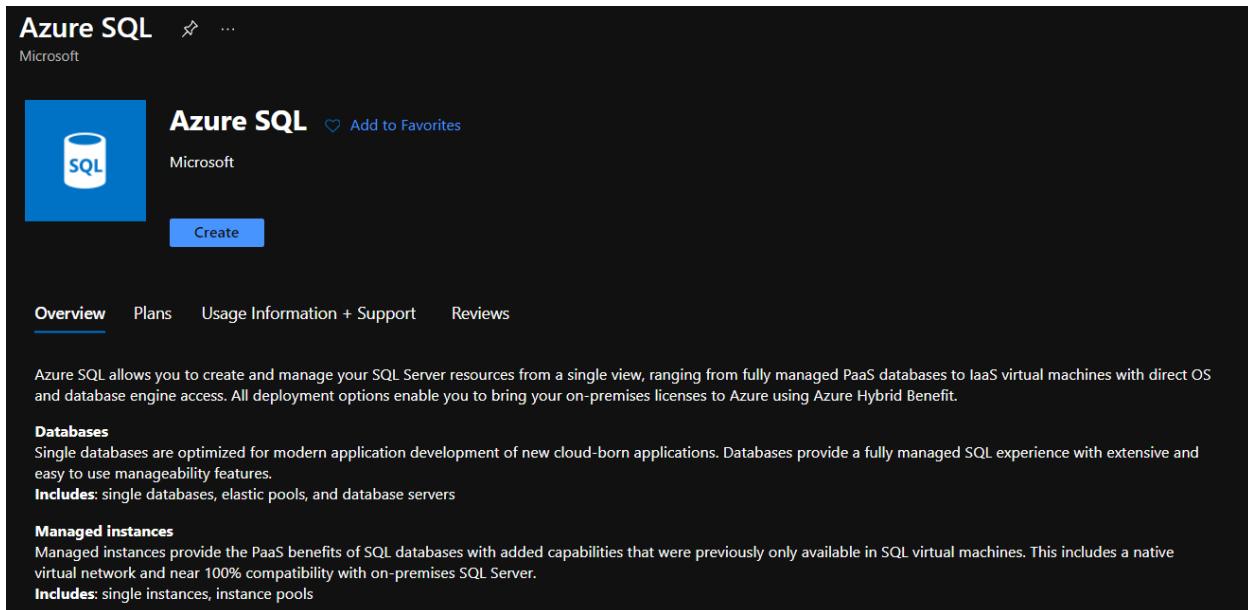
From the Azure portal we are going to work on the same Resource Group that we worked on before, whose suggested name is “sql101a-exp1-rg”. Once there you will click on new resource.

In the new resource window you will search for “azure sql” as seen on the screen:



The result that will appear will be the one published by Microsoft, which is called “Azure SQL”.

We will click on Create:



Azure SQL

Azure SQL Microsoft

Add to Favorites

Create

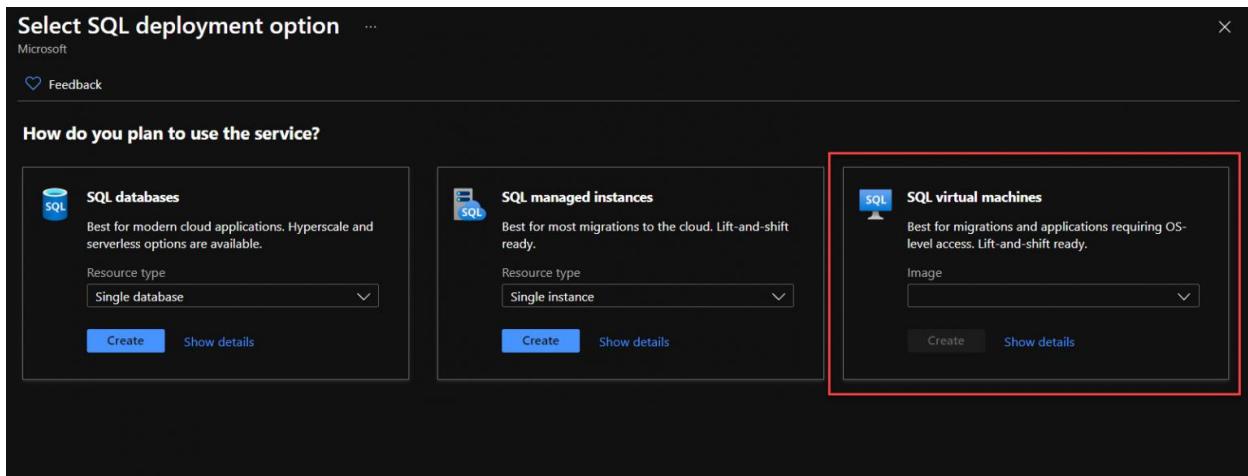
Overview Plans Usage Information + Support Reviews

Azure SQL allows you to create and manage your SQL Server resources from a single view, ranging from fully managed PaaS databases to IaaS virtual machines with direct OS and database engine access. All deployment options enable you to bring your on-premises licenses to Azure using Azure Hybrid Benefit.

Databases
Single databases are optimized for modern application development of new cloud-born applications. Databases provide a fully managed SQL experience with extensive and easy to use manageability features.
Includes: single databases, elastic pools, and database servers

Managed instances
Managed instances provide the PaaS benefits of SQL databases with added capabilities that were previously only available in SQL virtual machines. This includes a native virtual network and near 100% compatibility with on-premises SQL Server.
Includes: single instances, instance pools

A set of options will appear that is the same as the one we have seen in the theoretical introduction. We can choose to create an Azure SQL as a Database, as a Managed Instance and as a Virtual Machine. We will focus on Virtual Machine:



Select SQL deployment option

Feedback

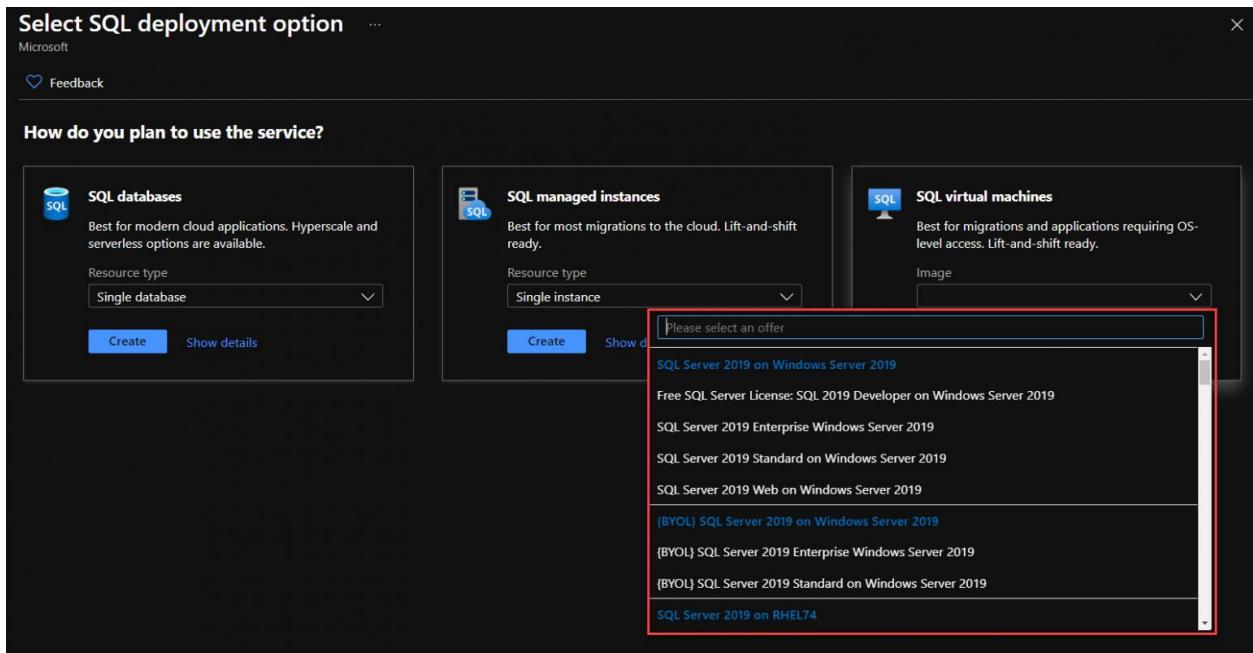
How do you plan to use the service?

SQL databases
Best for modern cloud applications. Hyperscale and serverless options are available.
Resource type
Single database

SQL managed instances
Best for most migrations to the cloud. Lift-and-shift ready.
Resource type
Single instance

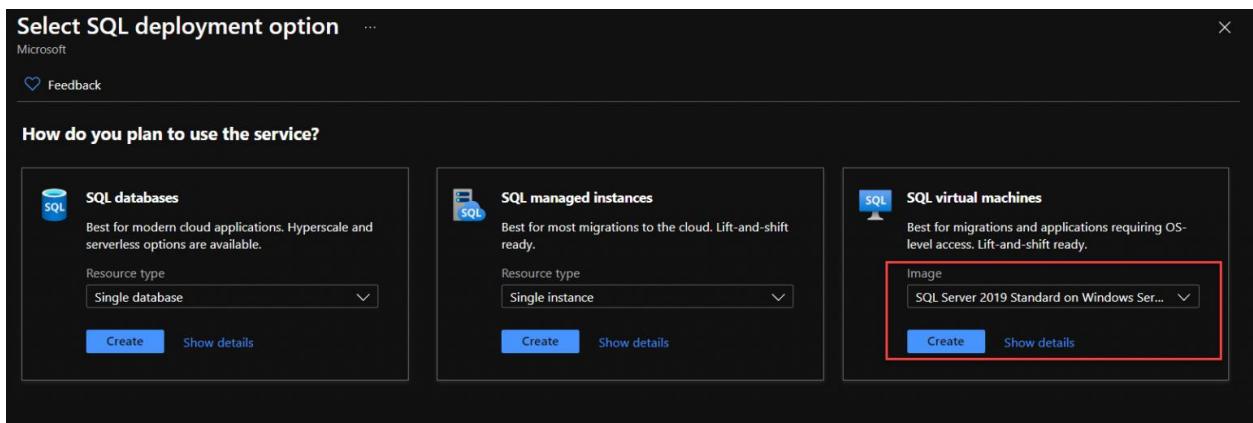
SQL virtual machines
Best for migrations and applications requiring OS-level access. Lift-and-shift ready.
Image

If we display the image option, we can quickly see all the images offered:



The screenshot shows the 'Select SQL deployment option' dialog from Microsoft. The 'How do you plan to use the service?' section is visible, with three options: 'SQL databases', 'SQL managed instances', and 'SQL virtual machines'. The 'SQL managed instances' section is expanded, showing a dropdown menu for 'Image'. This dropdown menu is highlighted with a red border and lists several options, including 'SQL Server 2019 on Windows Server 2019', 'SQL Server 2019 Enterprise Windows Server 2019', 'SQL Server 2019 Standard on Windows Server 2019', 'SQL Server 2019 Web on Windows Server 2019', '(BYOL) SQL Server 2019 on Windows Server 2019', '(BYOL) SQL Server 2019 Enterprise Windows Server 2019', '(BYOL) SQL Server 2019 Standard on Windows Server 2019', and 'SQL Server 2019 on RHEL74'.

We are going to choose the option “SQL Server 2019 Standard on Windows Server 2019”:



The screenshot shows the 'Select SQL deployment option' dialog from Microsoft. The 'How do you plan to use the service?' section is visible, with three options: 'SQL databases', 'SQL managed instances', and 'SQL virtual machines'. The 'SQL managed instances' section is expanded, showing a dropdown menu for 'Image'. This dropdown menu is highlighted with a red border and lists several options, including 'SQL Server 2019 Standard on Windows Ser...'. The 'Create' and 'Show details' buttons are also visible at the bottom of the dropdown menu.

Creation of the VM

The wizard that we will find next is nothing more than the creation of a virtual machine, although with a specific image with integrated SQL. Beyond the similarity, we will discover that we will have a tab of the wizard dedicated to SQL Server settings.

Basic Options

The basic options of the virtual machine are those that we must enter YES OR YES to advance in the wizard. This flap looks like the following image:

Create a virtual machine

Basics Disks Networking Management Advanced SQL Server settings Tags Review + create

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Visual Studio Enterprise – MPN [5.8k] ▾

Resource group * ⓘ ait-exp1-rg ▾ [Create new](#)

Instance details

Virtual machine name * ⓘ

Region * ⓘ (US) West US 2 ▾

Availability options ⓘ No infrastructure redundancy required ▾

Image * ⓘ SQL Server 2019 Standard on Windows Server 2019 - Gen1 ▾ [See all images](#)

We are going to create the machine with the following configuration:

- Resource Group: sql101a-exp1-rg
- Operating System: SQL Server 2019 on Windows Server 2019
- VM Name: sql101a-exp1-sql19-vm
- VM Size: Standard_B2ms
- Suggested Region: East US
- VM username and password: generate a personalized one
- RDP access: enabled
- Disks: 1 disk only (operating system)
- Network configuration: leave the suggested ones
- Boot diagnostics: disabled

- Auto shutdown: set at a convenient time

We will leave the disk options at default.

Network Options

It is important that when we are configuring the network options, we leave the default options making sure that the virtual network is /16 and the subnet created is /24.

Create a virtual machine ...

Basics Disks **Networking** Management Advanced SQL Server settings Tags Review + create

Define network connectivity for your virtual machine by configuring network interface card (NIC) settings. You can control ports, inbound and outbound connectivity with security group rules, or place behind an existing load balancing solution.
[Learn more](#)

Network interface

When creating a virtual machine, a network interface will be created for you.

Virtual network * ⓘ

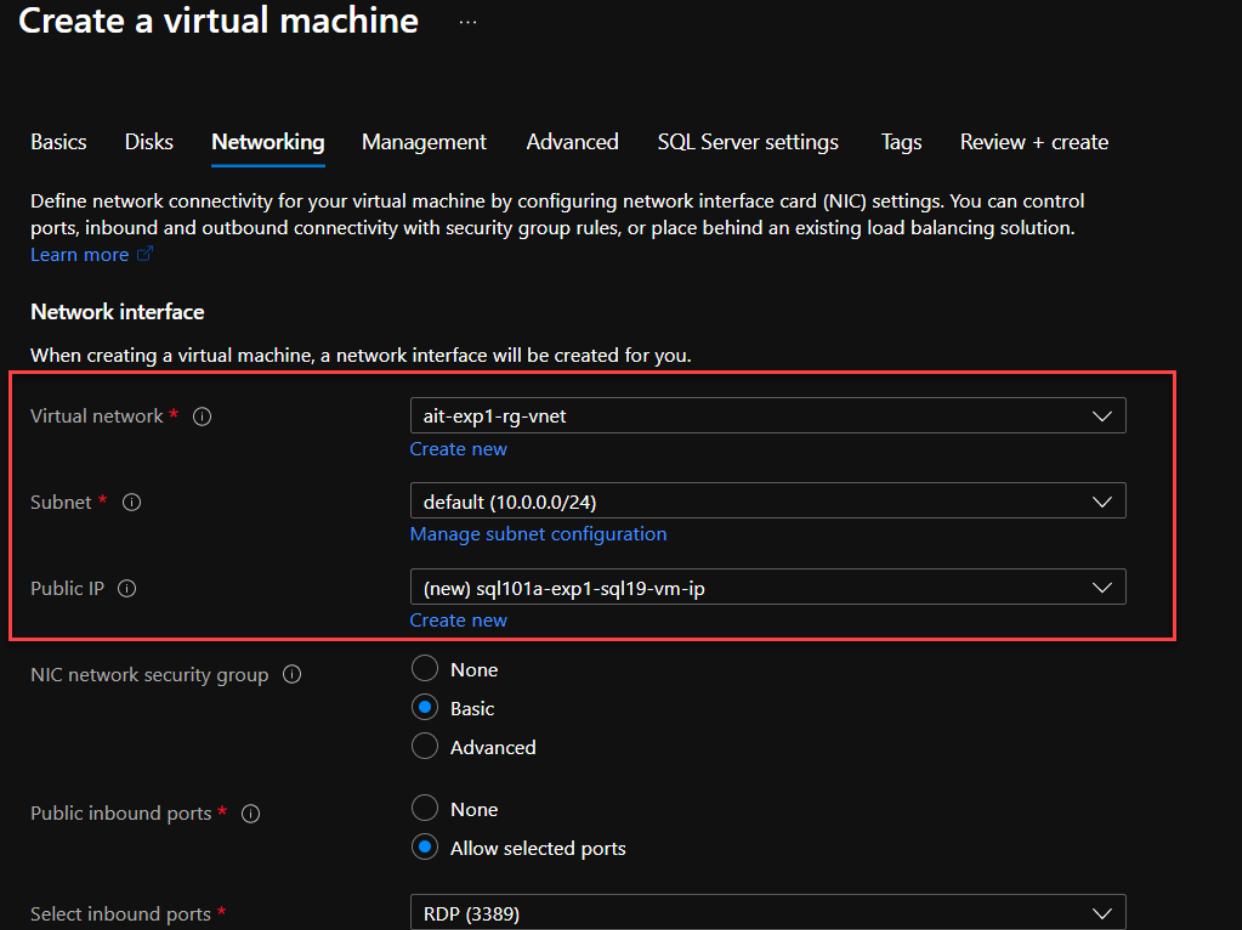
Subnet * ⓘ

Public IP ⓘ

NIC network security group ⓘ None Basic Advanced

Public inbound ports * ⓘ None Allow selected ports

Select inbound ports *



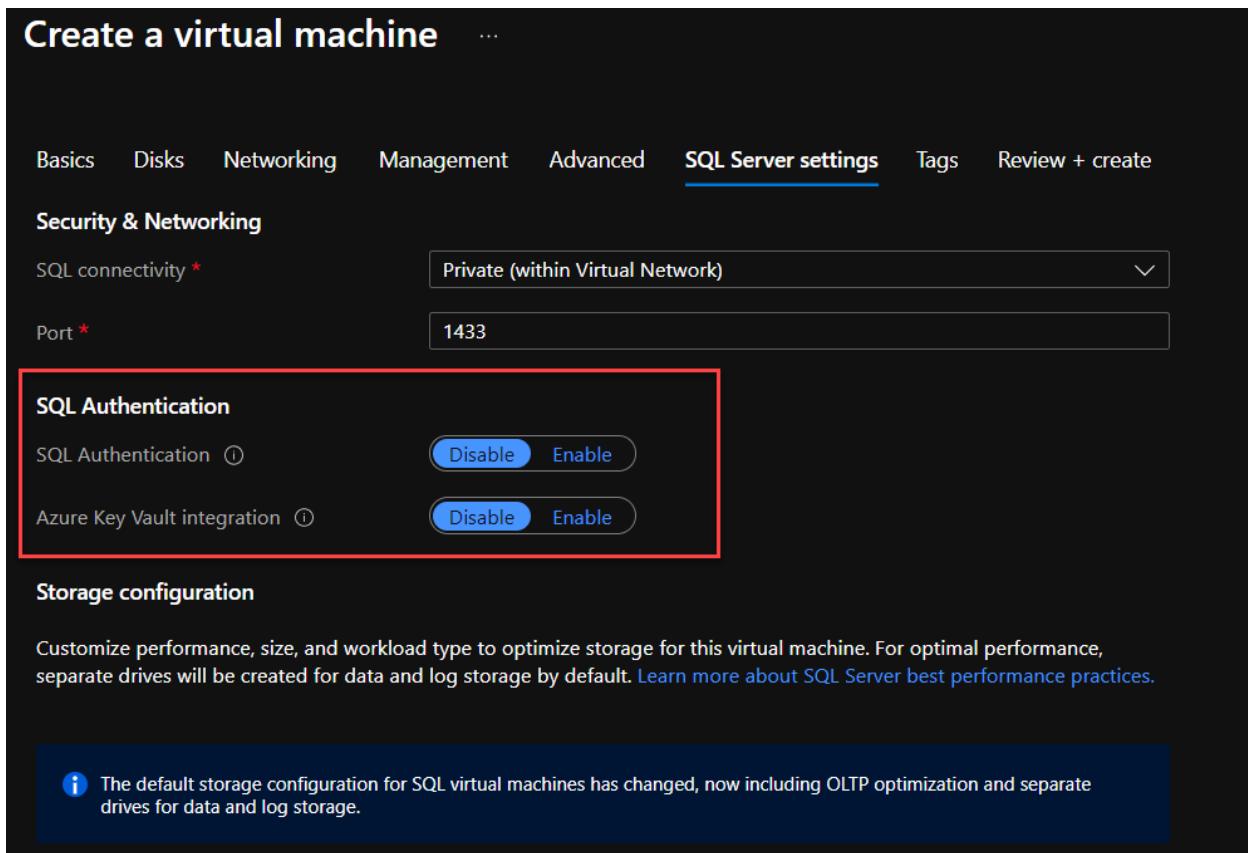
We will not modify the Management and Advanced options. We will move on to the SQL Server settings option.

SQL Server Options

This tab is a novelty, since we are talking about virtual machines for SQL Server. From here we can configure several aspects that we do not have in a normal virtual machine.

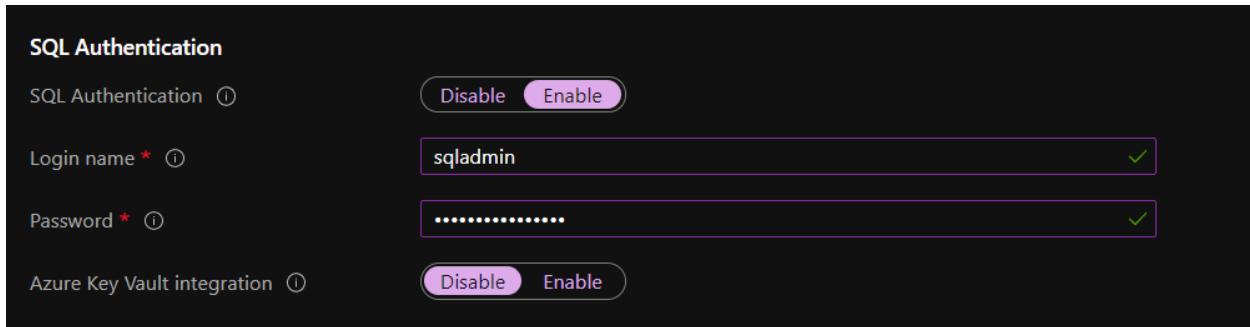
Authentication

To begin we can configure the authentication part:



The screenshot shows the 'Create a virtual machine' wizard with the 'SQL Server settings' tab selected. The 'Security & Networking' section includes fields for 'SQL connectivity' (set to 'Private (within Virtual Network)') and 'Port' (set to '1433'). The 'SQL Authentication' section, which includes options for 'SQL Authentication' and 'Azure Key Vault integration', is highlighted with a red box. A note at the bottom states: 'The default storage configuration for SQL virtual machines has changed, now including OLTP optimization and separate drives for data and log storage.'

If we enable SQL authentication, we can generate a local authentication user on the server. Let's generate one with the username sqladmin and a password of your own choosing:



Storage Settings

On the other hand, we can find a complete storage configuration. For this reason we have previously skipped the disk configuration in the VM creation wizard. This option allows us to focus on the storage for SQL Server:

Create a virtual machine

Storage

Storage optimization: Transactional processing

SQL Data: 1024 GiB, 5000 IOPS, 200 MB/s

SQL Log: 1024 GiB, 5000 IOPS, 200 MB/s

SQL TempDb: Use local SSD drive

[Change configuration](#)

SQL Server License

Save up to 43% with licenses you already own. Already have a SQL Server license? [Learn more](#)

SQL Server License  No Yes

Automated patching

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

Automated patching **Enabled**

Sunday at 2:00

[Change configuration](#)

Automated backup

Automated backup [Disable](#) [Enable](#)

R Services(Advanced Analytics)

SQL Server Machine Learning Services
(In-Database) [Disable](#) [Enable](#)

We are going to select “Change configuration” to customize the disk storage:

Create a virtual machine

Storage ...

Storage optimization: **Transactional processing**

SQL Data: 1024 GiB, 5000 IOPS, 200 MB/s
SQL Log: 1024 GiB, 5000 IOPS, 200 MB/s
SQL TempDb: Use local SSD drive

[Change configuration](#)

SQL Server License

Save up to 43% with licenses you already own. Already have a SQL Server license? [Learn more](#)

SQL Server License No Yes

Automated patching

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

Automated patching (i)

Enabled
Sunday at 2:00
[Change configuration](#)

Automated backup

Automated backup [Disable](#) [Enable](#)

R Services(Advanced Analytics)

SQL Server Machine Learning Services (In-Database) [Disable](#) [Enable](#)

We will be able to observe that, if you chose the size that we recommend, an alert will appear since the desired performance for the selection of "Storage optimization" is not according to the size of VM that we have. Let's dismiss this alert and continue with the wizard:

Configure storage

Storage optimization ⓘ

General **Transactional processing** Data warehousing

Data storage

These disks will be attached to your virtual machine as data disks and will be stored in storage as page blobs.

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...	1024	5000	200	1

1024 GiB, 5000 IOPS, 200 MB/s

Log storage

Transaction logs are a critical component of the database as they record all transactions and database modifications made by each transaction.

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...	1024	5000	200	1

1024 GiB, 5000 IOPS, 200 MB/s

⚠ The desired performance might not be reached due to the maximum virtual machine disk performance cap. The selected VM size (Standard_B2ms) only supports up to 1920 disk max iops (currently 10000 iops), 22.5 disk max throughput in MBps (currently 400 in MBps).

Note that we have options to choose from three storage optimization options: for general use, for transactional use, and for data warehouse. Let's choose the transactional use:

Configure storage

Storage optimization ⓘ

General **Transactional processing** Data warehousing

Data storage

These disks will be attached to your virtual machine as data disks and will be stored in storage as page blobs.

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...)	1024	5000	200	1

ⓘ 1024 GiB, 5000 IOPS, 200 MB/s

Log storage

Transaction logs are a critical component of the database as they record all transactions and database modifications made by each transaction.

Disk type	Log drive location *	Disk type *
Use a separate drive for lo...	G:\log	Premium SSD

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...)	1024	5000	200	1

ⓘ 1024 GiB, 5000 IOPS, 200 MB/s

! The desired performance might not be reached due to the maximum virtual machine disk performance cap. The selected VM size (Standard_B2ms) only supports up to 1920 disk max iops (currently 10000 iops), 22.5 disk max throughput in MBps (currently 400 in MBps).

Once we choose transactional use, we will be able to customize the disk configuration for SQL Server Data. We propose you to configure the disk you want according to the options of location of the unit (Data drive location) and type of disk (Disk type):

Configure storage

Storage optimization ⓘ

General **Transactional processing** Data warehousing

Data storage

These disks will be attached to your virtual machine as data disks and will be stored in storage as page blobs.

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...	1024	5000	200	1

i 1024 GiB, 5000 IOPS, 200 MB/s

Log storage

Transaction logs are a critical component of the database as they record all transactions and database modifications made by each transaction.

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...	1024	5000	200	1

i 1024 GiB, 5000 IOPS, 200 MB/s

! The desired performance might not be reached due to the maximum virtual machine disk performance cap. The selected VM size (Standard_B2ms) only supports up to 1920 disk max iops (currently 10000 iops), 22.5 disk max throughput in MBps (currently 400 in MBps).

Below we will have the option to customize the storage of logs. By default, SQL Server on VMs logically separates configuration data and configuration logs onto two separate disks. As in the previous step, we invite you to customize these options:

Configure storage

Storage optimization ⓘ

General **Transactional processing** Data warehousing

Data storage

These disks will be attached to your virtual machine as data disks and will be stored in storage as page blobs.

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...	1024	5000	200	1

1024 GiB, 5000 IOPS, 200 MB/s

Log storage

Transaction logs are a critical component of the database as they record all transactions and database modifications made by each transaction.

Disk type	Log drive location *	Disk type *
Use a separate drive for lo...	G:\log	Premium SSD

Disk type	Size (GiB)	Max IOPS	Max Throughput	Number of disks
1024 GiB, Premium SSD (...	1024	5000	200	1

1024 GiB, 5000 IOPS, 200 MB/s

! The desired performance might not be reached due to the maximum virtual machine disk performance cap. The selected VM size (Standard_B2ms) only supports up to 1920 disk max iops (currently 10000 iops), 22.5 disk max throughput in MBps (currently 400 in MBps).

Keep in mind that the Data and Logs configuration must be sized, according to the use that we will give to the SQL Server and the amount of data that we will have to host, as well as the periodicity of the backups and their strategy.

SQL Server License Configuration

We will accept this configuration and move on to configure the Licensing aspects. At this time we can:

- Choose pay per use according to the selected image (in our case SQL Server Standard).

- Choose a hybrid benefit option, which is the case that we already have a SQL Server license that can be applied to an Azure VM.

If you have questions about your license, you should consult a Microsoft or partner licensing specialist. In our case we will choose the "No" option (that is, we will advance by payment for use):

Create a virtual machine

Storage **Storage optimization: Transactional processing**
SQL Data: 1024 GiB, 5000 IOPS, 200 MB/s
SQL Log: 1024 GiB, 5000 IOPS, 200 MB/s
SQL TempDb: Use local SSD drive
[Change configuration](#)

SQL Server License

Save up to 43% with licenses you already own. Already have a SQL Server license? [Learn more](#)

SQL Server License No Yes

Automated patching

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

Automated patching **Enabled**
Sunday at 2:00
[Change configuration](#)

Automated backup

Automated backup [Disable](#) [Enable](#)

R Services(Advanced Analytics)

SQL Server Machine Learning Services (In-Database) [Disable](#) [Enable](#)

Update Settings

SQL Server in virtual machines allows us to have facilities in relation to the installation of updates. The wizard allows us to configure automatic patching, which applies updates to SQL Server at a pre-established day and time. This does not remove our responsibility for updates: we are responsible for any problems in the VM, since we are in the IaaS delivery method. Let's choose Change configuration to explore the options we have:

Create a virtual machine ...

Storage **Storage optimization: Transactional processing**
SQL Data: 1024 GiB, 5000 IOPS, 200 MB/s
SQL Log: 1024 GiB, 5000 IOPS, 200 MB/s
SQL TempDb: Use local SSD drive
[Change configuration](#)

SQL Server License
Save up to 43% with licenses you already own. Already have a SQL Server license? [Learn more](#)

SQL Server License No Yes

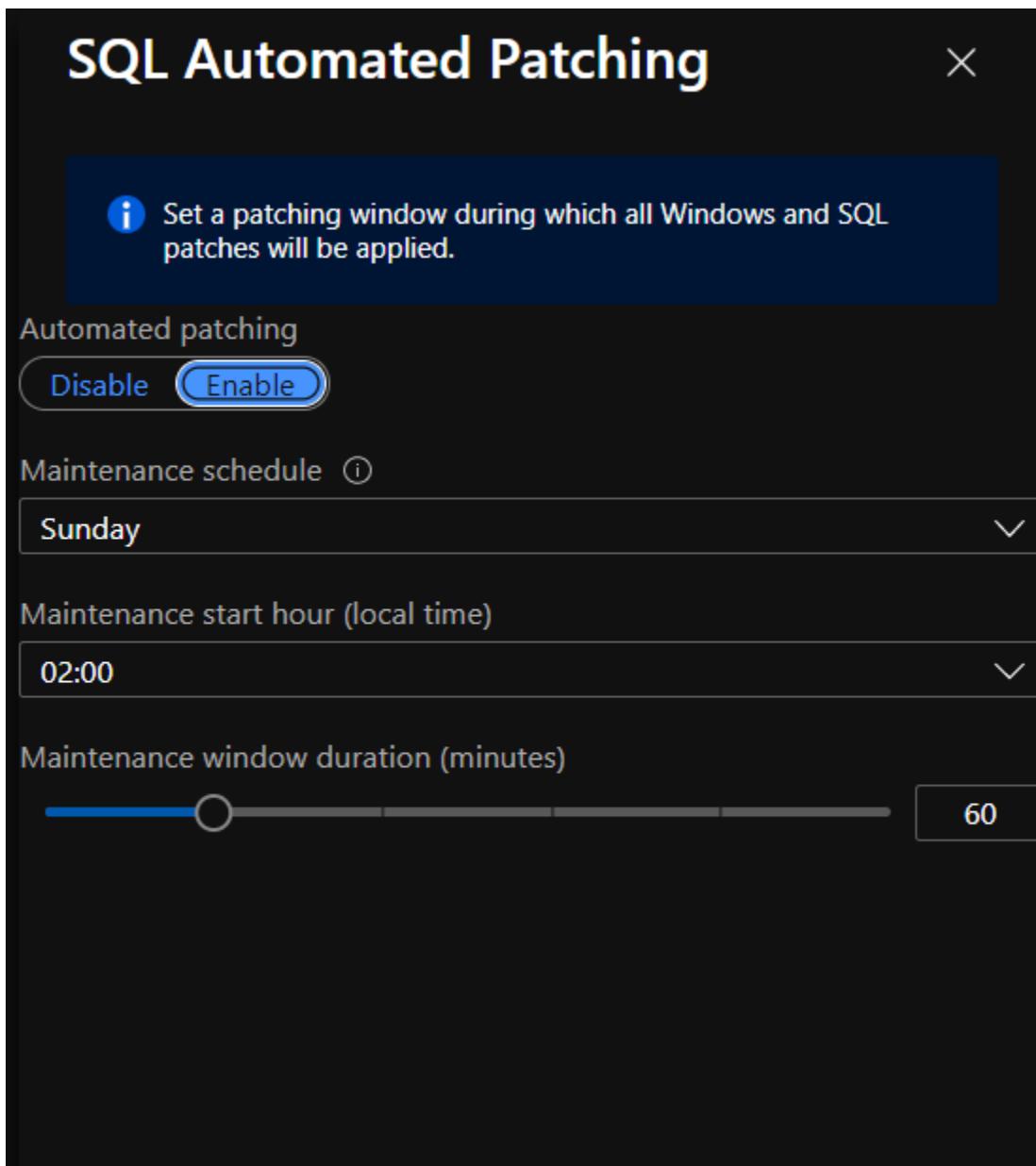
Automated patching
Set a patching window during which all Windows and SQL patches will be applied.

Automated patching **Enabled**
Sunday at 2:00
[Change configuration](#)

Automated backup
Automated backup [Disable](#) [Enable](#)

R Services(Advanced Analytics)
SQL Server Machine Learning Services (In-Database) [Disable](#) [Enable](#)

From here we can enable or disable automatic patching, and if we choose, we can select the day and time preference with a maintenance window. The maintenance window allows a space for patches to be applied.



Backup Configuration

Another aspect with which we have facilities when we talk about SQL Server VM is backup copies. We can choose to have automatic backups made in the VM to protect our databases. However, this aspect cannot be customized from here, only enabled and disabled.

Remember that we are in IaaS delivery method: this means that the configuration we select does not remove our responsibility for backup and recovery, it is only an enabler.

Create a virtual machine

...

Storage

Storage optimization: Transactional processing

SQL Data: 1024 GiB, 5000 IOPS, 200 MB/s
SQL Log: 1024 GiB, 5000 IOPS, 200 MB/s
SQL TempDb: Use local SSD drive
[Change configuration](#)

SQL Server License

Save up to 43% with licenses you already own. Already have a SQL Server license? [Learn more](#)

SQL Server License ⓘ No Yes

Automated patching

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

Automated patching ⓘ **Enabled**
Sunday at 2:00
[Change configuration](#)

Automated backup

Automated backup ⓘ [Disable](#) [Enable](#)

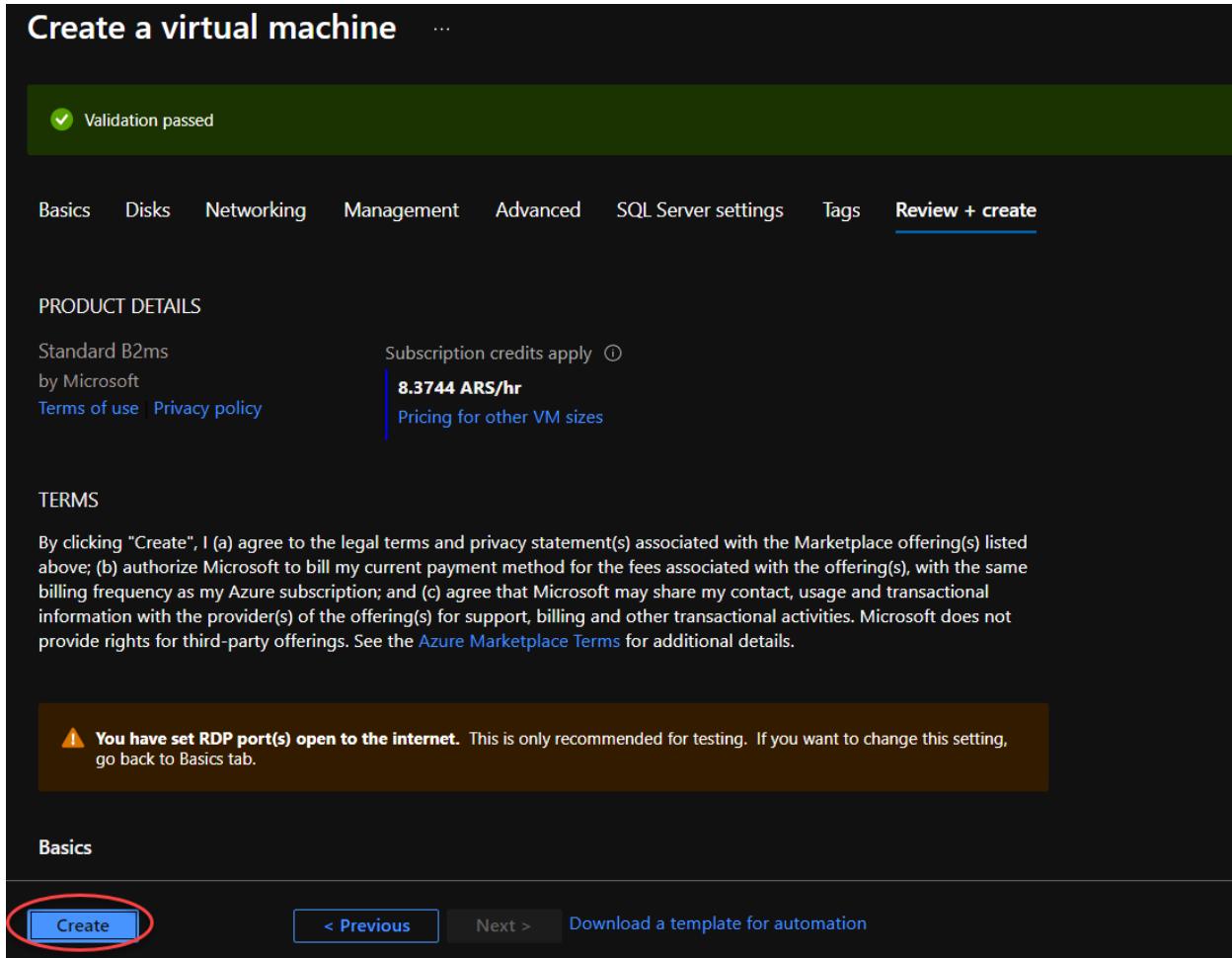
R Services(Advanced Analytics)

SQL Server Machine Learning Services (In-Database) ⓘ [Disable](#) [Enable](#)

At the moment we will not configure the advanced analytics services.

Validation and Creation of VM

The last step is the validation of the selected options. If all goes well, we can generate the VM:



Create a virtual machine ...

Validation passed

Basics Disks Networking Management Advanced SQL Server settings Tags **Review + create**

PRODUCT DETAILS

Standard B2ms by Microsoft

Subscription credits apply ⓘ
8.3744 ARS/hr
Pricing for other VM sizes

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the [Azure Marketplace Terms](#) for additional details.

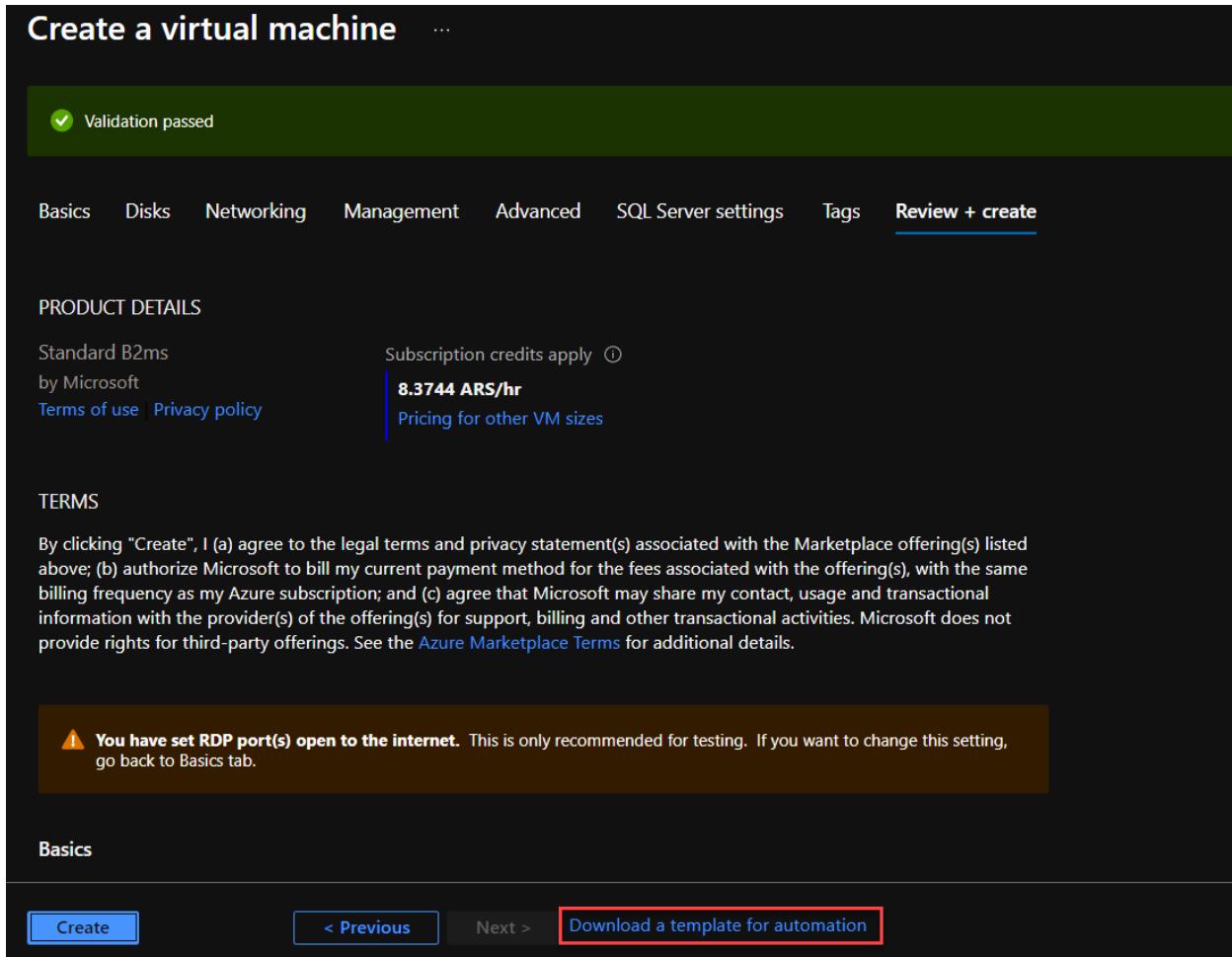
⚠ You have set RDP port(s) open to the internet. This is only recommended for testing. If you want to change this setting, go back to Basics tab.

Basics

Create < Previous Next > Download a template for automation

Build by Infrastructure as Code

If we want to automate the tasks performed by the graphical interface, we can choose to export the template for future use:



Create a virtual machine ...

Validation passed

Basics Disks Networking Management Advanced SQL Server settings Tags **Review + create**

PRODUCT DETAILS

Standard B2ms by Microsoft Subscription credits apply ⓘ
8.3744 ARS/hr
Terms of use | Privacy policy Pricing for other VM sizes

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the [Azure Marketplace Terms](#) for additional details.

! You have set RDP port(s) open to the internet. This is only recommended for testing. If you want to change this setting, go back to Basics tab.

Basics

Create < Previous Next > **Download a template for automation**

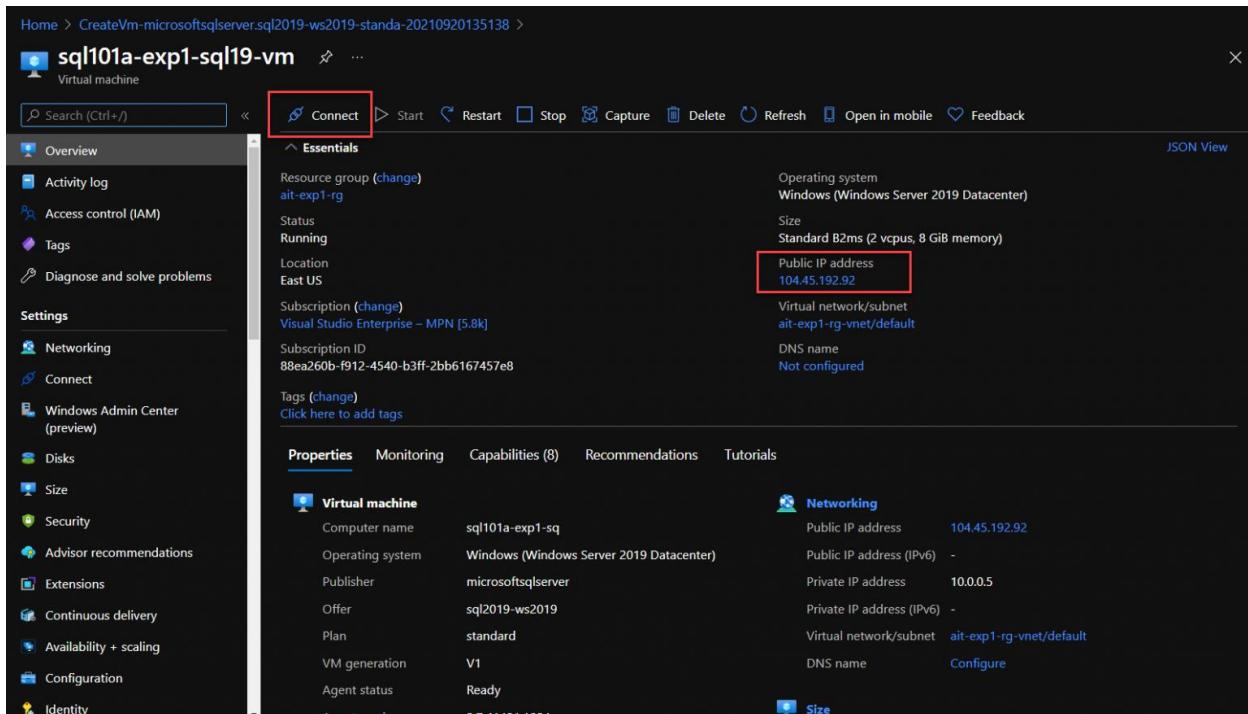
When the VM finishes creating, we can enter. We suggest you move forward.

Login to our Windows VM with SQL Server

Once the VM has been generated, we can log in via RDP. In the case of a VM with Linux, we can use SSH.

Connect to the VM via RDP

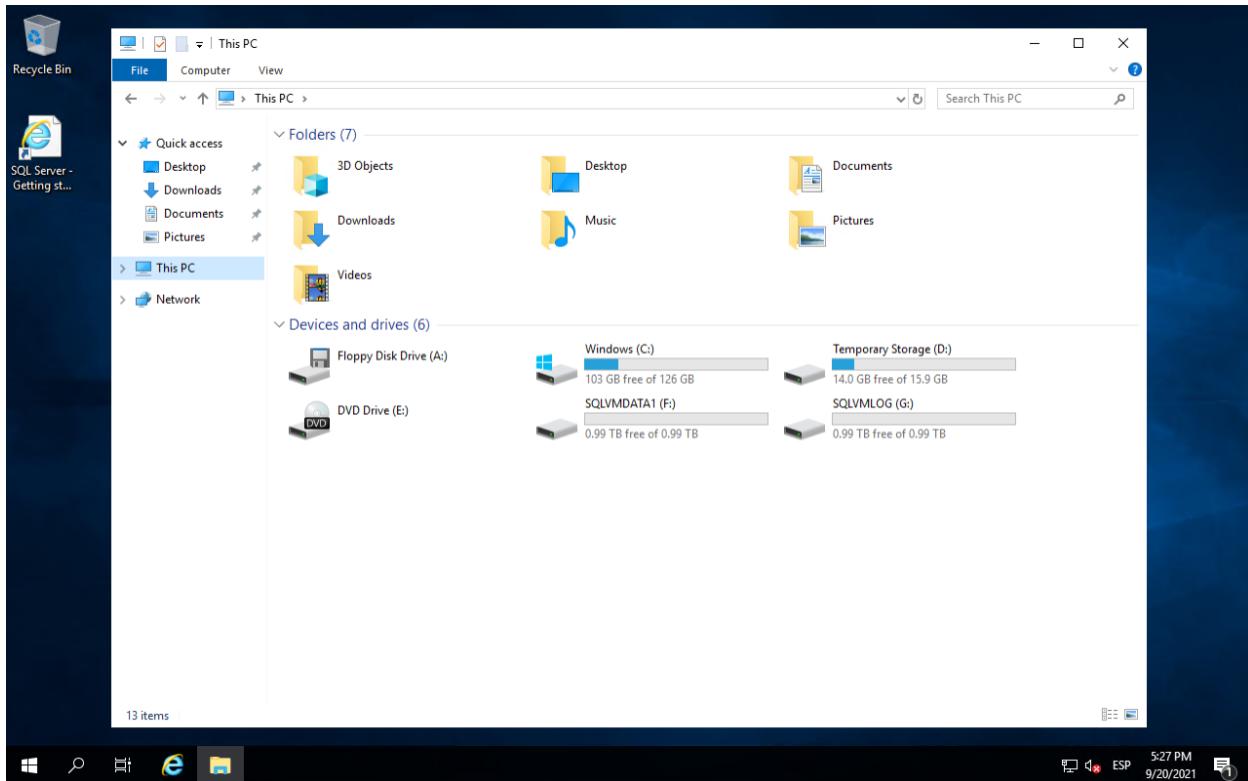
Since the goal of the course and this experience is to create a simple SQL Server VM, we have done basic configurations on our computer. To enter via RDP we will have to use the Connect button or the Public IP address from an RDP client:



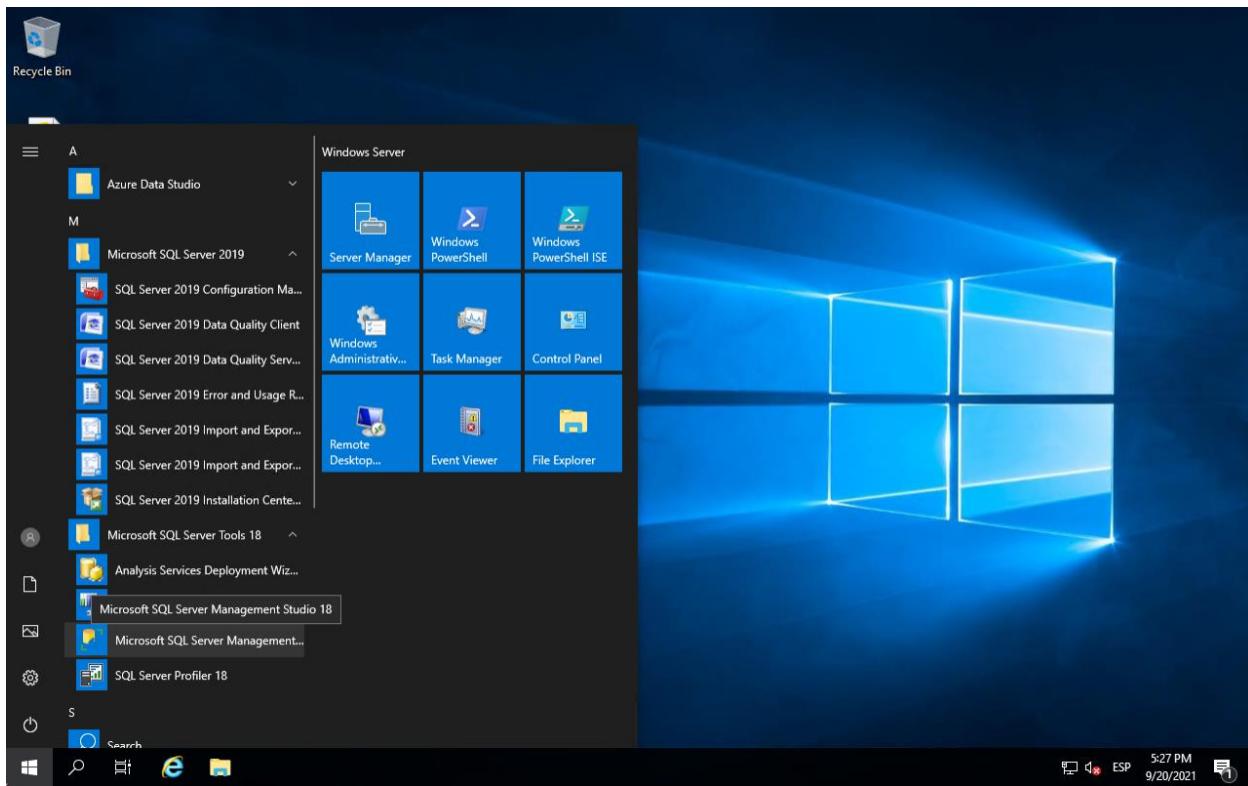
The screenshot shows the Azure portal interface for a virtual machine named "sql101a-exp1-sql19-vm". The "Connect" button in the top navigation bar is highlighted with a red box. The "Public IP address" field, which displays "104.45.192.92", is also highlighted with a red box. The main pane displays the VM's configuration, including its operating system (Windows Server 2019 Datacenter), size (Standard B2ms), and networking details (Virtual network/subnet: ait-exp1-rg-vnet/default, DNS name: Not configured).

SQL Server VM Validations

We can see that the virtual disk configuration in the VM is as chosen in the configuration:

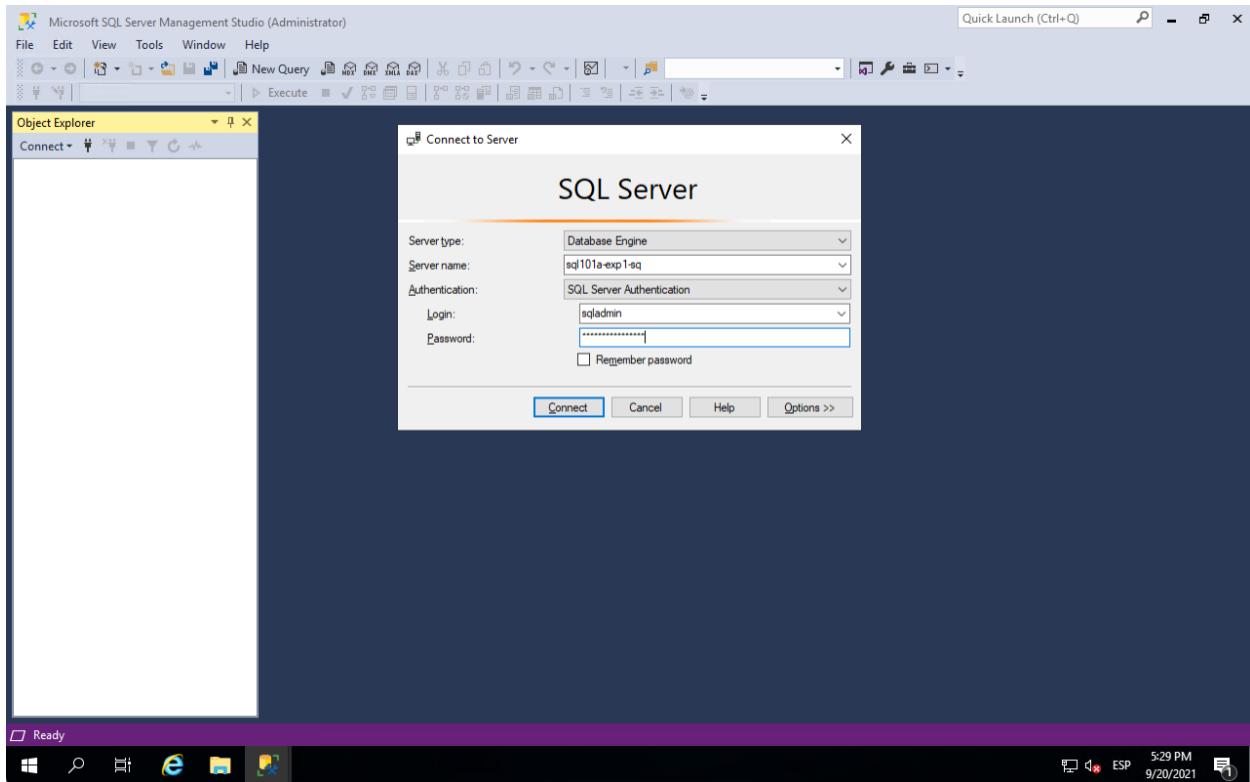


On the other hand, we can validate that management tools such as SQL Management Studio have been installed:

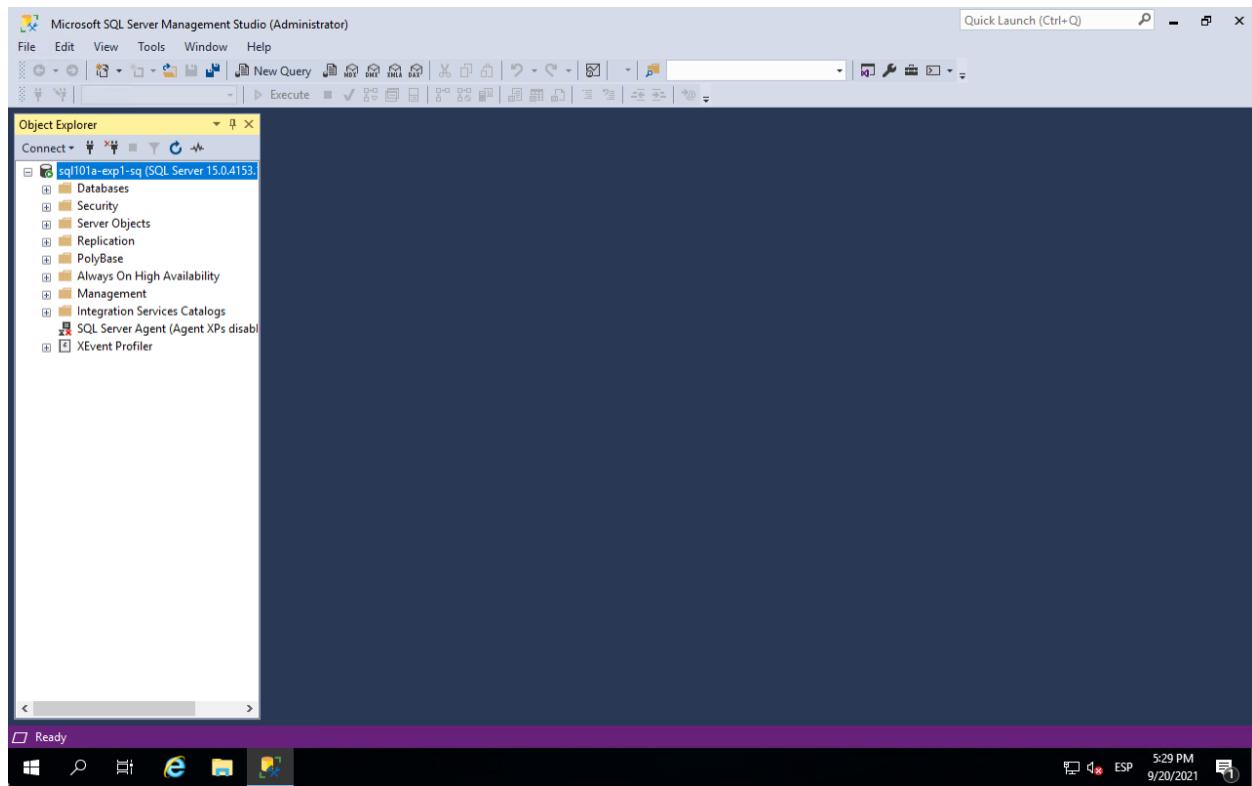


Connection to local SQL Management Studio

If we enter the SQL Management Studio we can connect with our local engine. For this we will use the credentials created during the creation of the VM, in the SQL Server settings tab:



If all goes well, we have been able to connect to the local SQL Server:



You will also be able to use Azure Data Studio to connect. Check with your instructor.

Exercise 2: Azure SQL Database (part 1)

Introduction to the exercise

In this section we will do the second experience together. This experience requires you to have a Microsoft Azure subscription set up and available and consumes any credits you have on it. Please review this topic to avoid charges on subscriptions where you don't want them to exist.

In this experience we will:

- Learn more about Azure SQL Database.
- Create a SQL Database Server.
- Configure Networks and Firewall of the SQL Database Server.
- Connect to SQL Database Server from administrative tools (such as SQL Management Studio and Azure Data Studio).
- Create single database type SQL Databases, DTU-based as well as vCPU-based.

This experience is going to be intense! Let's keep going!

About Azure SQL Database

Since 2008, when Windows Azure was announced, SQL on Azure was one of its five main components. From the beginning, SQL has been a big part of Azure. SQL Azure was built to provide a cloud-hosted version of SQL Server. Later, Windows Azure was renamed to Microsoft Azure, SQL Azure was renamed to Azure SQL, and both have increased services ever since, very noticeably.

SQL Database is an Azure SQL PaaS deployment option that abstracts both the operating system and the instance of SQL Server from users.

We are going to explore some points about Deployment Models, Purchasing and Licensing Models.

Deployment Models in Azure SQL Database

In Azure SQL Database there are two resource types or deployment models: single database and elastic pool. Let's briefly review each one:

- A single database represents a fully managed isolated database. You can use this option if you have modern cloud applications and microservices that need a single, trusted source of data. A single database is similar to a standalone database in the SQL Server database engine.
- The elastic pool is a collection of single databases with a shared set of resources, such as CPU or memory. Single databases can be moved in and out of an elastic pool.

In this section we will concentrate on single databases.

Azure SQL Database purchasing models

Azure SQL Database allow you to easily purchase a fully managed platform-as-a-service (PaaS) database engine that meets your performance and cost needs. Depending on the deployment model you've chosen for Azure SQL Database, you can select the purchasing model that best suits your needs:

- Virtual core based purchasing model (recommended). This purchasing model allows you to choose between a provisioned compute tier and a serverless compute tier. With the provisioned compute tier, you choose the exact amount of compute resources that are always provisioned for the workload. With the serverless compute tier, you must specify autoscaling of compute resources using a range of configurable computes. With this compute level, you can also automatically pause and resume the database based on

workload activity. The unit price of a vCore per unit of time is lower at the provisioned compute tier than at the serverless compute tier.

- Purchasing model based on database transaction unit (DTU). This purchasing model provides bundled and balanced storage and compute packages for typical workloads.

Azure SQL Database Hybrid Benefit

At the provisioned compute level of the vCore-based purchasing model, you can exchange your existing licenses for discounted rates on Azure SQL Database and Azure SQL Managed Instance through the Azure Hybrid Benefit. This Azure benefit allows you to save up to 30% or even more on SQL Database and SQL Managed Instance when you use SQL Server licenses with Software Assurance.

Creating a SQL Database Server

The first step to get started with Azure SQL Database is to create a SQL Database Server.

What is a SQL Database Server?

A server is a logical construct that acts as the central administrative point for a collection of databases. At the server level, you can:

- Manage logins, firewall rules,
- audit rules,
- Threat detection policies and
- Automatic failover groups.

The server must exist before you can create a database, and all databases managed by a single server are created in the same region as that server. The SQL Database Server is FREE: there is no cost or cost to create it. The databases that we generate dependent on it, on the other hand, will have a cost.

A server is different than an instance of SQL Server, which you may be familiar with in the world of locales. In particular, there is no warranty regarding the location of the databases or the data storage database with respect to the server that manages them.

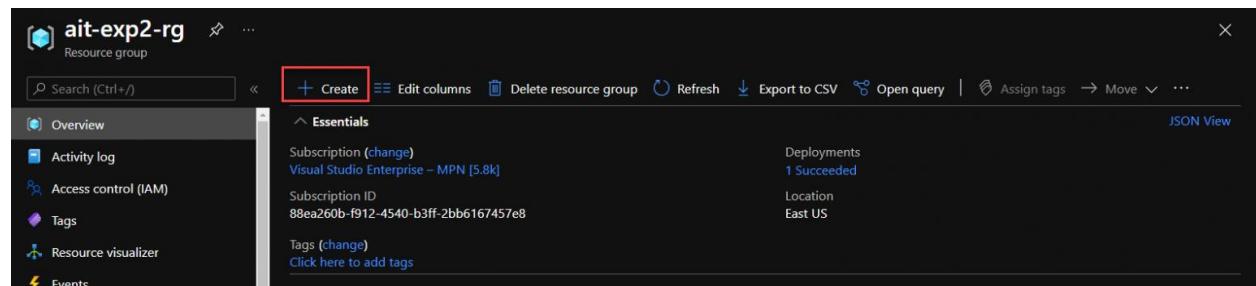
In this experience and the ones that follow, you will learn many things about a SQL Database Server that will surely surprise you.

Resource Group Creation

For this experiment we are going to work on the group of resources that you will have to create with the name "**sql101a-exp2-rg**".

Creating a SQL Database Server

We can create a SQL Database Server directly from the Azure Portal. We'll move to the suggested resource group for this experience and create a new resource:



The screenshot shows the Azure Resource Group 'ait-exp2-rg'. The 'Create' button in the top navigation bar is highlighted with a red box. The page displays the 'Essentials' section with the following information:

Subscription (change)	Deployments
Visual Studio Enterprise - MPN [5.8k]	1 Succeeded
Subscription ID	Location
88ea260b-9112-4540-b3ff-2bb6167457e8	East US
Tags (change)	
Click here to add tags	

There we will choose "Azure SQL" in the search bar:

Create a resource ...

Get started

Recently created

Categories

- AI + Machine Learning
- Analytics
- Blockchain
- Compute
- Containers
- Databases
- Developer Tools
- DevOps
- Identity
- Integration
- Internet of Things
- IT & Management Tools

azure sq|

TimeXtender® with Azure SQL DB

Azure SQL **(selected)**

Azure SQL Edge

Azure SQL Analytics (Preview)

TimeXtender® with ADLS Gen2 and Azure SQL ...

 **Web App**
Create | Docs | MS Learn

 **SQL Database**
Create | Docs | MS Learn

 **Function App**
Create | Docs

 **Azure Cosmos DB**
Create | Docs | MS Learn

We will enter the screen with the Azure SQL deployment options. This screen should be familiar to us, since it is the same one that we have seen in the theoretical introduction.

We are going to select SQL Databases and, in the resource type, “Database server”:

Select SQL deployment option ...

Microsoft

Feedback

How do you plan to use the service?

 **SQL databases**
Best for modern cloud applications. Hyperscale and serverless options are available.

Resource type

Database server **(selected)**

Single database

Elastic pool

Database server

 **SQL managed instances**
Best for most migrations to the cloud. Lift-and-shift ready.

Resource type

Single instance

Create Show details

 **SQL virtual machines**
Best for migrations and applications requiring OS-level access. Lift-and-shift ready.

Image

Create Show details

Now it's time to start entering data to create our SQL Database Server. We suggest you follow the following guidelines:

- Server name: ait-sqldatabase-<string>-sqlserver, where <yourstring> must be replaced with your own unique text and numbers (since this server name must be unique across all of Azure).
- Location: eastus
- Server admin login and password: the one you choose, and as a suggestion enter "sqladmin" in the login.

Create SQL Database Server

Microsoft

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Visual Studio Enterprise – MPN [5.8k] ▾

Resource group * ⓘ ait-exp2-rg ▾
Create new

Server details

Enter required settings for this server, including providing a name and location.

Server name * ait-sqldatabase-sqlserver .database.windows.net ✓

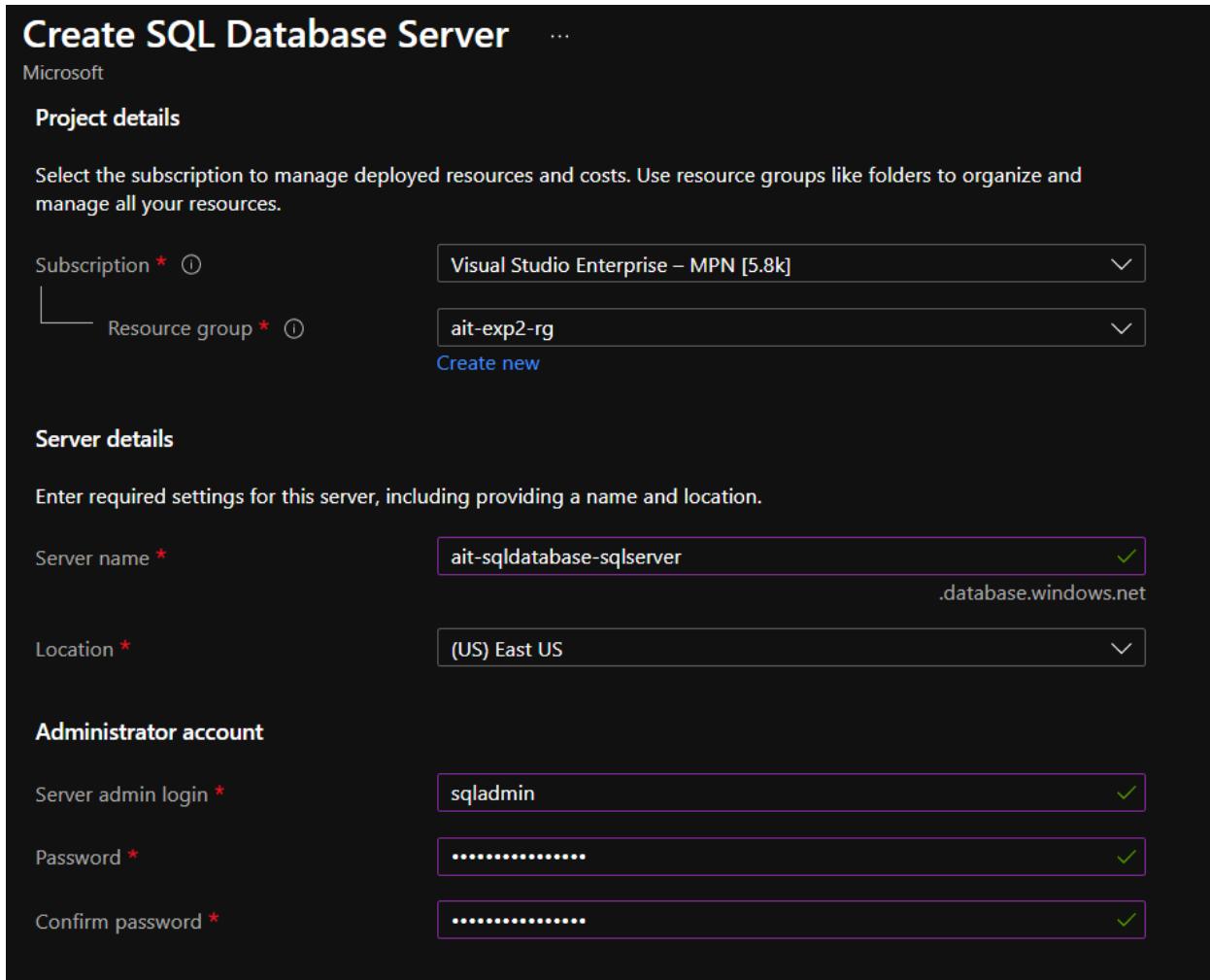
Location * (US) East US ▾

Administrator account

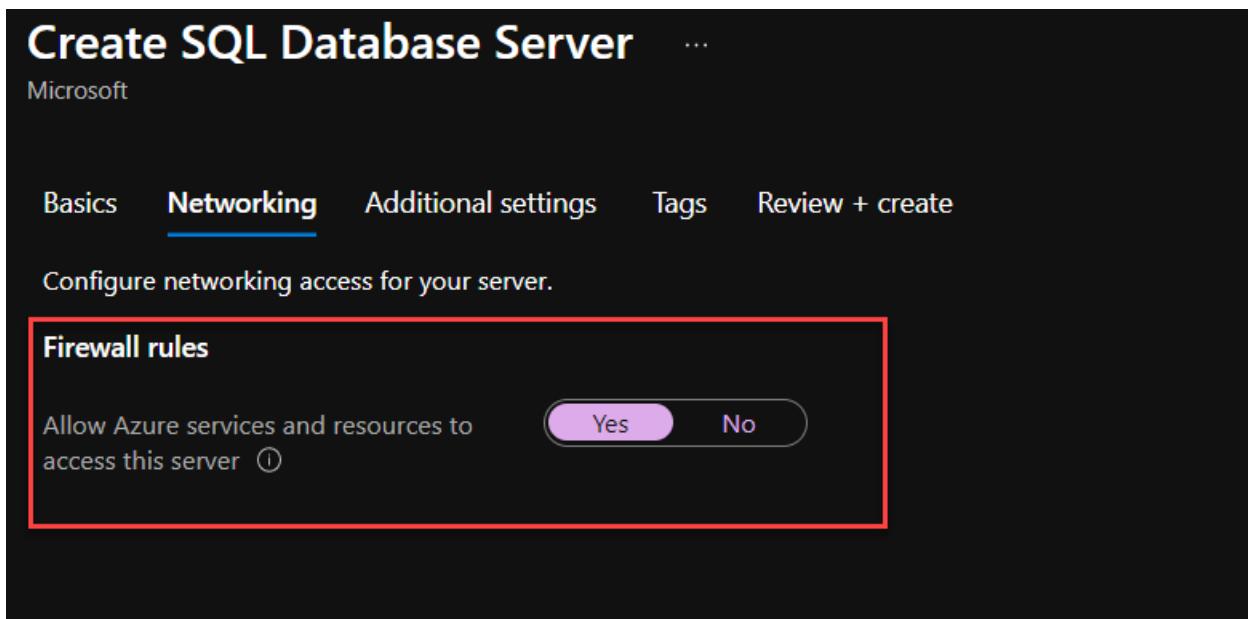
Server admin login * sqladmin ✓

Password * ✓

Confirm password * ✓



After completing the previous data, we will go on to configure the networking part. We will enable Azure services (VMs, Websites, etc) to connect to this SQL Database Server. This, later in the experience, we will modify:



In Additional settings we will have the possibility to configure Azure Defender. This time we will not:

Create SQL Database Server

Microsoft

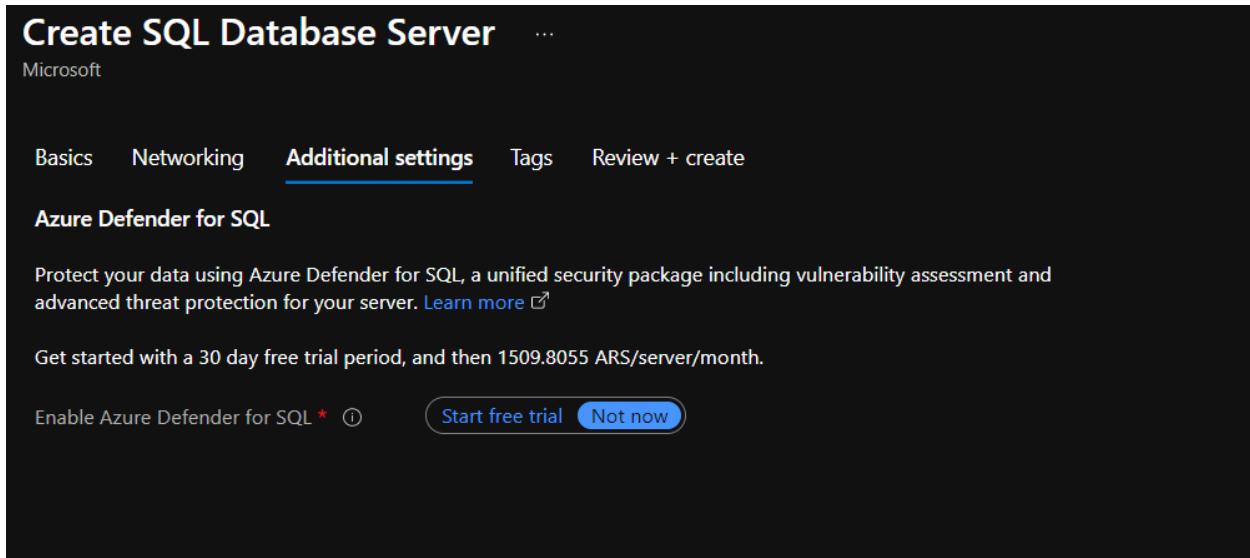
Basics Networking Additional settings Tags Review + create

Azure Defender for SQL

Protect your data using Azure Defender for SQL, a unified security package including vulnerability assessment and advanced threat protection for your server. [Learn more](#)

Get started with a 30 day free trial period, and then 1509.8055 ARS/server/month.

Enable Azure Defender for SQL * ⓘ [Start free trial](#) [Not now](#)



Finally, we are going to review the selected options and, when the validations have passed, we will create the SQL Database Server:

Create SQL Database Server

Microsoft

Basics Networking Additional settings Tags Review + create

Product details

SQL Database Server by Microsoft [Estimated cost per month](#)
[Terms of use](#) | [Privacy policy](#) No additional charges

Terms

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. For additional details see [Azure Marketplace Terms](#).

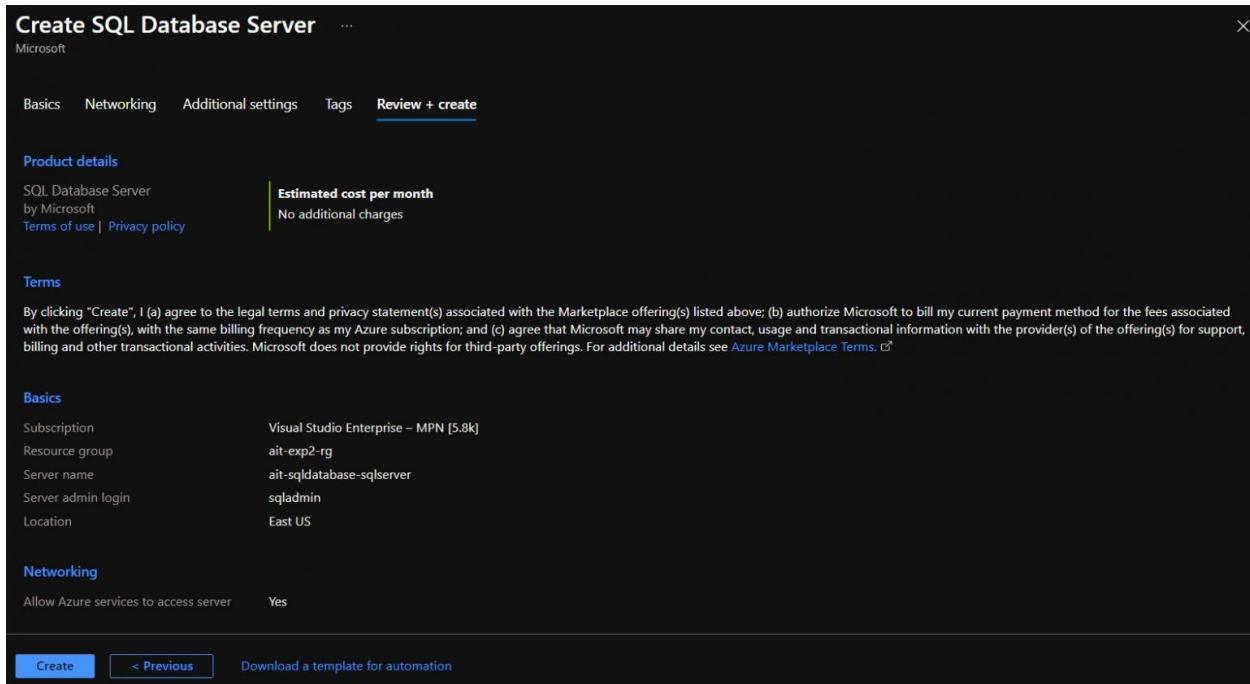
Basics

Subscription	Visual Studio Enterprise – MPN [5.8k]
Resource group	ait-exp2-rg
Server name	ait-sqldatabase-sqlserver
Server admin login	sqladmin
Location	East US

Networking

Allow Azure services to access server Yes

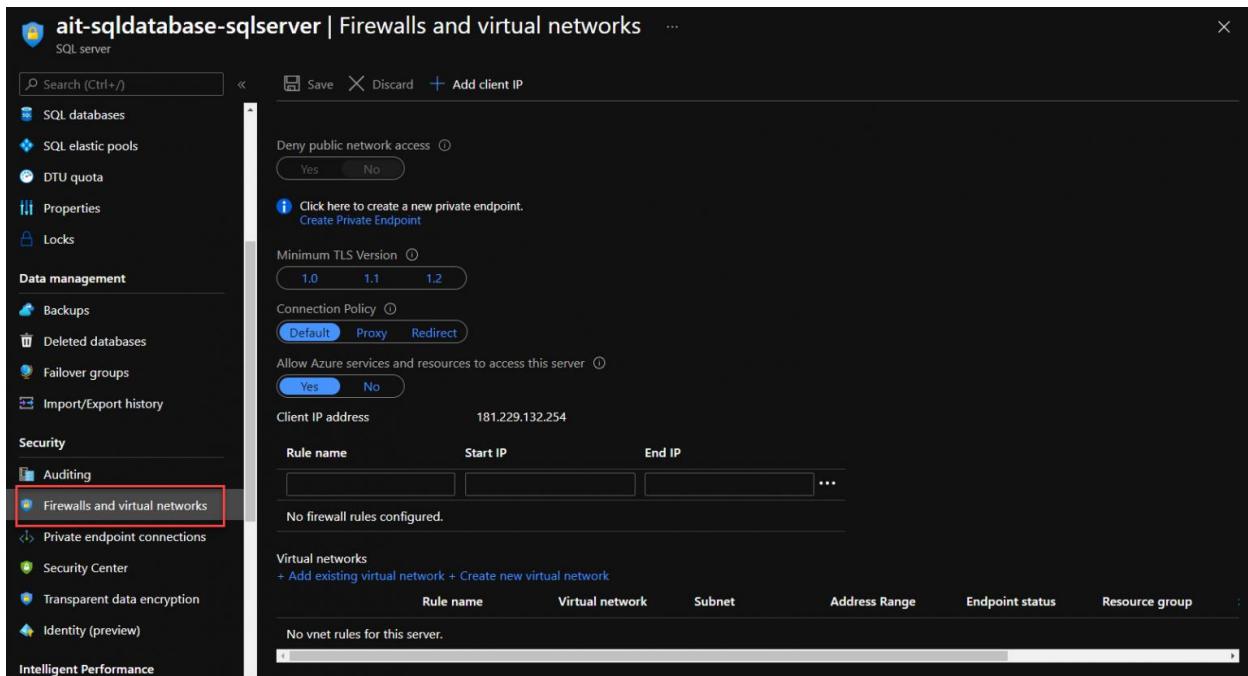
[Create](#) [Previous](#) Download a template for automation



Ready! When you have finished generating it you will move on to the next lesson.

Network and Firewall Configuration

In order to connect to the SQL Database Server from management tools or from our apps, we must correctly configure the Networks and Firewall. This option is found within our server, as indicated on the screen:



In this lesson we will not carry out any configuration, we will only go through the options so that you know what each of them is for.

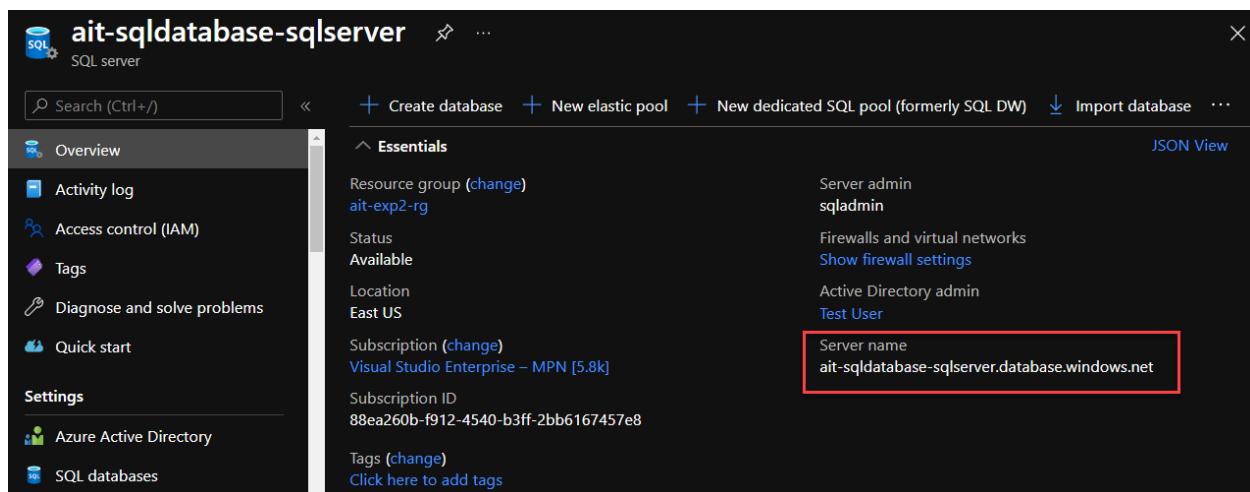
Connection from Administrative Tools

In this lesson we are going to validate that we can connect using SQL Management Studio and from Azure Data Studio from our Azure virtual machine. However, we are going to validate that we cannot do it from our desktop computer.

We will not generate databases yet, an action that we will leave for later in this experience.

Get the connection URL to the SQL Database Server

We are going to enter our created SQL Database Server resource, and in the Overview screen we will extract (copy) the Server name with the full connection URL:



The screenshot shows the Azure portal's Overview screen for a SQL server named "ait-sqldatabase-sqlserver". The left sidebar includes links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Quick start, Settings, Azure Active Directory, and SQL databases. The main content area displays the following details under the "Essentials" section:

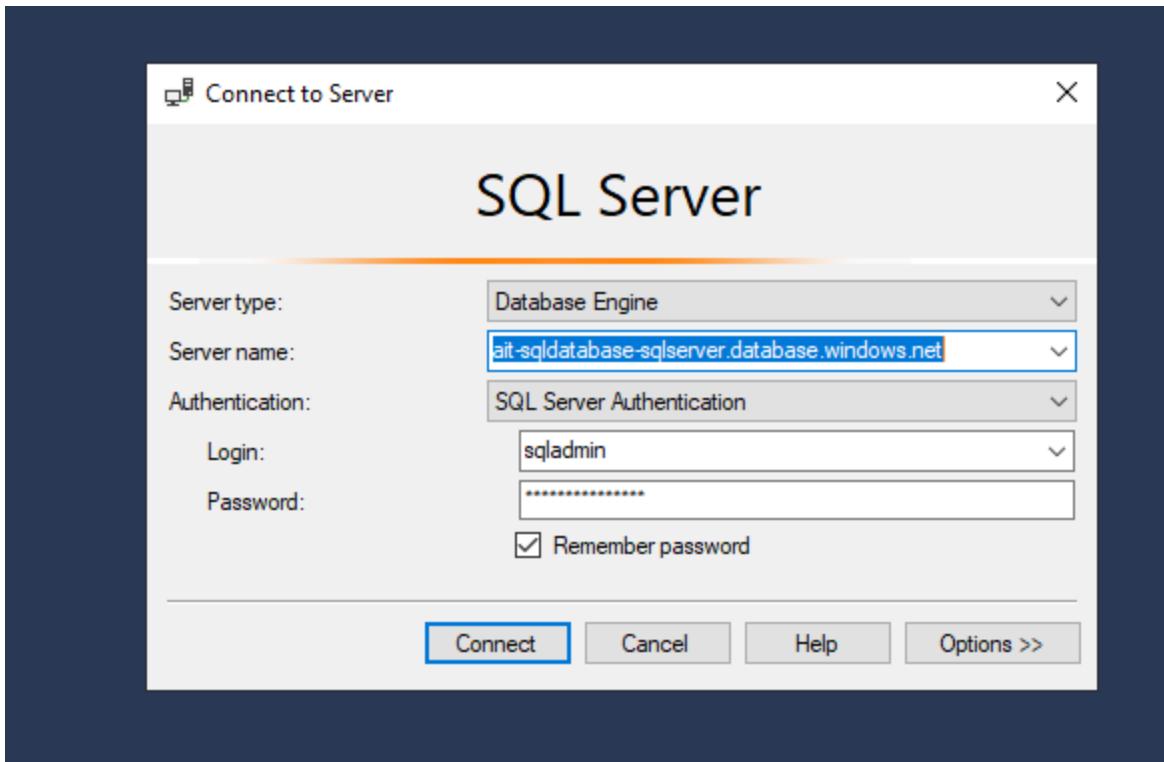
- Resource group (change): ait-exp2-rg
- Status: Available
- Location: East US
- Subscription (change): Visual Studio Enterprise – MPN [5.8k]
- Subscription ID: 88ea260b-f912-4540-b3ff-2bb6167457e8
- Tags (change): Click here to add tags
- Server admin: sqladmin
- Firewalls and virtual networks: Show firewall settings
- Active Directory admin: Test User
- Server name: ait-sqldatabase-sqlserver.database.windows.net

Connect from Azure using SQL Management Studio

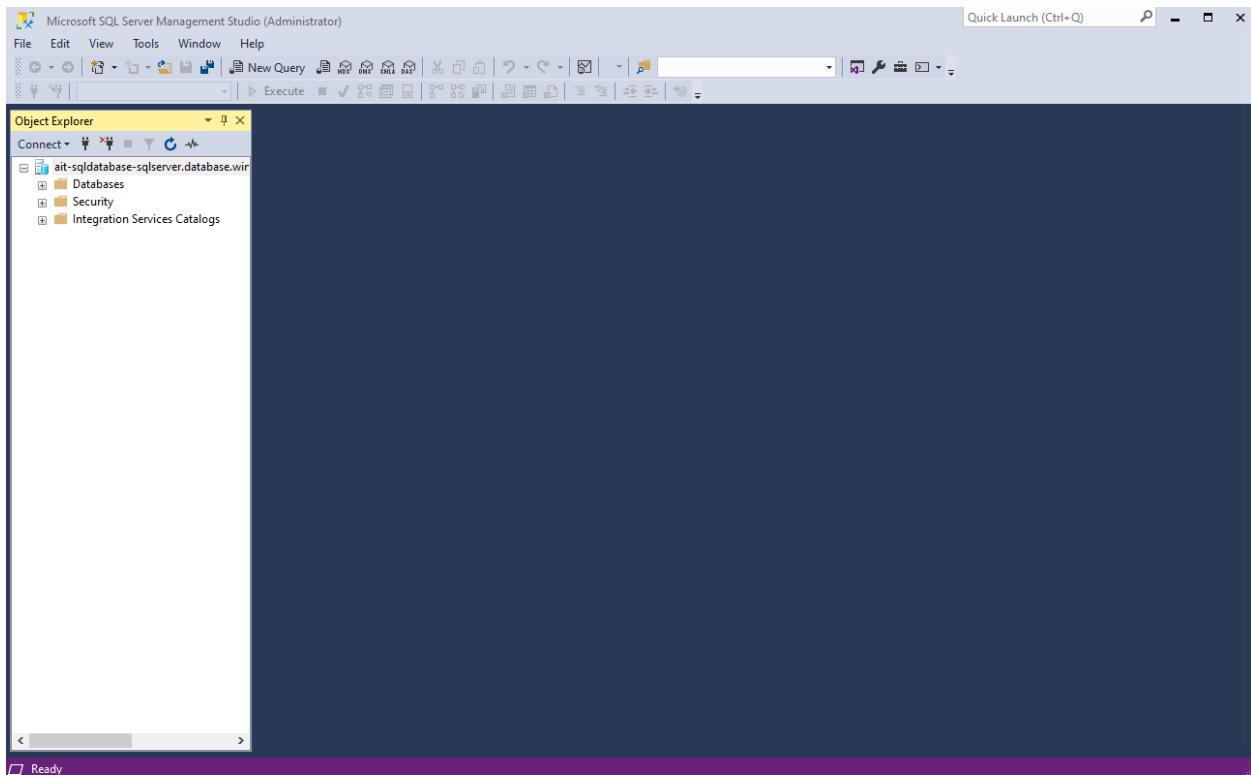
Since we have configured all the corresponding network and firewall aspects, enabling connections from Azure to be established with the server we just generated, we are going to go to our virtual team (created in the first experience) and open SQL Management Studio .

We will enter:

- In Server name the full URL of the SQL Database Server,
- Under Authentication “SQL Server Authentication”.
- Login and Password that we have assigned to our SQL Database Server.



We will be able to verify that our SQL Management Studio connected without problems to the SQL Database Server:



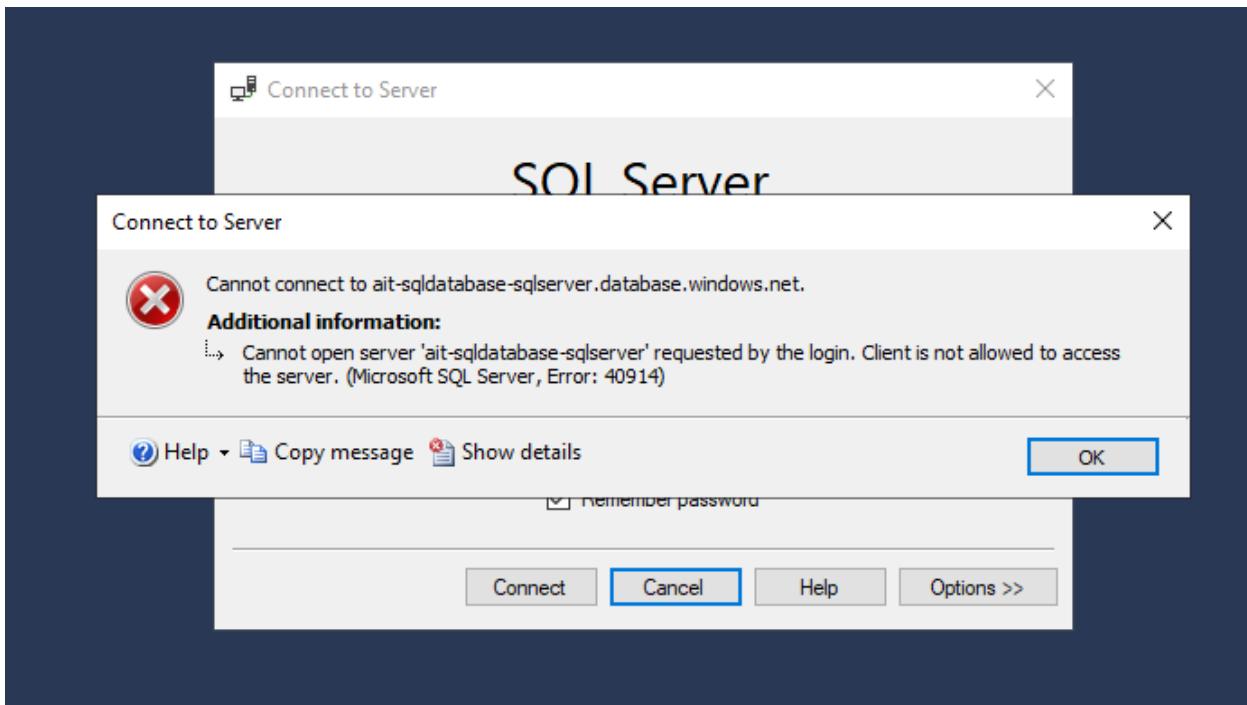
We will be able to verify that our SQL Management Studio connected without problems to the SQL Database Server:

Now... and what happens if I try the same connection from my house? Let's explore it.

Connect from another location using SQL Management Studio

To do this test we are going to need to have SQL Management Studio installed in our house, or at least in some computer :-). To download it, go to Experience 1 and use the same download URL.

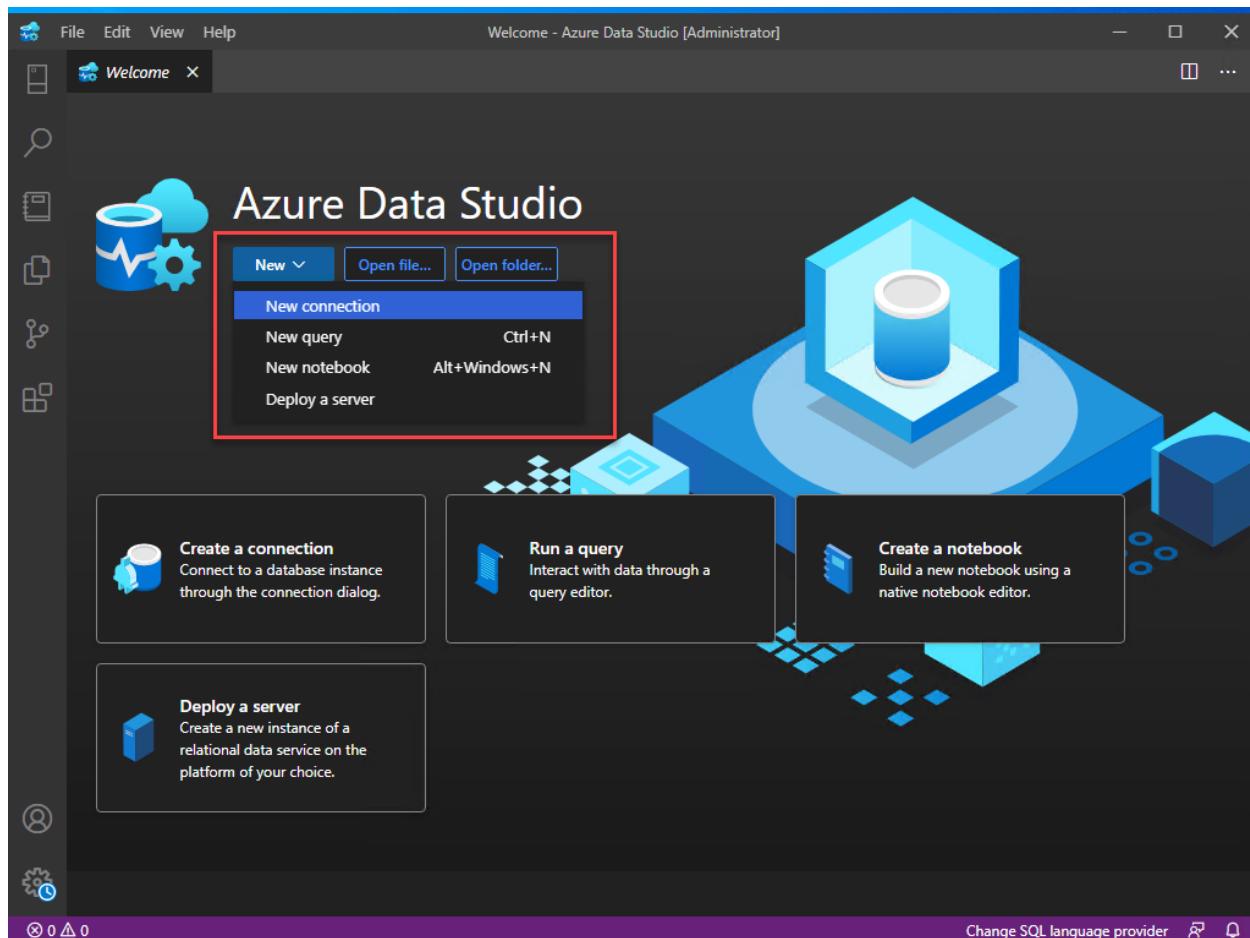
Entering the connection data, it will not be possible for us to connect since it will be denied with the error "Client is not allowed to access the server":



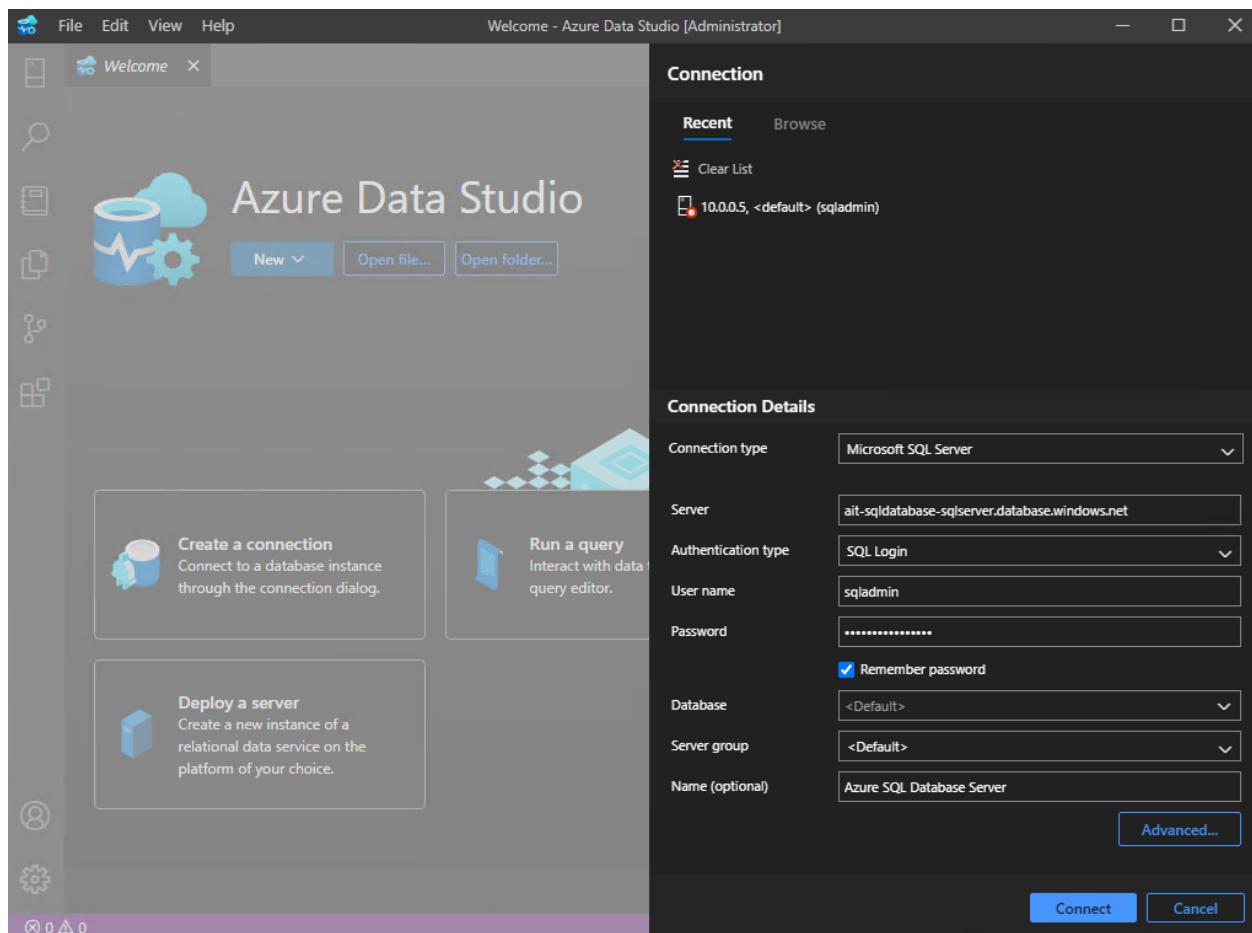
How do we go about solving it? Here's a hint: add your public (home) IP address in the SQL Database Server Firewall and try again.

Connect from Azure using Azure Data Studio

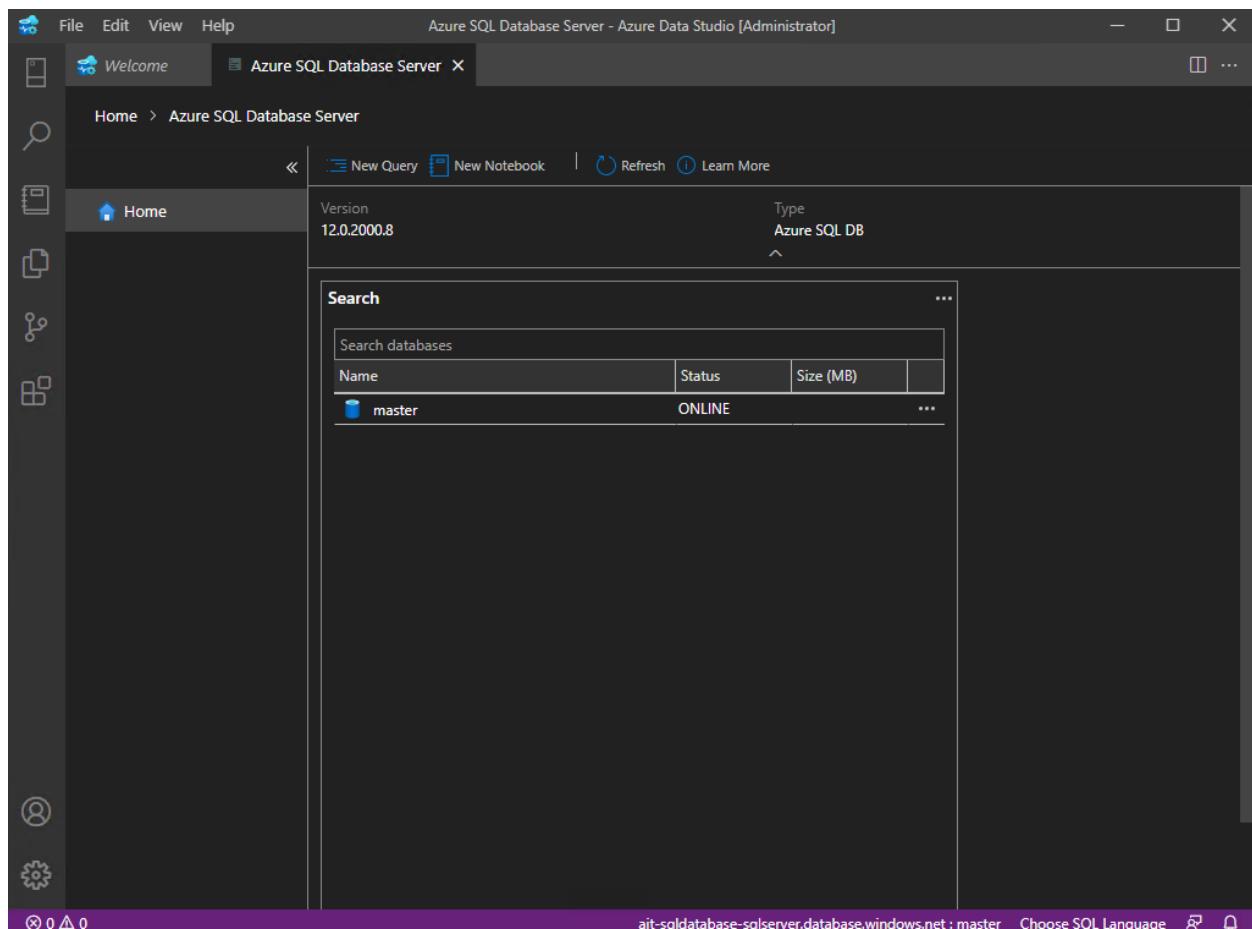
In the same way that we have tried connecting to SQL Management Studio from the Azure VM that we created in experience 1, we are going to connect to Azure Data Studio:



We will enter the server data and credentials:



Ready! We are already connected, too, with this tool:



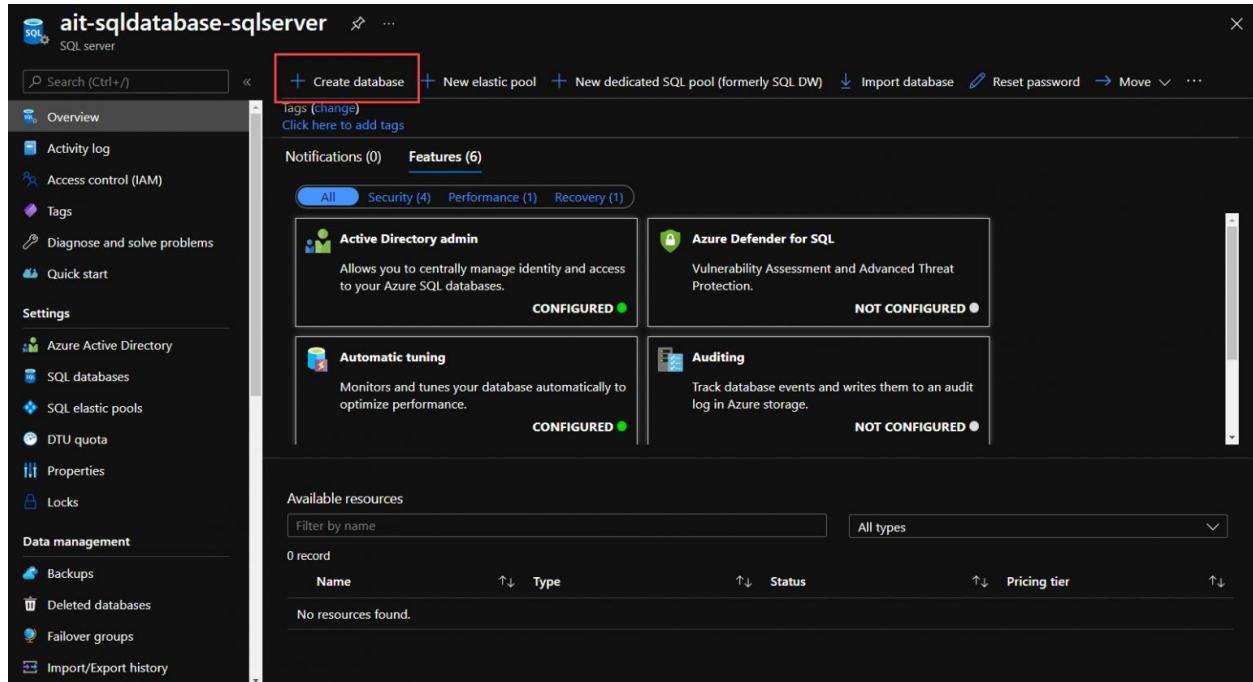
Let's move on to the next lesson!

Single Database Creation (DTU)

We are going to create our first unique database using the DTU-based purchasing model.

Unique database creation based on DTUs

From our Azure SQL Database Server, on the Overview screen, we are going to click on Create database:



The screenshot shows the Azure portal interface for managing an Azure SQL Server named 'ait-sqldatabase-sqlserver'. The left sidebar contains navigation links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Quick start, Settings (Azure Active Directory, SQL databases, SQL elastic pools, DTU quota, Properties, Locks), Data management (Backups, Deleted databases, Failover groups, Import/Export history), and Monitoring (Metrics, Log Analytics, Application Insights). The main content area displays the 'Create database' button at the top, followed by sections for Notifications (0) and Features (6). The 'Features' section lists four items: 'Active Directory admin' (CONFIGURED), 'Azure Defender for SQL' (NOT CONFIGURED), 'Automatic tuning' (CONFIGURED), and 'Auditing' (NOT CONFIGURED). Below this is a section for 'Available resources' with a table header for Name, Type, Status, and Pricing tier, and a note stating 'No resources found.'

This will start the SQL Database creation wizard. In the same way, we could have generated a new resource in our Resource Group and searched for “Azure SQL”, and then chosen the “Single database” item in the “SQL database” option.

Note that we only need to fill in the name of the database. For our exercise we will enter ait-sql-1-db:

Create SQL Database

Microsoft

Basics Networking Security Additional settings Tags Review + create

Create a SQL database with your preferred configurations. Complete the Basics tab then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription ⓘ Visual Studio Enterprise – MPN [5.8k] ⌄

Resource group ⓘ ait-exp2-rg ⌄

Database details

Enter required settings for this database, including picking a logical server and configuring the compute and storage resources

Database name * ait-sql-1-db ✓

Server ⓘ ait-sqldatabase-sqlserver (East US) ⌄

In the “Compute + storage” section we are going to choose the purchase model and the service level, by clicking on “Configure database”:

Create SQL Database ...

Microsoft

Want to use SQL elastic pool? * Yes No

Compute + storage *

General Purpose
Gen5, 2 vCores, 32 GB storage, zone redundant disabled
[Configure database](#)

Backup storage redundancy

Choose how your PITR and LTR backups are replicated. Geo restore or ability to recover from regional outage is only available when geo-redundant storage is selected.

Backup storage redundancy
 Locally-redundant backup storage - Preview
 Zone-redundant backup storage - Preview
 Geo-redundant backup storage

! Selected value for backup storage redundancy is Geo-redundant backup storage. Note that database backups will be geo-replicated to the paired region. [Learn more ↗](#)

i Your use of either of the Preview backup storage redundancy options (ZRS and LRS) is governed by the agreement under which you obtained Microsoft Azure Services. By selecting a Preview redundancy option, you confirm that you agree to the preview terms in such agreement.
Microsoft Azure Legal Information: [Learn more ↗](#)

On the screen that is displayed we can see in "Service tier" the options based on vCore and DTU. Let's select the DTU-based option "Basic":

Configure ...

Feedback

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls and offers Hyperscale and Serverless to automatically scale your database based on your workload needs. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier

DTUs [What is a DTU?](#)

5 (Basic)

Data max size (GB)

Basic (For less demanding workloads)

vCore-based purchasing model

General Purpose (Scalable compute and storage options)

Hyperscale (On-demand scalable storage)

Business Critical (High transaction rate and high resiliency)

DTU-based purchasing model

Basic (For less demanding workloads)

Standard (For workloads with typical performance requirements)

Premium (For IO-intensive workloads)



Cost summary

Cost per DTU (in -)	--
DTUs selected	x 5
ESTIMATED COST / MONTH	-- --

We can also configure aspects of backup copies and their redundancy, or leave the default value:

Create SQL Database

Microsoft

Want to use SQL elastic pool? * Yes No

Compute + storage *

Basic
2 GB storage
[Configure database](#)

Backup storage redundancy

Choose how your PITR and LTR backups are replicated. Geo restore or ability to recover from regional outage is only available when geo-redundant storage is selected.

Backup storage redundancy
 Locally-redundant backup storage - Preview
 Zone-redundant backup storage - Preview
 Geo-redundant backup storage

! Selected value for backup storage redundancy is Geo-redundant backup storage. Note that database backups will be geo-replicated to the paired region. [Learn more ↗](#)

i Your use of either of the Preview backup storage redundancy options (ZRS and LRS) is governed by the agreement under which you obtained Microsoft Azure Services. By selecting a Preview redundancy option, you confirm that you agree to the preview terms in such agreement.
Microsoft Azure Legal Information: [Learn more ↗](#)

In the next step of the wizard, we will proceed to configure the network aspects. This configuration, in reality, corresponds to the SQL Database Server, although in the creation of the database it is presented to customize. Note that we cannot modify the Azure services option, but what we can do is enable (or not) a client IP (from which we are connecting) so that with any administration tool we can connect to the server and to the future database.

In our case we are going to set the option to “No”:

Create SQL Database ...

Microsoft

Basics Networking Security Additional settings Tags Review + create

Configure network access and connectivity for your server. The configuration selected below will apply to the selected server 'ait-sqldatabase-sqlserver' and all databases it manages. [Learn more ↗](#)

Firewall rules

The settings displayed below are read-only. They can be modified from the "Firewalls and virtual networks" blade for the selected server after database creation. [Learn more ↗](#)

Allow Azure services and resources to access this server No Yes

Add current client IP address * No Yes

Private endpoints

Private endpoint connections are associated with a private IP address within a Virtual Network. The list below shows all the private endpoint connections for this server. Note that private endpoint connections are defined at the server level and they provide access to all databases in the server. [Learn more ↗](#)

+ Add private endpoint

Name	Subscription	Resource group	Region	Subnet
Click on add to create private endpoint				

In the next step of the wizard, we will proceed to configure security aspects. For the purposes of this experience, we are not going to enable "Azure Defender for SQL" (at least for now) or configure Ledger:

Create SQL Database ...

Microsoft

Basics Networking **Security** Additional settings Tags Review + create

Azure Defender for SQL

Protect your data using Azure Defender for SQL, a unified security package including vulnerability assessment and advanced threat protection for your server. [Learn more ↗](#)

Get started with a 30 day free trial period, and then 1509.8055 ARS/server/month.

Enable Azure Defender for SQL * ⓘ Start free trial Not now

Ledger (preview)

Ledger cryptographically verifies the integrity of your data and detects any tampering that might have occurred. [Learn more ↗](#)

Ledger (preview)	Not configured Configure ledger
------------------	---

Identity (preview)

Use system-assigned and user-assigned managed identities to enable central access management between this database and other Azure resources. [Learn more ↗](#)

Identity settings for the existing server can be updated by navigating to 'ait-sqldatabase-sqlserver'

Transparent data encryption

Transparent data encryption (TDE) encrypts your databases, backups, and logs at rest without any changes to your

[Review + create](#) [< Previous](#) [Next : Additional settings >](#)

In the "Additional settings" section we will find the possibility of configuring that the created database is blank, or starting with an example or backup restoration. We'll start with the blank database:

Create SQL Database

Microsoft

Basics Networking Security Additional settings Tags Review + create

Customize additional configuration parameters including collation & sample data.

Data source

Start with a blank database, restore from a backup or select sample data to populate your new database.

Use existing data * None Backup Sample

Database collation

Database collation defines the rules that sort and compare data, and cannot be changed after database creation. The default database collation is SQL_Latin1_General_CI_AS. [Learn more ↗](#)

Collation * SQL_Latin1_General_CI_AS [Find a collation](#)

Maintenance window

Select a preferred maintenance window from the drop down. Please note, during a maintenance event, Azure SQL Database are fully available and accessible but some of the maintenance updates require a failover as Azure takes SQL DB instances offline for a short time to apply the maintenance updates. If the database is part of elastic pool, the maintenance configuration of elastic pool will be applied. [Learn more](#)

Maintenance window

[Review + create](#) [< Previous](#) [Next : Tags >](#)

We validate the selected options in the summary part, and when we are ok we click on "Create":

Create SQL Database ...

Microsoft

Basics Networking Security Additional settings Tags **Review + create**

Product details

SQL database by Microsoft **Estimated cost per month** 502.36 ARS [View pricing details](#)

[Terms of use](#) | [Privacy policy](#)

Terms

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. For additional details see [Azure Marketplace Terms](#).

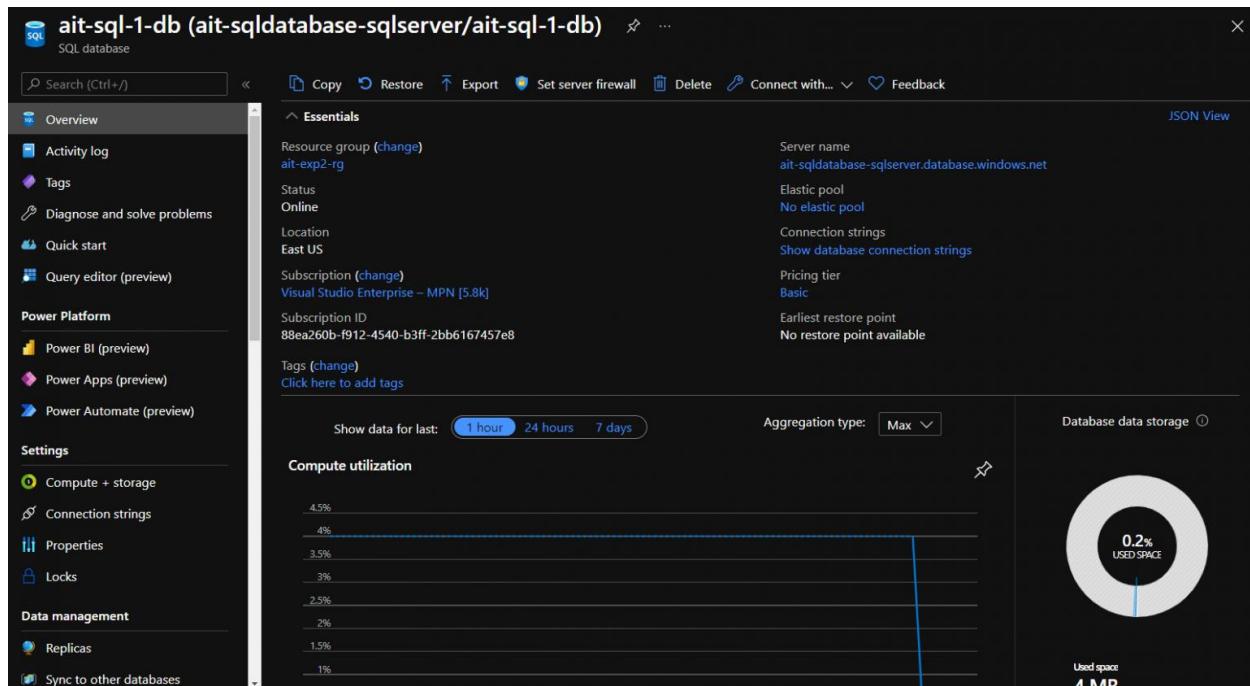
Basics

Subscription	Visual Studio Enterprise – MPN [5.8k]
Resource group	ait-exp2-rg
Region	eastus
Database name	ait-sql-1-db
Server	ait-sqldatabase-sqlserver
Compute + storage	Basic: 2 GB storage
Backup storage redundancy	Geo-redundant backup storage

Create [< Previous](#) [Download a template for automation](#)

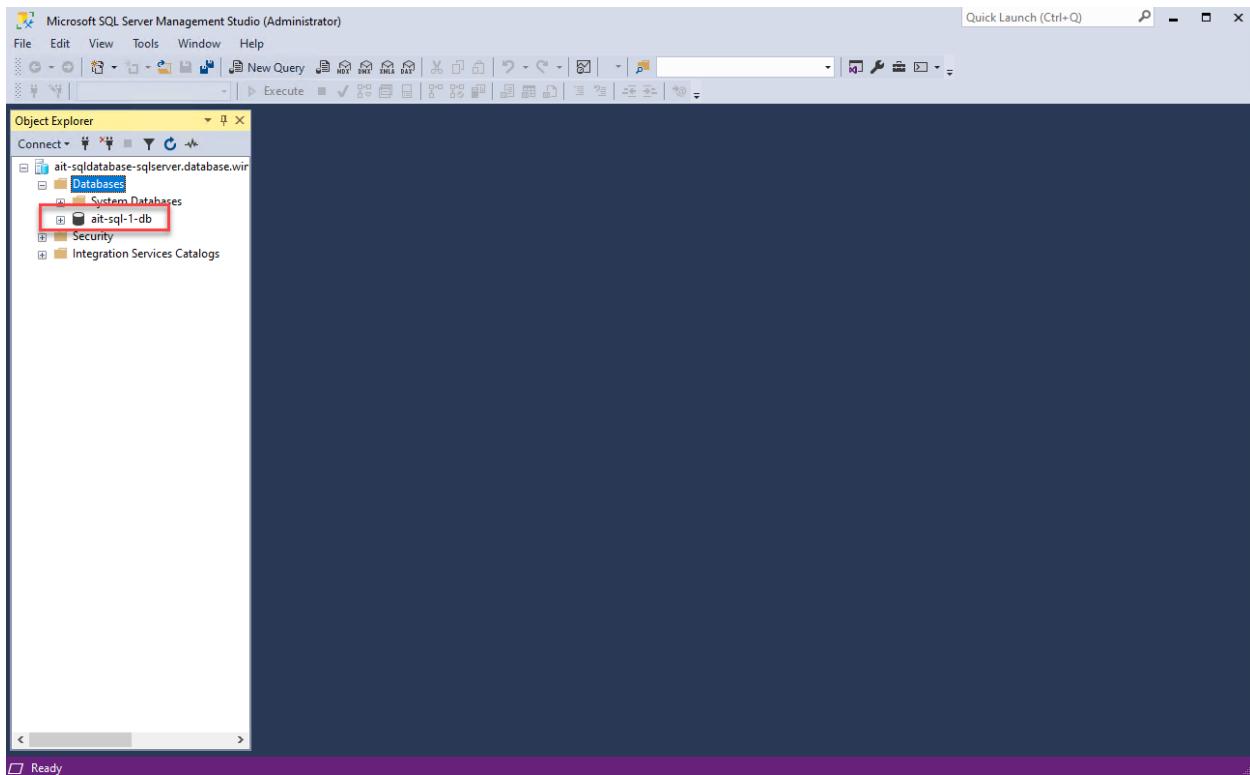
Database and connection validation

When the database creation task is finished, we can enter the particular database. We will find an Overview screen where we can see some specific metrics:



The screenshot shows the Azure portal interface for managing a SQL database named 'ait-sql-1-db'. The left sidebar contains navigation links for Overview, Activity log, Tags, Diagnose and solve problems, Quick start, Query editor (preview), Power Platform (Power BI, Power Apps, Power Automate), Settings (Compute + storage, Connection strings, Properties, Locks), and Data management (Replicas, Sync to other databases). The main content area displays the 'Essentials' section with details such as Resource group (ait-exp2-rg), Status (Online), Location (East US), Subscription (Visual Studio Enterprise - MPN [5.8k]), Subscription ID (88ea260b-f912-4540-b3ff-2bb6167457e8), and Tags (Click here to add tags). It also includes a chart titled 'Compute utilization' showing usage over the last 1 hour, 24 hours, or 7 days, with an aggregation type set to 'Max'. A large circular gauge indicates 'Database data storage' at 0.2% used space (4 MB).

We can see the database from any of the administration tools that we have installed in our virtual machine:



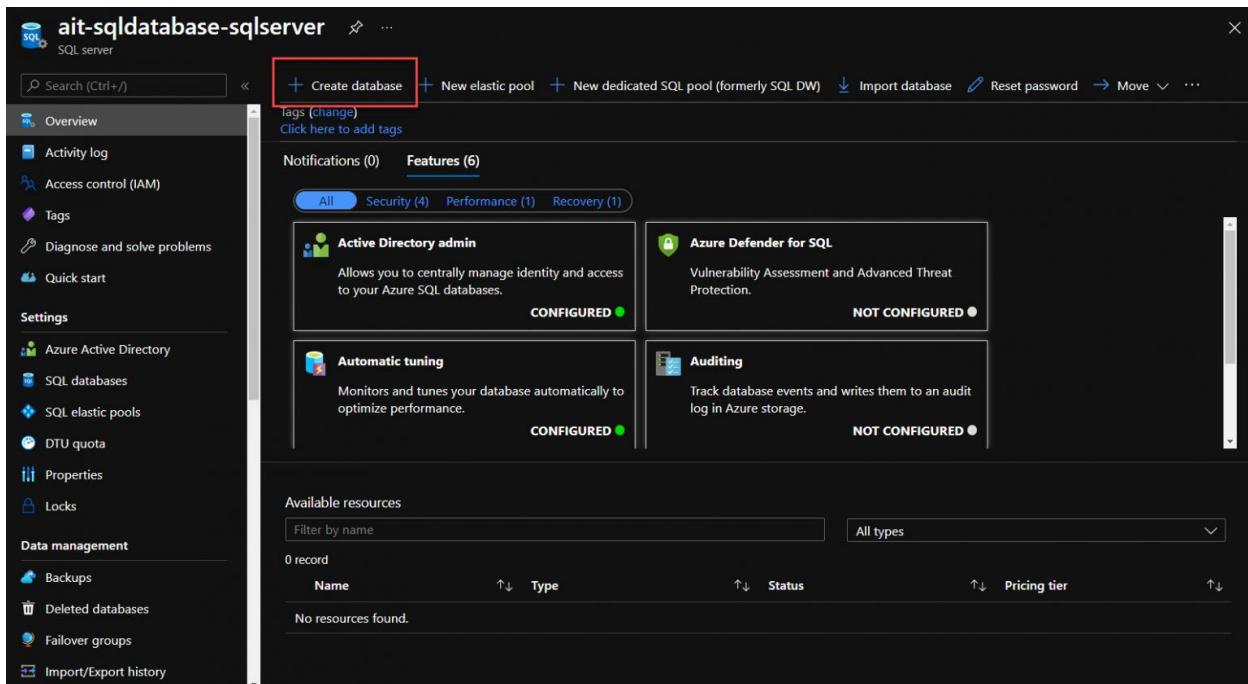
Ready! We have generated our first single database based on DTU.

Single Database Creation (vCore)

We are going to create our first unique database using the vCore-based purchasing model. The wizard is the same one we went through in the previous step, although the selected purchase model changes.

Creation of a single database based on vCore

From our Azure SQL Database Server, on the Overview screen, we are going to click on Create database:



The screenshot shows the Azure portal interface for managing a SQL database named 'ait-sqldatabase-sqlserver'. The left sidebar contains navigation links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Quick start, Settings, Data management, Backups, Deleted databases, Failover groups, and Import/Export history. The main content area displays the 'Features (6)' tab under 'Notifications (0)'. It lists six features: 'Active Directory admin' (Configured), 'Azure Defender for SQL' (Not Configured), 'Automatic tuning' (Configured), and 'Auditing' (Not Configured). Below this, there is a section titled 'Available resources' with a table header for Name, Type, Status, and Pricing tier, which currently shows 'No resources found.'

This will start the SQL Database creation wizard. In the same way, we could have generated a new resource in our Resource Group and searched for “Azure SQL”, and then chosen the “Single database” item in the “SQL database” option.

Note that we only need to fill in the name of the database. For our exercise we will enter ait-sql-2-db:

Create SQL Database

Microsoft

Basics Networking Security Additional settings Tags Review + create

Create a SQL database with your preferred configurations. Complete the Basics tab then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription

Resource group

Database details

Enter required settings for this database, including picking a logical server and configuring the compute and storage resources

Database name *

Server

Want to use SQL elastic pool? * Yes No

Compute + storage *

In the “Compute + storage” section we are going to choose the purchase model and the service level, by clicking on “Configure database”:

Create SQL Database

Microsoft

Want to use SQL elastic pool? * Yes No

Compute + storage *

General Purpose
Gen5, 2 vCores, 32 GB storage, zone redundant disabled
[Configure database](#)

Backup storage redundancy

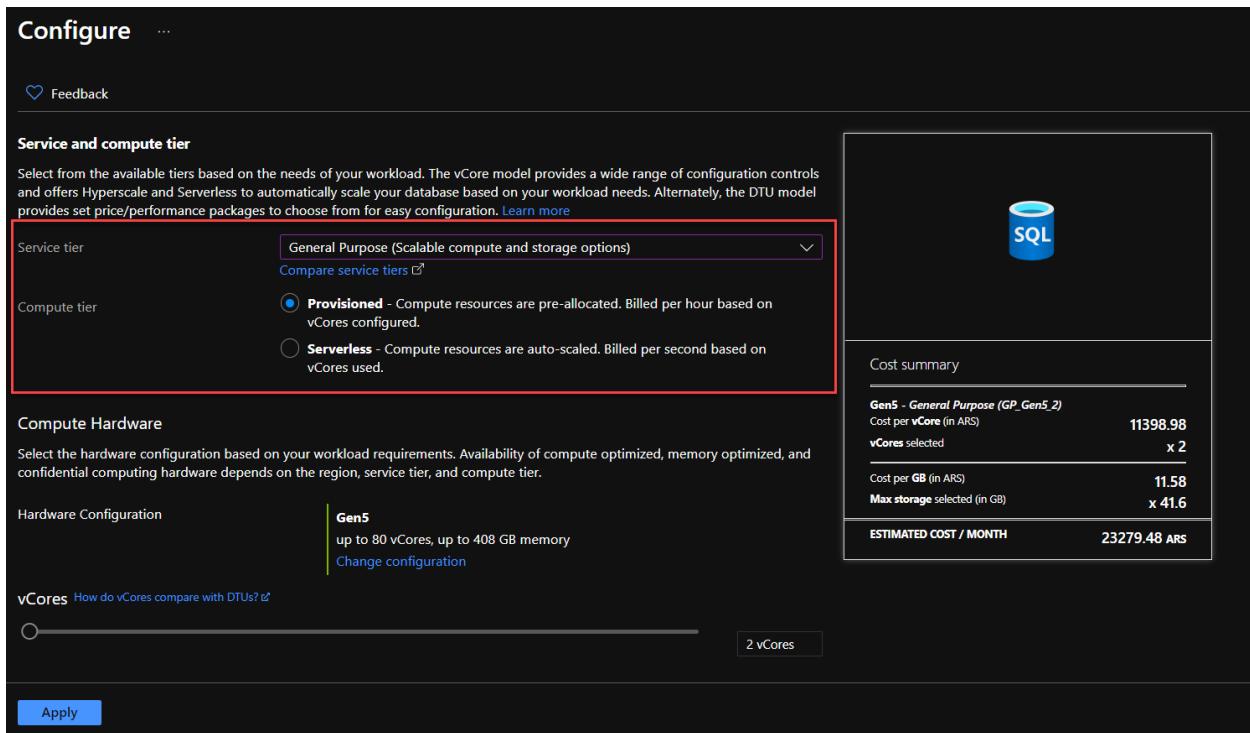
Choose how your PITR and LTR backups are replicated. Geo restore or ability to recover from regional outage is only available when geo-redundant storage is selected.

Backup storage redundancy
 Locally-redundant backup storage - Preview
 Zone-redundant backup storage - Preview
 Geo-redundant backup storage

! Selected value for backup storage redundancy is Geo-redundant backup storage. Note that database backups will be geo-replicated to the paired region. [Learn more ↗](#)

i Your use of either of the Preview backup storage redundancy options (ZRS and LRS) is governed by the agreement under which you obtained Microsoft Azure Services. By selecting a Preview redundancy option, you confirm that you agree to the preview terms in such agreement.
Microsoft Azure Legal Information: [Learn more ↗](#)

On the screen that is displayed we can see in "Service tier" the options based on vCore and DTU. We are going to select the option based on vCore “General Purpose”:



Cost summary	
Gen5 - General Purpose (GP_Gen5_2)	
Cost per vCore (in ARS)	11398.98
vCores selected	x 2
Cost per GB (in ARS)	11.58
Max storage Selected (in GB)	x 41.6
ESTIMATED COST / MONTH 23279.48 ARS	

Note, in the image above, that we have the Compute tier available with two basic options:

- Provisioned – This means that the compute will be pre-allocated and paid for hourly based on the number of vCores selected.
- Serverless: Unlike the previous model, compute resources are not pre-allocated and only scale on demand. You will be billed per second of utilization based on the vCores ultimately used.

We will work on the “Provisioned” Compute tier, and this will allow us to configure the hardware as we see below. Let's explore the "Hardware Configuration" options:

Configure ...

Feedback

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls and offers Hyperscale and Serverless to automatically scale your database based on your workload needs. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier: General Purpose (Scalable compute and storage options) [Compare service tiers](#)

Compute tier: **Provisioned** - Compute resources are pre-allocated. Billed per hour based on vCores configured.
 Serverless - Compute resources are auto-scaled. Billed per second based on vCores used.

Compute Hardware

Select the hardware configuration based on your workload requirements. Availability of compute optimized, memory optimized, and confidential computing hardware depends on the region, service tier, and compute tier.

Hardware Configuration	Gen5 up to 80 vCores, up to 408 GB memory Change configuration
------------------------	--

vCores [How do vCores compare with DTUs?](#)

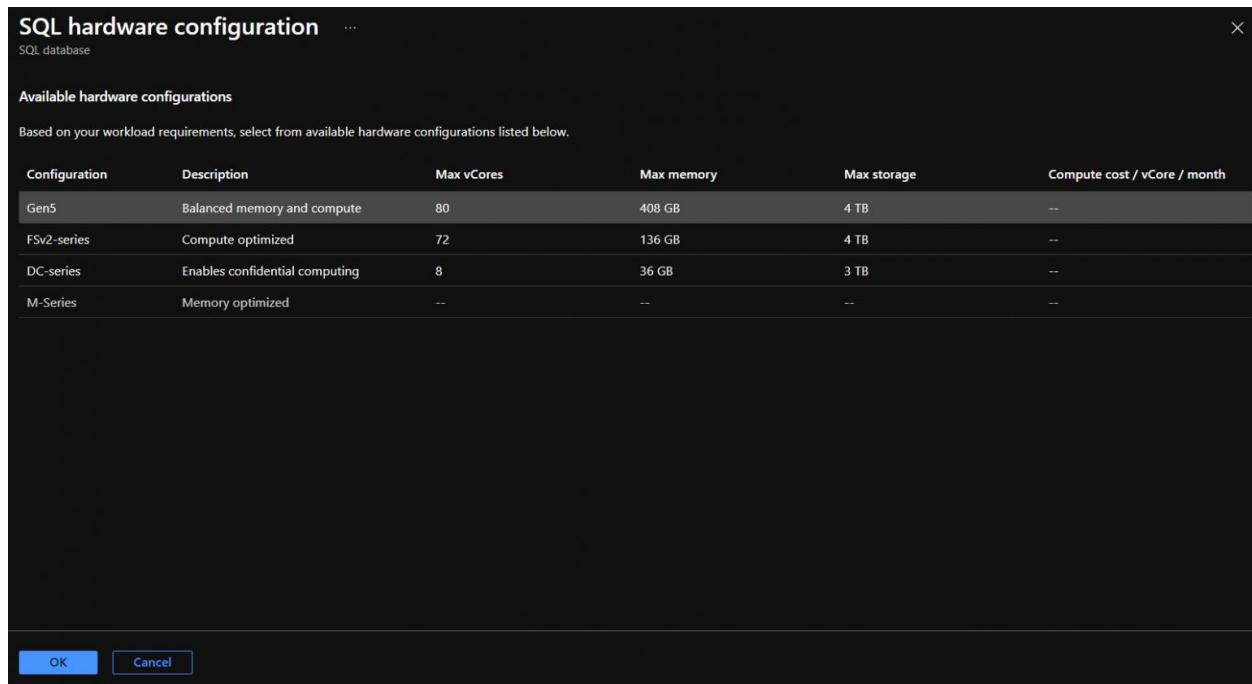
2 vCores

Cost summary

Gen5 - General Purpose (GP_Gen5_2)	11398.98
Cost per vCore (in ARS)	x 2
Cost per GB (in ARS)	11.58
Max storage Selected (in GB)	x 41.6
ESTIMATED COST / MONTH	23279.48 ARS

Apply

We have limited selection options, with a possibility of maximum use of Cores and Memory, as well as storage for our data. We will select the “Gen5” option for the purposes of this experience:



Once we select the Hardware, we can configure the vCores that we want to include in our provisioning. For the purposes of this experience we will configure 2 vCores (which is the minimum we can assign):

Configure ...

Feedback

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls and offers Hyperscale and Serverless to automatically scale your database based on your workload needs. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier: General Purpose (Scalable compute and storage options) [Compare service tiers](#)

Compute tier: **Provisioned** - Compute resources are pre-allocated. Billed per hour based on vCores configured.
 Serverless - Compute resources are auto-scaled. Billed per second based on vCores used.

Compute Hardware

Select the hardware configuration based on your workload requirements. Availability of compute optimized, memory optimized, and confidential computing hardware depends on the region, service tier, and compute tier.

Hardware Configuration: Gen5
 up to 80 vCores, up to 408 GB memory
[Change configuration](#)

vCores: How do vCores compare with DTUs? [?](#)

2 vCores

Cost summary

Gen5 - General Purpose (GP_Gen5_2)	
Cost per vCore (in ARS)	11398.98
vCores selected	x 2
Cost per GB (in ARS)	11.58
Max storage selected (in GB)	x 41.6
ESTIMATED COST / MONTH 23279.48 ARS	

Apply

Let's move on to testing and creating our unique database based on vCores:

Create SQL Database ...

Microsoft

Basics Networking Security Additional settings Tags [Review + create](#)

Product details

SQL database by Microsoft	Estimated cost per month 23279.48 ARS
Terms of use Privacy policy	View pricing details

Terms

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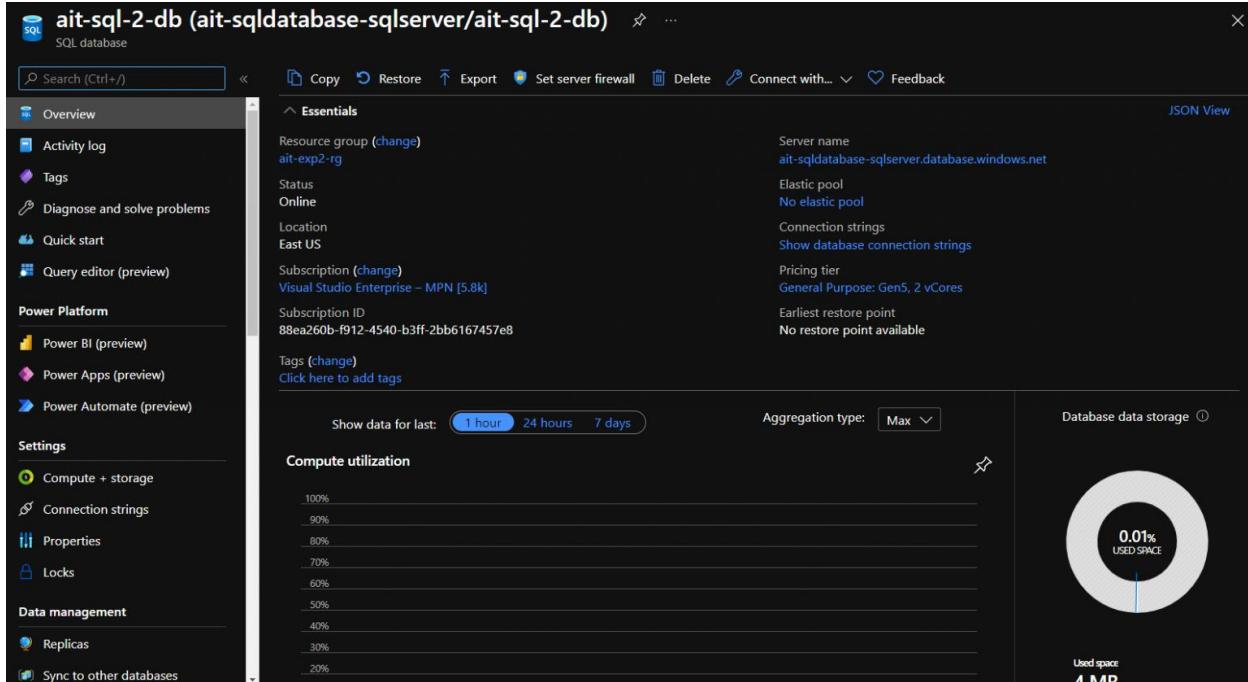
Basics

Subscription	Visual Studio Enterprise – MPN [5.8k]
Resource group	ait-exp2-rg
Region	eastus
Database name	ait-sql-2-db
Server	ait-sqldatabase-sqlserver
Compute + storage	General Purpose: Gen5, 2 vCores, 32 GB storage, zone redundant disabled
Backup storage redundancy	Geo-redundant backup storage

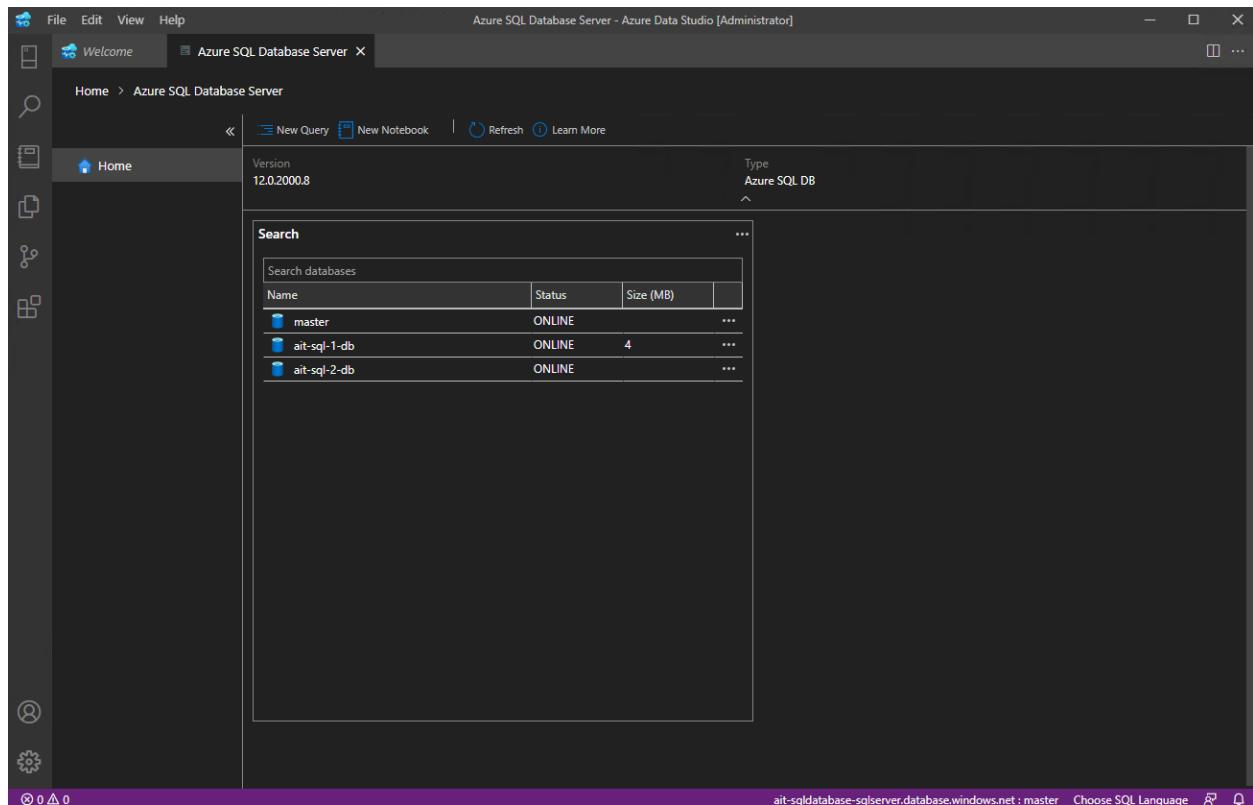
Validating... [?](#) < Previous Download a template for automation

Database and connection validation

When the database creation task is finished, we can enter the particular database. We will find an Overview screen where we can see some specific metrics:



We can see the database from any of the administration tools that we have installed in our virtual machine:



In this case, we will see two databases: the one generated in the previous exercise and the one generated in this one, from Azure Data Studio.

Exercise 3: Azure SQL Database (part 2)

Introduction to the exercise

In this section we will do the third experience together. This experience requires you to have a Microsoft Azure subscription set up and available and consumes any credits you have on it. Please review this topic to avoid charges on subscriptions where you don't want them to exist.

In this experience we will:

- Learn more about Azure SQL Database.
- Create an Azure SQL Database elastic pool.
- Move SQL Databases from single DB to elastic pool, both for DTU and vCore.
- Configure authentication with Azure AD admin.
- Integrate with virtual networks to increase security.

This experience is going to be intense! Let's keep going!

About elastic groups

What is an elastic pool in Azure SQL Database?

As we have reviewed in the theoretical introductions, Azure SQL Database elastic pools are a simple and cost-effective solution for managing and scaling multiple databases that have different and unpredictable usage demands.

In an elastic pool, the databases reside on a single server and share a set number of resources at a set price. Elastic pools in Azure SQL Database allow SaaS developers to optimize price performance for a pool of databases within a prescribed budget while providing performance elasticity for each database.

Elastic groups in real life

SaaS developers build applications at the upper data tiers of the scale that consist of multiple databases. A common application pattern is to provision a unique database for each client. However, each customer often has variable and unpredictable usage patterns, and it is difficult to predict the resource requirements of each individual database user. Traditionally, there were two options:

- Overprovisioning resources based on peak usage and overpaying, or
- Under-provision to save costs at the expense of performance and customer satisfaction during peak hours.

Elastic pools solve this problem and ensure that databases get the performance resources they need, when they need them. They provide a simple resource allocation mechanism within a predictable budget.

Elastic pools for DTU and vCore

Elastic pools allow a developer to purchase resources for a shared pool across multiple databases to cope with unpredictable periods of usage by individual databases. You can configure the resources for the pool based on the DTU-based purchasing model or the vCore-based purchasing model. The resource requirement for a pool is determined by the aggregate usage of its databases. The amount of resources available to the pool is determined by the developer's budget.

The developer simply adds databases to the pool, optionally sets the minimum and maximum resources for the databases (min or max DTUs or min and max vCores, depending on the resource model choice), and then sets the resources of the group according to your budget. A developer can use pools to efficiently grow their service from a Lean Startup method to a mature business on an ever-increasing scale.

Elastic Pool Costs

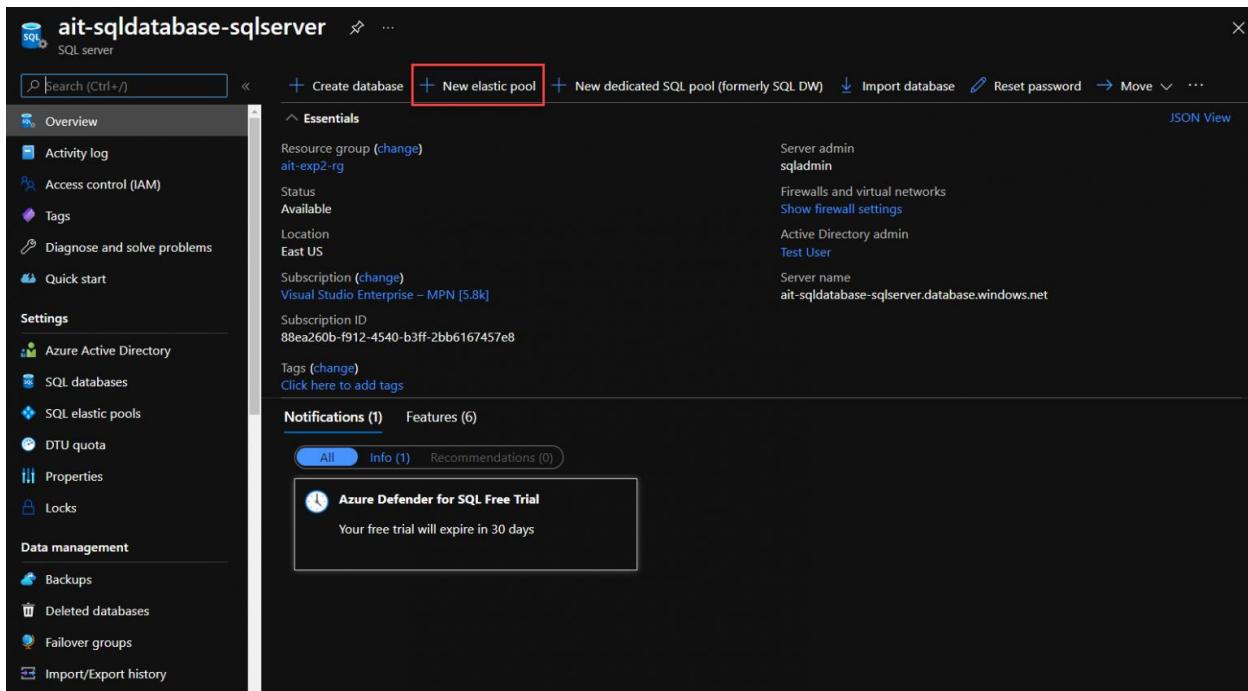
There are no database charges for elastic pools. You are charged for every hour that a pool exists in the highest eDTU or vCores, regardless of usage or whether the pool was active for less than one hour.

Elastic pool (DTU) creation and database conversion

We are going to create an elastic pool based on DTU, and then we are going to move the first database named “ait-sql-1-db” and created earlier to this pool.

Creating an elastic pool based on DTUs

We are going to enter the SQL Database Server that we have generated in experience 2 and, in the Overview screen, we are going to click on “New elastic pool”:



The screenshot shows the Azure portal interface for managing a SQL server named 'ait-sqldatabase-sqlserver'. The left sidebar contains navigation links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Quick start, Settings (including Azure Active Directory, SQL databases, SQL elastic pools, DTU quota, Properties, Locks), Data management (Backups, Deleted databases, Failover groups, Import/Export history), and Monitoring (Metrics, Log Analytics, Application Insights). The main content area displays the 'Essentials' section with details such as Resource group (change) to 'ait-exp2-rg', Status 'Available', Location 'East US', Subscription 'Visual Studio Enterprise - MPN (5.8k)', Subscription ID '88ea260b-f912-4540-b3ff-2bb6167457e8', and Tags. A notification for 'Azure Defender for SQL Free Trial' states 'Your free trial will expire in 30 days'. At the top right, there are buttons for Create database, New elastic pool (highlighted with a red box), New dedicated SQL pool (formerly SQL DW), Import database, Reset password, Move, and JSON View.

The wizard for creating a new SQL Elastic Pool will start here. Note that the parent of the elastic pool is always the SQL Database Server. We will enter a name for the elastic pool, and a suggested form is ait-elastic-dtu-sqlpool:

Create SQL Elastic pool

Microsoft

Basics Additional settings Tags Review + create

Create a SQL Elastic pool with your preferred configurations. Elastic pools provide a simple and cost effective solution for managing the performance of multiple databases within a fixed budget. Complete the Basic tab, then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription: Visual Studio Enterprise – MPN [5.8k] ▾
Resource group: ait-exp2-rg ▾

Elastic pool details

Enter required settings for this pool, including picking a logical server and configuring the compute and storage resources.

Elastic Pool Name: ait-elastic-dtu-sqlpool ✓

Server: ait-sqldatabase-sqlserver (East US) ▾

Compute + storage: General Purpose
Gen5, 2 vCores, 32 GB, 0 databases
[Configure elastic pool](#)

[Review + create](#) [Next : Additional settings >](#)

Having entered the name, it remains to configure the computing and storage part. We will click on “Configure elastic pool”:

Create SQL Elastic pool

Microsoft

Basics Additional settings Tags Review + create

Create a SQL Elastic pool with your preferred configurations. Elastic pools provide a simple and cost effective solution for managing the performance of multiple databases within a fixed budget. Complete the Basic tab, then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription ① Visual Studio Enterprise – MPN [5.8k] ▾

Resource group ① ait-exp2-rg ▾

Elastic pool details

Enter required settings for this pool, including picking a logical server and configuring the compute and storage resources.

Elastic Pool Name * ait-elastic-dtu-sqlpool ✓

Server ① ait-sqldatabase-sqlserver (East US) ▾

Compute + storage * ⓘ

General Purpose
Gen5, 2 vCores, 32 GB, 0 databases
[Configure elastic pool](#)

[Review + create](#) [Next : Additional settings >](#)

We will notice that we can select between the already known purchase models: vCore and DTU.
Let's choose "Basic" from DTU:

Configure ...

Feedback

Pool settings Databases Per database settings

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier

eDTUs ⓘ

50 100 200 300

Data max size ⓘ

4.88 GB

Basic (For less demanding workloads)

vCore-based purchasing model

General Purpose (Scalable compute and storage options)

Business Critical (High transaction rate and high resiliency)

DTU-based purchasing model

Basic (For less demanding workloads)

Standard (For workloads with typical performance requirements)

Premium (For IO-intensive workloads)

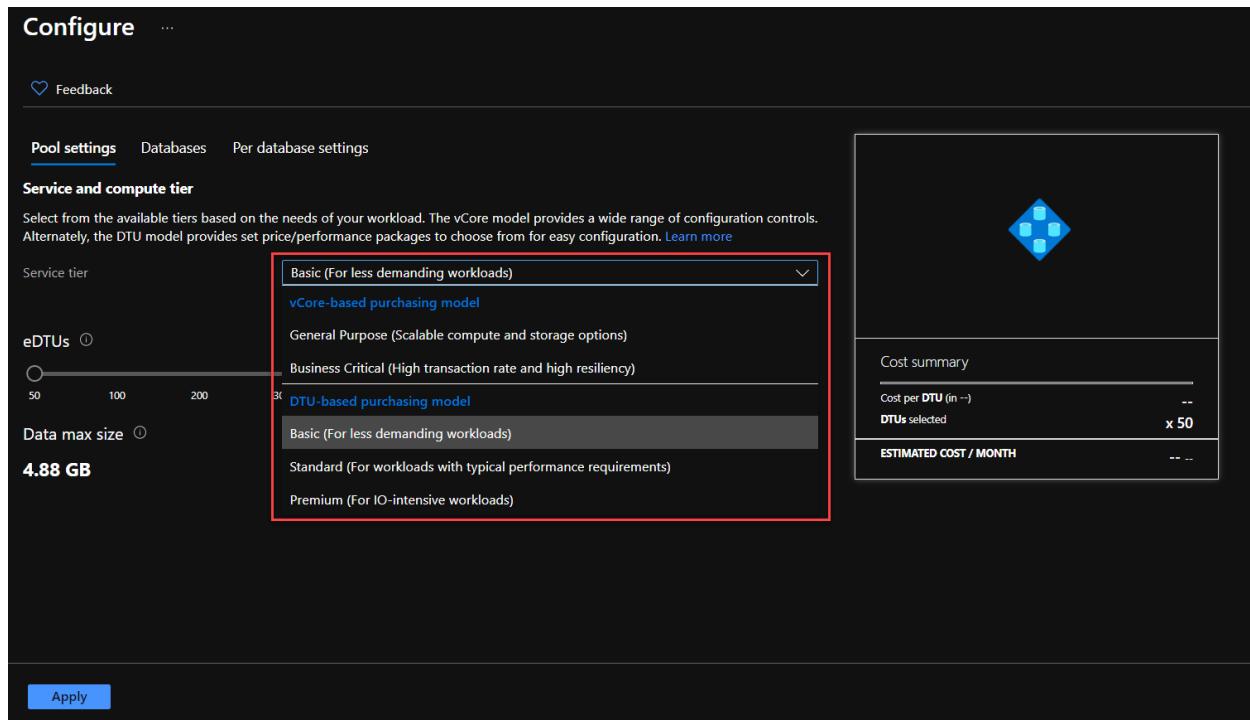
Cost summary

Cost per DTU (in --) --

DTUs selected x 50

ESTIMATED COST / MONTH -- --

Apply



Unlike a single database, here the DTUs are called "eDTUs" (Elastic DTUs) and the minimum purchase is 50. Also, the maximum amount of storage in the Basic plan is 4.88 GB:

Configure ...

Feedback

Pool settings Databases Per database settings

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier Basic (For less demanding workloads) [Compare service tiers](#)

eDTUs ⓘ

50 100 200 300 400 800 1200 1600 50 DTUs

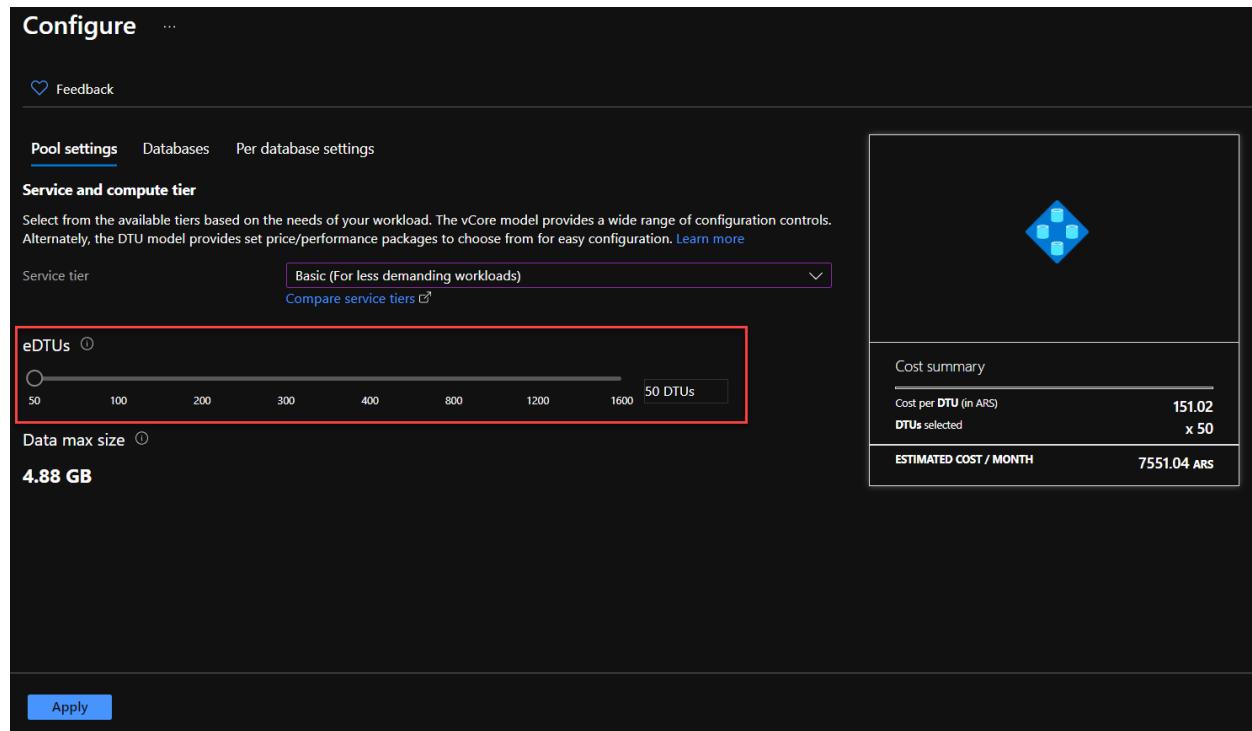
Data max size ⓘ

4.88 GB

Cost summary

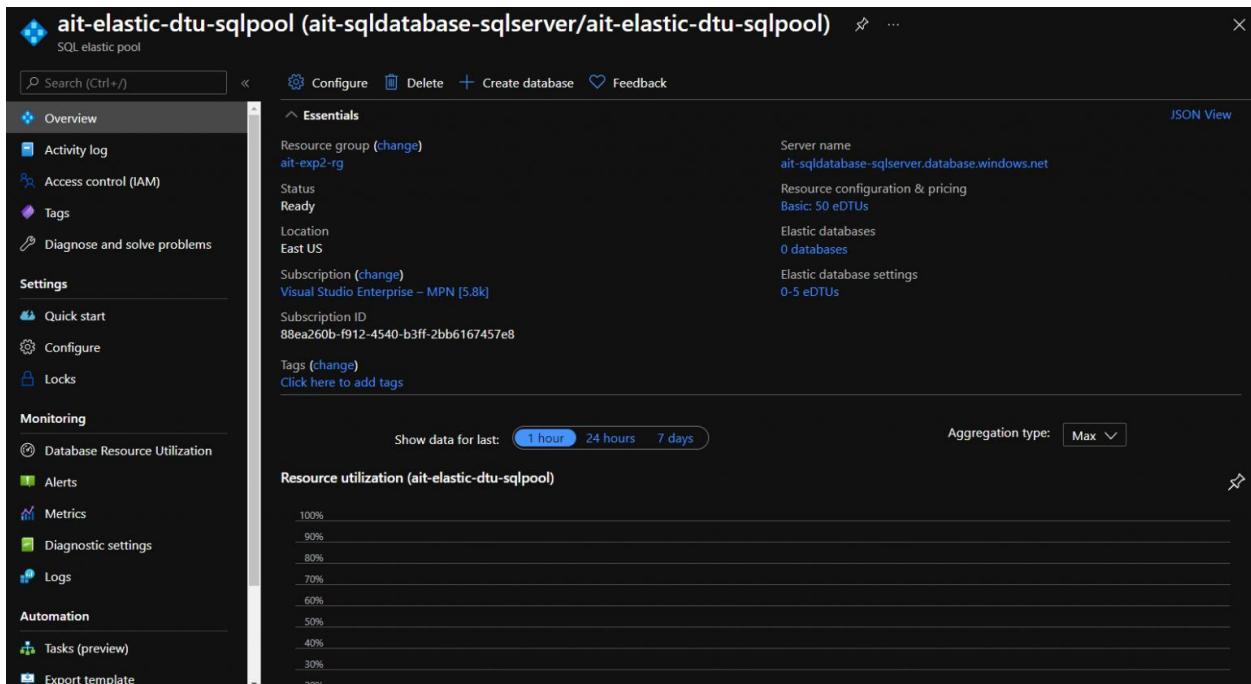
Cost per DTU (in ARS)	151.02
DTUs selected	x 50
ESTIMATED COST / MONTH	7551.04 ARS

Apply



Cost per DTU (in ARS)	151.02
DTUs selected	x 50
ESTIMATED COST / MONTH	7551.04 ARS

Let's generate the Elastic Pool. Once the generation is finished, we can enter the initial page of the resource that looks like the following:



ait-elastic-dtu-sqlpool (ait-sqldatabase-sqlserver/ait-elastic-dtu-sqlpool)

Essentials

Resource group (change)
ait-exp2-rg

Status
Ready

Location
East US

Subscription (change)
Visual Studio Enterprise – MPN [5.8K]

Subscription ID
88ea260b-f912-4540-b3ff-2bb6167457e8

Tags (change)
Click here to add tags

Show data for last: 1 hour 24 hours 7 days

Aggregation type: Max

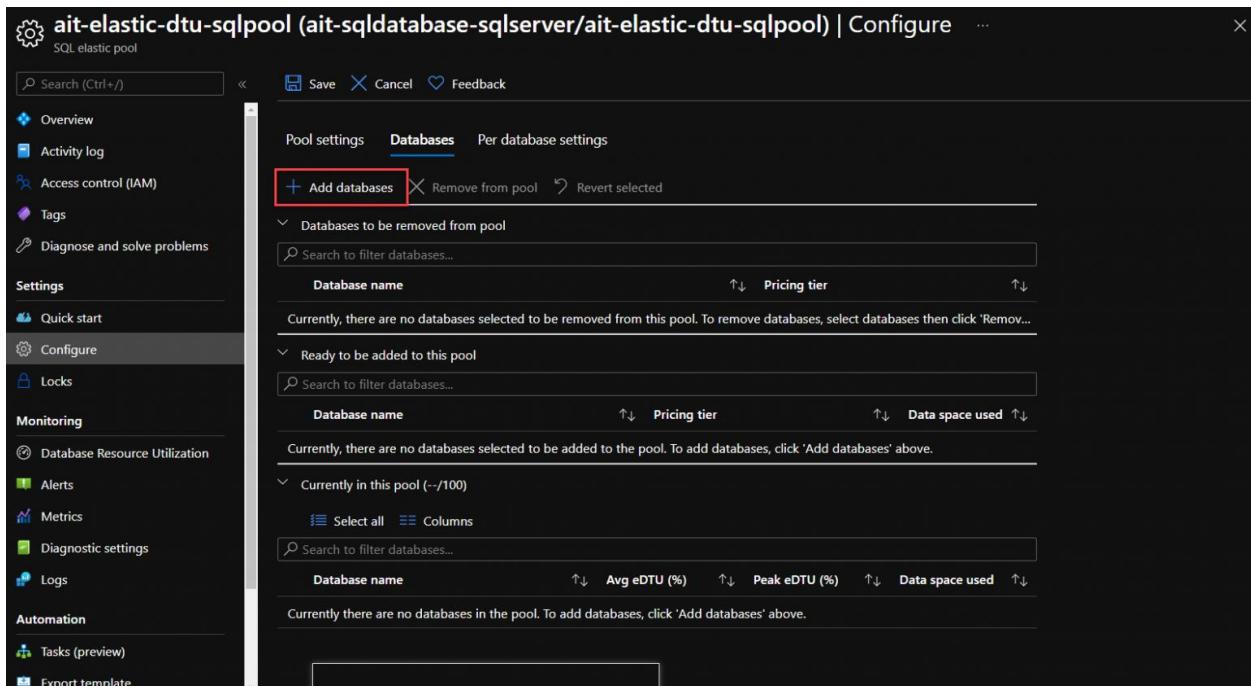
Resource utilization (ait-elastic-dtu-sqlpool)

100%
90%
80%
70%
60%
50%
40%
30%
20%

Now let's see how we can include databases in this pool!

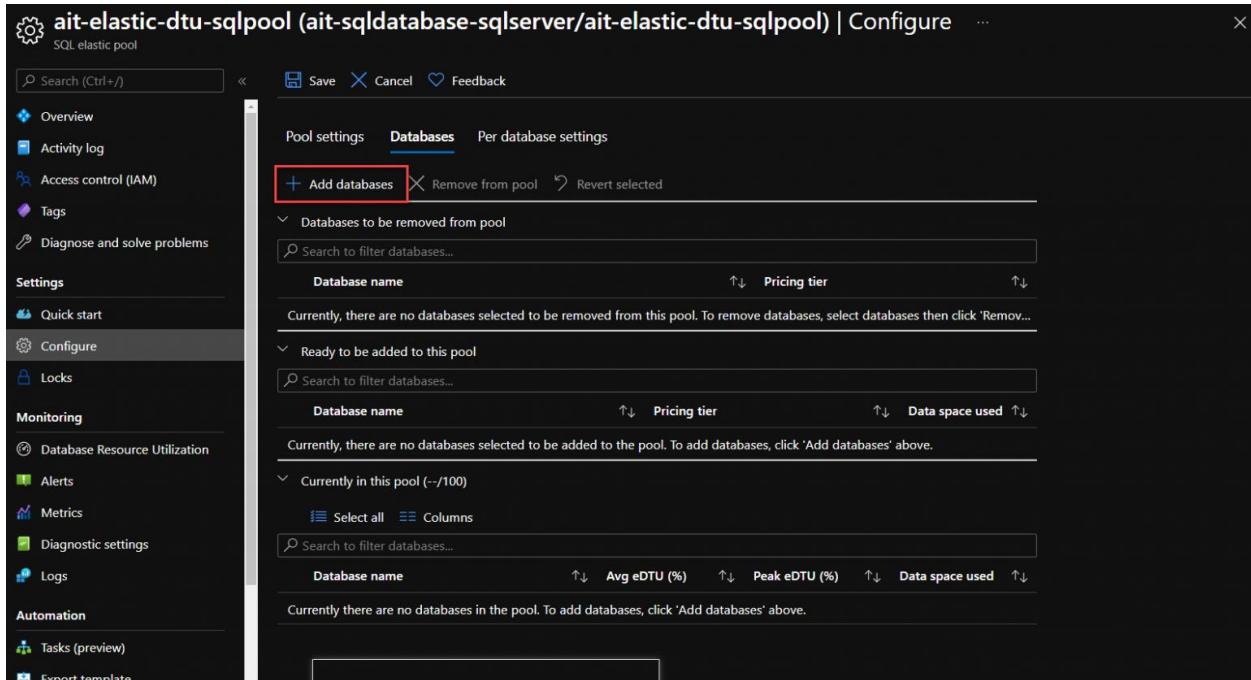
Conversion from single database to elastic pool

If we enter our SQL elastic pool, we are going to look for the "Configure" part to enter the following screen. From here we can include databases that ALREADY EXIST (we are not creating them now):



The screenshot shows the 'Configure' blade for an SQL elastic pool named 'ait-elastic-dtu-sqlpool'. The left sidebar has 'Configure' selected. The main area shows the 'Databases' tab. At the top, there's a 'Save' button, a 'Cancel' button, and a 'Feedback' link. Below that is a section for 'Pool settings' with tabs for 'Databases' (which is selected) and 'Per database settings'. A prominent red box highlights the '+ Add databases' button. To its right are 'Remove from pool' and 'Revert selected' buttons. There are two sections: 'Databases to be removed from pool' and 'Ready to be added to this pool', both with search bars and tables for managing databases.

We will click on “Add databases”:



This screenshot is identical to the one above, showing the 'Configure' blade for the same SQL elastic pool. The 'Add databases' button is again highlighted with a red box. The rest of the interface remains the same, showing the 'Databases' tab selected with its respective settings and sections.

The wizard will open the available databases to add to the Pool. We will select the first one: ait-sql-1-db.

Add databases

Select all X

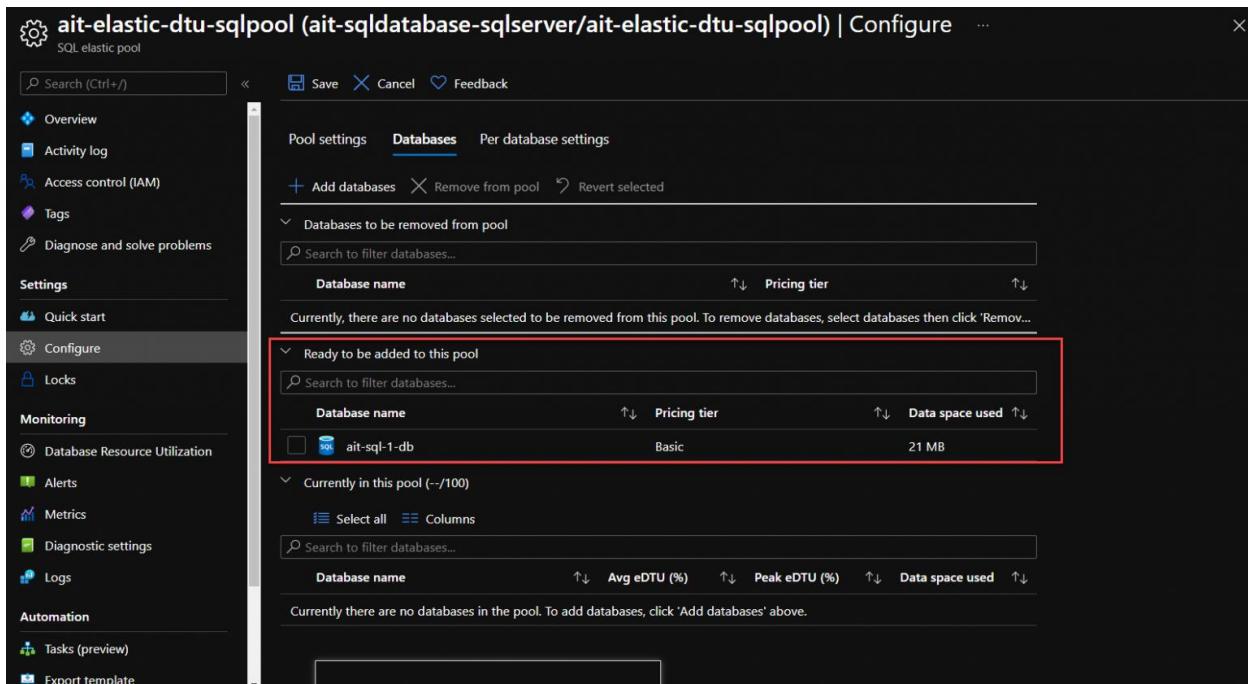
Selected/Total databases
1/2

Search to filter databases...

Database name	Pricing tier	Database size
<input checked="" type="checkbox"/>  ait-sql-1-db	Basic	21 MB
<input type="checkbox"/>  ait-sql-2-db	General Purpose: Gen5, 2 vCores	21 MB

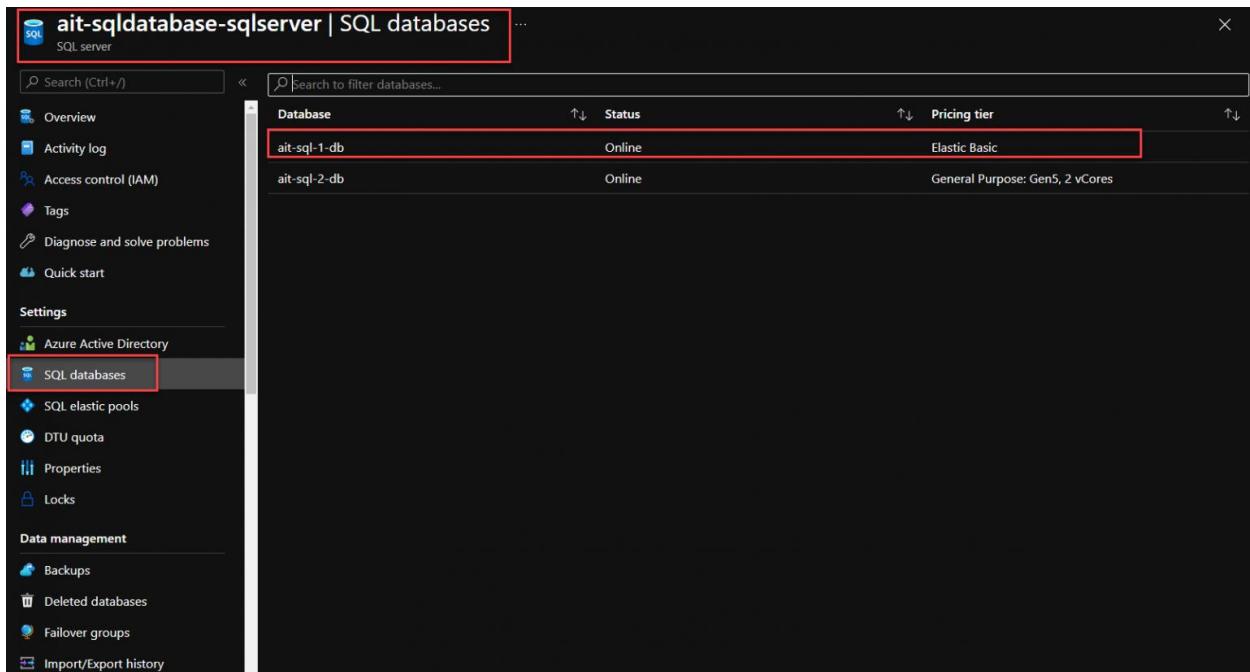
Apply

When we click ok, the database will appear in “Ready to be added to this pool”:



The screenshot shows the Azure portal interface for managing an SQL elastic pool. The left sidebar contains various navigation options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings, Quick start, Configure, Locks, Monitoring, Database Resource Utilization, Alerts, Metrics, Diagnostic settings, Logs, Automation, Tasks (preview), and Export template. The main content area is titled 'ait-elastic-dtu-sqlpool (ait-sqldatabase-sqlserver/ait-elastic-dtu-sqlpool) | Configure'. It has tabs for Pool settings, Databases, and Per database settings. Under 'Databases', there are sections for 'Databases to be removed from pool' (empty), 'Ready to be added to this pool' (containing 'ait-sql-1-db'), and 'Currently in this pool (-/100)' (empty). The 'ait-sql-1-db' row in the 'Ready to be added to this pool' section is highlighted with a red border.

Once we confirm the action, and after a few minutes, we can verify that if we enter the SQL Database Server logical server and go to the "SQL databases" option, the database already has the "Pricing tier" of Elastic Basic :

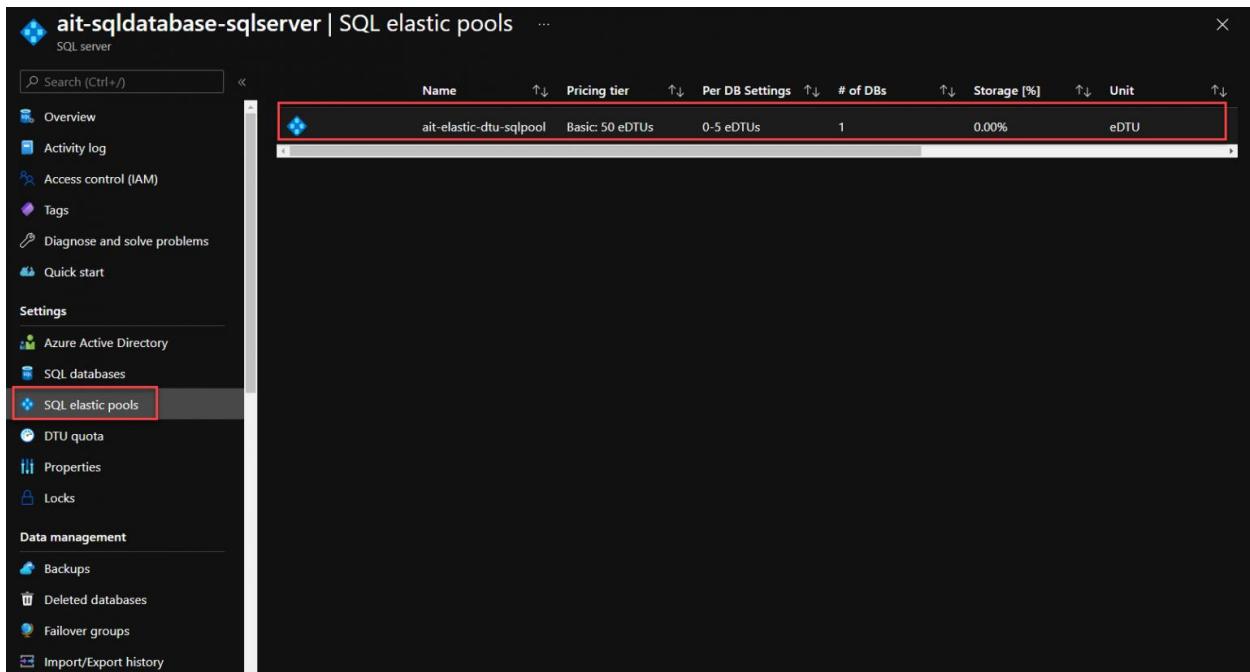


ait-sqldatabase-sqlserver | SQL databases

Database Status Pricing tier

Database	Status	Pricing tier
ait-sql-1-db	Online	Elastic Basic
ait-sql-2-db	Online	General Purpose: Gen5, 2 vCores

At the same time, if we enter SQL elastic pools within our logical server, we will verify that our pool is already operational:



ait-sqldatabase-sqlserver | SQL elastic pools

Name Pricing tier Per DB Settings # of DBs Storage [%] Unit

Name	Pricing tier	Per DB Settings	# of DBs	Storage [%]	Unit
ait-elastic-dtu-sqlpool	Basic: 50 eDTUs	0-5 eDTUs	1	0.00%	eDTU

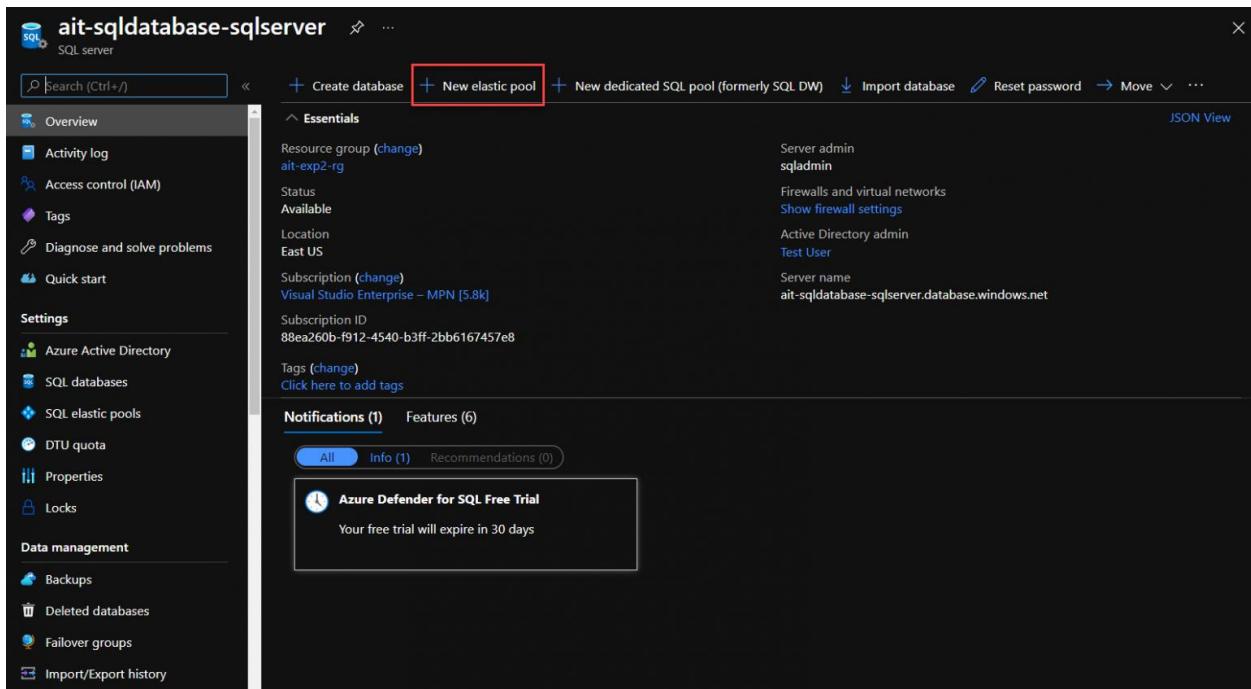
You can try connecting from SQL Management Studio, or from Azure Data Studio: you will see that your base remains the same.

Elastic pool creation (vCore) and database conversion

We are going to create an elastic pool based on vCore, and then we are going to move the first database named “ait-sql-2-db” and created earlier to this pool.

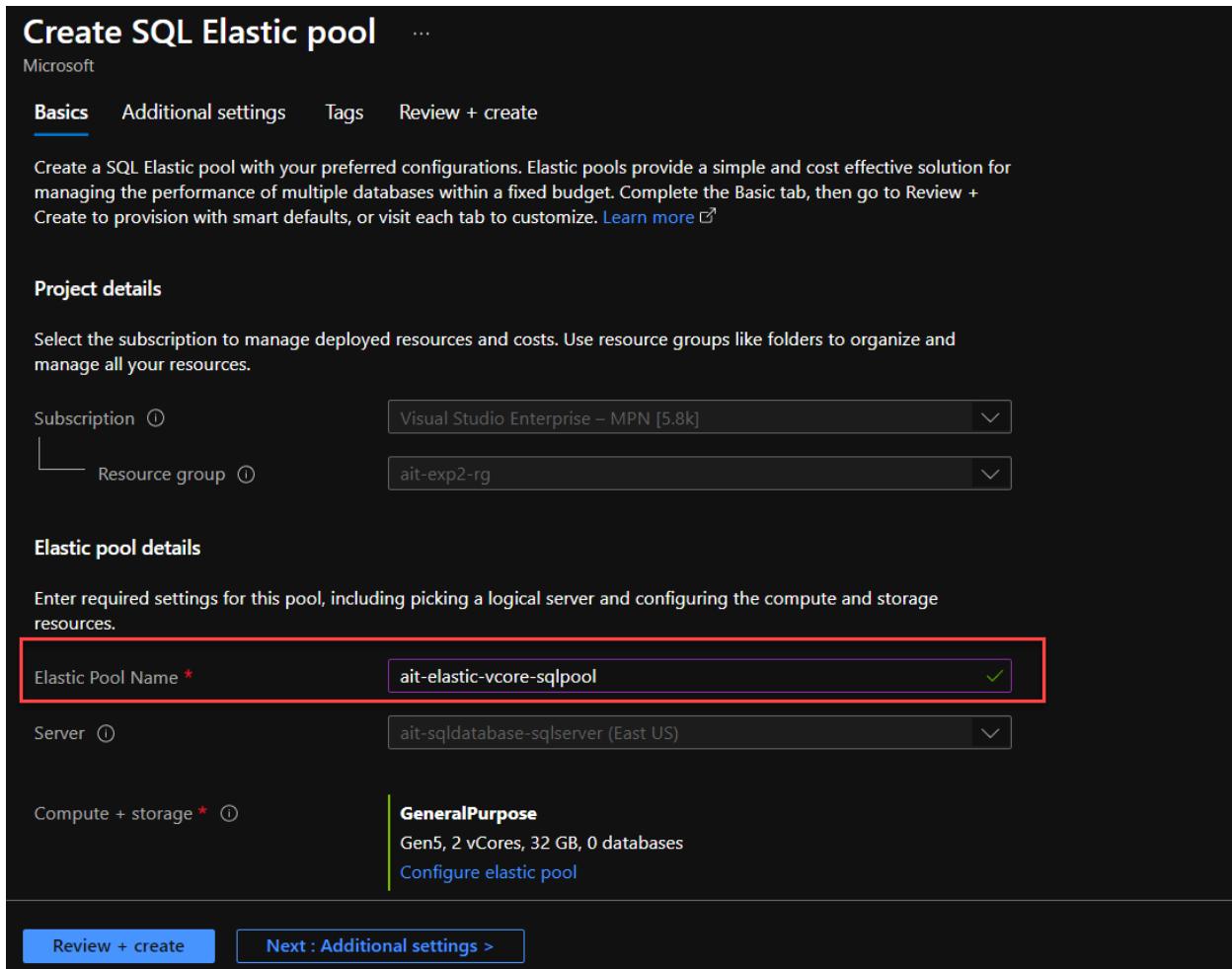
Elastic pool creation and single database conversion

We are going to enter the SQL Database Server that we have generated in experience 2 and, in the Overview screen, we are going to click on “New elastic pool”:



The screenshot shows the Azure portal interface for a SQL server named 'ait-sqldatabase-sqserver'. The left sidebar contains navigation links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Quick start, Settings, Azure Active Directory, SQL databases, SQL elastic pools, DTU quota, Properties, Locks, Data management, Backups, Deleted databases, Failover groups, and Import/Export history. The main content area displays the 'Essentials' section with details such as Resource group (change) to 'ait-exp2-rg', Status 'Available', Location 'East US', Subscription (change) to 'Visual Studio Enterprise - MPN [5.8k]', Subscription ID '88ea260b-f912-4540-b3ff-2bb6167457e8', and Tags (change). It also shows notifications for 'Azure Defender for SQL Free Trial' (Info 1) stating 'Your free trial will expire in 30 days'. At the top of the page, there are buttons for Create database, New elastic pool (highlighted with a red box), New dedicated SQL pool (formerly SQL DW), Import database, Reset password, Move, and JSON View.

The wizard for creating a new SQL Elastic Pool will start here. Note that the parent of the elastic pool is always the SQL Database Server. We will enter a name for the elastic pool, and a suggested form is ait-elastic-vcore-sqlpool:



Create SQL Elastic pool ...

Microsoft

Basics Additional settings Tags Review + create

Create a SQL Elastic pool with your preferred configurations. Elastic pools provide a simple and cost effective solution for managing the performance of multiple databases within a fixed budget. Complete the Basic tab, then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription ⓘ Visual Studio Enterprise – MPN [5.8k] ▾

Resource group ⓘ ait-exp2-rg ▾

Elastic pool details

Enter required settings for this pool, including picking a logical server and configuring the compute and storage resources.

Elastic Pool Name * ait-elastic-vcore-sqlpool ✓

Server ⓘ ait-sqldatabase-sqlserver (East US) ▾

Compute + storage * ⓘ

GeneralPurpose
Gen5, 2 vCores, 32 GB, 0 databases
[Configure elastic pool](#)

[Review + create](#) [Next : Additional settings >](#)

Having entered the name, it remains to configure the computing and storage part. We will click on “Configure elastic pool”:

Create SQL Elastic pool

Microsoft

Basics Additional settings Tags Review + create

Create a SQL Elastic pool with your preferred configurations. Elastic pools provide a simple and cost effective solution for managing the performance of multiple databases within a fixed budget. Complete the Basic tab, then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription [Visual Studio Enterprise – MPN \[5.8k\]](#)
Resource group [ait-exp2-rg](#)

Elastic pool details

Enter required settings for this pool, including picking a logical server and configuring the compute and storage resources.

Elastic Pool Name [ait-elastic-vcore-sqlpool](#)
Server [ait-sqldatabase-sqlserver \(East US\)](#)

Compute + storage * [GeneralPurpose](#)
Gen5, 2 vCores, 32 GB, 0 databases
[Configure elastic pool](#)

[Review + create](#) [Next : Additional settings >](#)

We will notice that we can select between the already known purchase models: vCore and DTU.
Let's choose "General Purpose" of vCore:

Configure ...

[Feedback](#)

Pool settings Databases Per database settings

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier	General Purpose (Scalable compute and storage options)
	vCore-based purchasing model
Compute Hardware	General Purpose (Scalable compute and storage options)
	Business Critical (High transaction rate and high resiliency)
Hardware Configuration	DTU-based purchasing model
	Basic (For less demanding workloads)
	Standard (For workloads with typical performance requirements)
	Premium (For IO-intensive workloads)

vCores [How do vCores compare with DTUs?](#)

2 4 6 8 10 12 14 16 18 20 24 32 40 80 **2 vCores**

Data max size (GB) [?](#)

32

Apply



Cost summary

Gen5 - General Purpose	
Cost per vCore (in --)	--
vCores selected	x 2
Cost per GB (in --)	--
Max storage selected (in GB)	x 41.6
ESTIMATED COST / MONTH -- --	

Unlike the previous case, where we created the elastic pool based on DTU, here we can choose vCores (for the experience we will select 2) and the maximum amount of pre-provisioned data (storage) (for the experience we will select 32 GB):

Configure ...

Feedback

Pool settings Databases Per database settings

Service and compute tier

Select from the available tiers based on the needs of your workload. The vCore model provides a wide range of configuration controls. Alternately, the DTU model provides set price/performance packages to choose from for easy configuration. [Learn more](#)

Service tier: General Purpose (Scalable compute and storage options) [Compare service tiers](#)

Compute Hardware

Select the hardware configuration based on your workload requirements. Availability of compute optimized, memory optimized, and confidential computing hardware depends on the region, service tier, and compute tier.

Hardware Configuration

vCores: How do vCores compare with DTUs? [Change configuration](#)

Gen5
up to 80 vCores, up to 408 GB memory

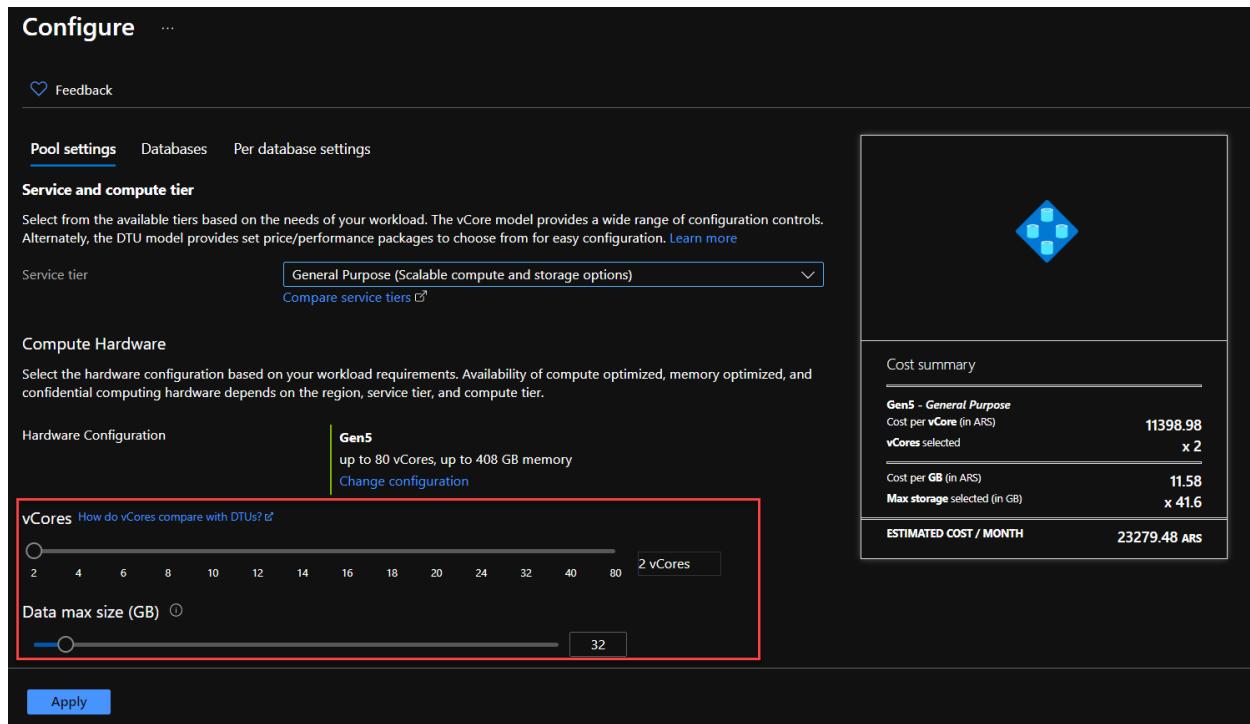
vCores: 2 vCores

Data max size (GB): 32

Cost summary

Gen5 - General Purpose	
Cost per vCore (in ARS)	11398.98
vCores selected	x 2
Cost per GB (in ARS)	11.58
Max storage selected (in GB)	x 41.6
ESTIMATED COST / MONTH 23279.48 ARS	

Apply



One-time database conversion during Pool creation

Unlike the previous lesson, this time we won't wait to convert databases and include them inside the instance. We'll explore a way to do this during Pool creation.

On the same Computing and Storage configuration screen, we will have a tab called "Databases":

Configure ...

Feedback

Pool settings Databases Per database settings

+ Add databases Revert selected

Search to filter databases...

Database name	Pricing tier	Data space used
Currently, there are no databases selected to be added to the pool. To add databases, click 'Add databases' ab...		

Cost summary

Gen5 - General Purpose	
Cost per vCore (in ARS)	11398.98
vCores selected	x 2
Cost per GB (in ARS)	11.58
Max storage selected (in GB)	x 41.6
ESTIMATED COST / MONTH	23279.48 ARS

Apply

There we will select the "ait-sql-2-db" database to convert it and add it to the pool on creation:

Add databases

Select all X

Selected/Total database
1/2

Search to filter databases...

Database name	Pricing tier	Database size
<input type="checkbox"/>  ait-sql-1-db	Elastic Basic	4 MB
<input checked="" type="checkbox"/>  ait-sql-2-db	General Purpose: Gen5, 2 vCores	21 MB

Apply

In this way we can review the selected options and confirm the creation of the pool, including the inclusion of the second database within:

Create SQL Elastic pool ...

Microsoft

Basics Additional settings Tags **Review + create**

Product details

SQL elastic pool by Microsoft	Estimated cost per month 23279.48 ARS View pricing details
Terms of use Privacy policy	

Terms

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. For additional details see [Azure Marketplace Terms](#).

Basics

Subscription	Visual Studio Enterprise – MPN [5.8k]
Resource group	ait-exp2-rg
Region	eastus
Elastic pool	ait-elastic-vcore-sqlpool
Server	ait-sqldatabase-sqlserver
Compute + storage	GeneralPurpose: Gen5, 2 vCores, 32 GB, 1 database

Additional settings

Create < Previous Download a template for automation

When the creation is finished, we will be able to view our new pool as a new resource:

ait-elastic-vcore-sqlpool (ait-sqldatabase-sqlserver/ait-elastic-vcore-sqlpool) X

SQL elastic pool

Search (Ctrl+ /) Configure Delete + Create database Feedback

Overview

- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

Settings

- Quick start
- Configure
- Locks

Monitoring

- Database Resource Utilization
- Alerts
- Metrics
- Diagnostic settings
- Logs

Automation

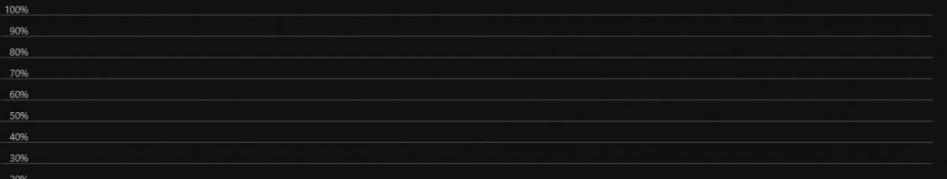
- Tasks (preview)
- Export template

Essentials

Resource group (change) ait-exp2-rg	Server name ait-sqldatabase-sqlserver.database.windows.net
Status Ready	Resource configuration & pricing GeneralPurpose: Gen5, 2 vCores
Location East US	Elastic databases 1 database
Subscription (change) Visual Studio Enterprise – MPN [5.8k]	Elastic database settings 0-2 vCores
Subscription ID 88ea260b-f912-4540-b3ff-2bb6167457e8	
Tags (change) Click here to add tags	

Show data for last: **1 hour** 24 hours 7 days Aggregation type: Max

Resource utilization (ait-elastic-vcore-sqlpool)

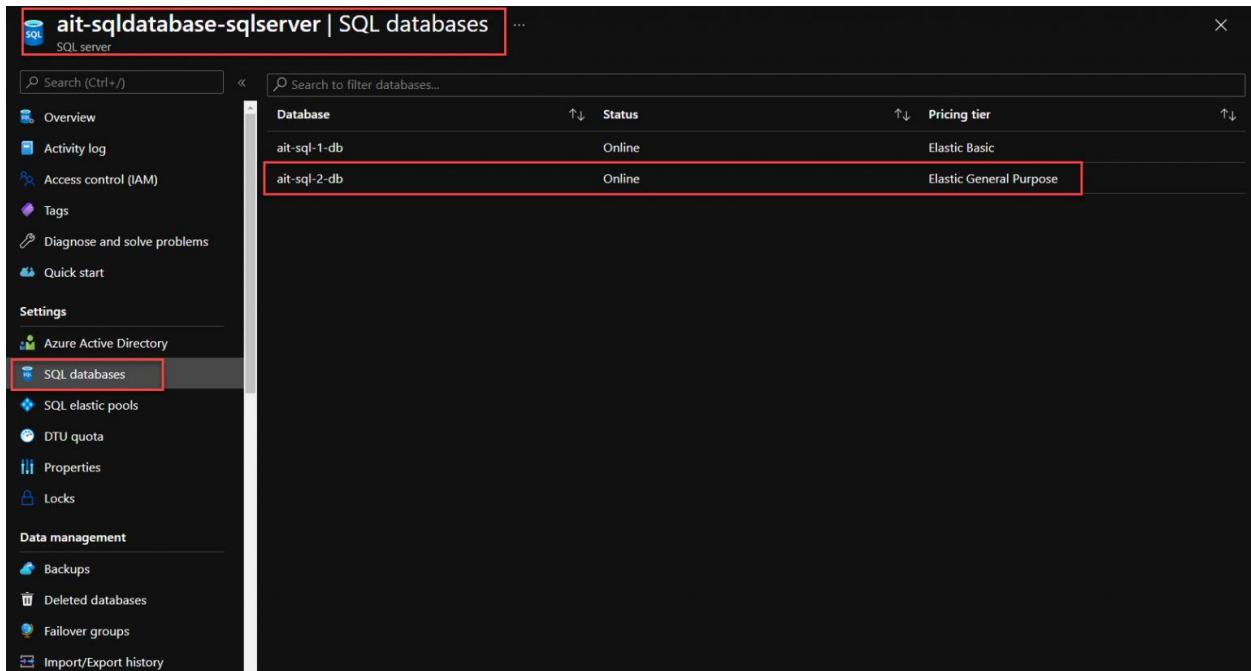


The chart displays a single data series representing the resource utilization of the elastic pool over a period of 7 days. The Y-axis shows utilization percentages from 0% to 100%. The X-axis represents time. The utilization remains consistently low, fluctuating slightly between 0% and 10% throughout the observed period.

Let's validate the elastic group!

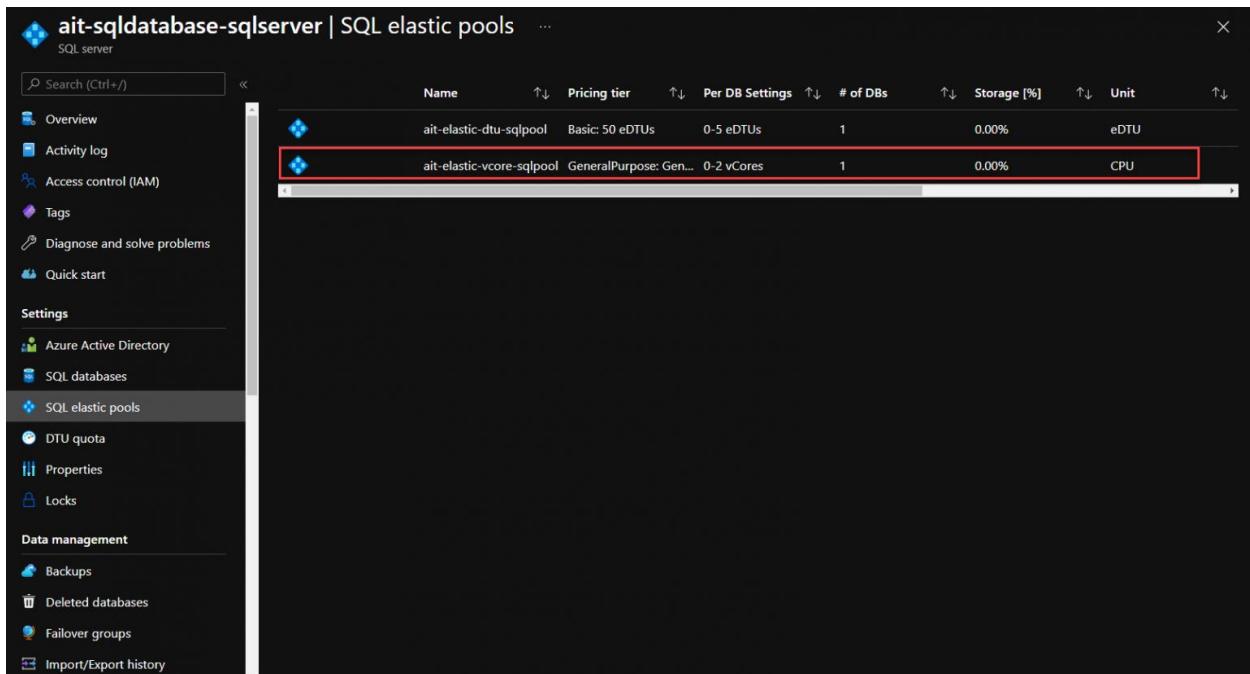
Elastic pool validation

If we enter our SQL Database Server, and go to the SQL databases part, we will verify that the second database is already part of the pricing tier of a pool, based on vCore:



Database	Status	Pricing tier
ait-sql-1-db	Online	Elastic Basic
ait-sql-2-db	Online	Elastic General Purpose

In the same way, we can validate that in the SQL elastic pools section, within our SQL Database Server, we will find the second active pool:



Name	Pricing tier	Per DB Settings	# of DBs	Storage [%]	Unit
ait-elastic-dtu-sqlpool	Basic: 50 eDTUs	0-5 eDTUs	1	0.00%	eDTU
ait-elastic-vcore-sqlpool	GeneralPurpose: Gen...	0-2 vCores	1	0.00%	CPU

You can try connecting from SQL Management Studio, or from Azure Data Studio: you will see that your base remains the same.

Replicas in Azure SQL Database

Before finishing this experience number 3 (intense! Right?), we are going to see one last topic: the possibility of carrying out a database replication to take advantage of availability between regions. And we will discover how easy it is to do it with Azure SQL Database.

What are replicas in Azure SQL Database?

Azure SQL Database replicas allow us to have our data replicated in another region (or the same one, if we wish) with a read-only copy of our database.

Create an additional SQL Database Server (other region)

The first thing we need to do is create a SQL Database Server in a new region, for example WestUS. Remember that the region of the SQL Database Server determines the location of its databases.

We will create a new SQL Database Server with the following data:

- Server name: ait-sqlreplica-<string>-sqlserver, where <yourstring> must be replaced with your own unique text and numbers (since this server name must be unique across all of Azure).
- Location: Westus

Create SQL Database Server

Microsoft

Basics Networking Additional settings Tags Review + create

SQL database server is a logical container for managing databases and elastic pools. Complete the Basic tab, then go to Review + Create to provision with smart defaults, or visit each tab to customize. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Visual Studio Enterprise – MPN [5.8k] ▾

Resource group * ⓘ ait-exp2-rg ▾
[Create new](#)

Server details

Enter required settings for this server, including providing a name and location.

Server name * ait-sqlreplica-sqlserver .database.windows.net

Location * (US) West US ▾

Administrator account

Server admin login * Enter server admin login

[Review + create](#) [Next : Networking >](#)

Server admin login and password: the one you choose, and as a suggestion enter “sqladmin” in the login.

Create SQL Database Server

Microsoft

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Visual Studio Enterprise – MPN [5.8k] ▾

Resource group * ⓘ ait-exp2-rg ▾
Create new

Server details

Enter required settings for this server, including providing a name and location.

Server name * ait-sqlreplica-sqlserver .database.windows.net

Location * (US) West US ▾

Administrator account

Server admin login * sqldadmin ✓

Password * ✓

Confirm password * ✓

[Review + create](#) [Next : Networking >](#)

In relation to the Networking options, we will leave WITHOUT ACCESS to Azure services. In this way we can validate the independence of the service in relation to the replica itself, not the access:

Create SQL Database Server

Microsoft

Basics **Networking** Additional settings Tags Review + create

Configure networking access for your server.

Firewall rules

Allow Azure services and resources to
access this server 

Yes

No

[Review + create](#)

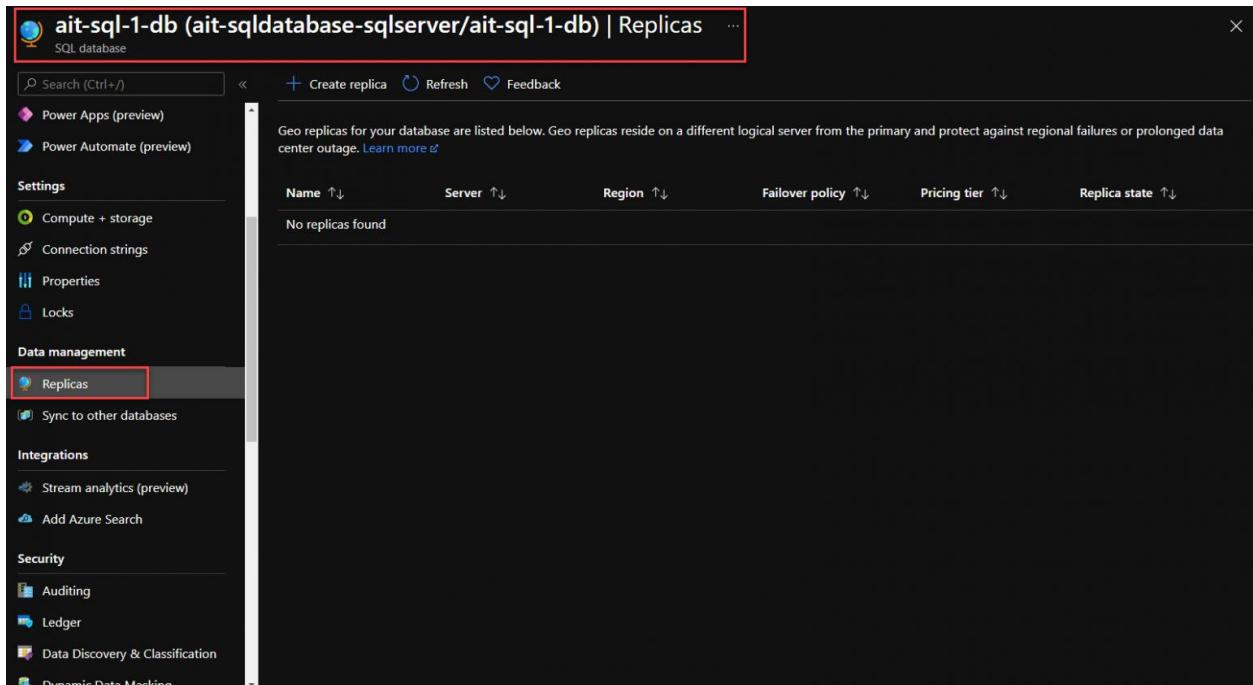
[< Previous](#)

[Next : Additional settings >](#)

With the creation of our new SQL Database Server complete, we continue to move forward.

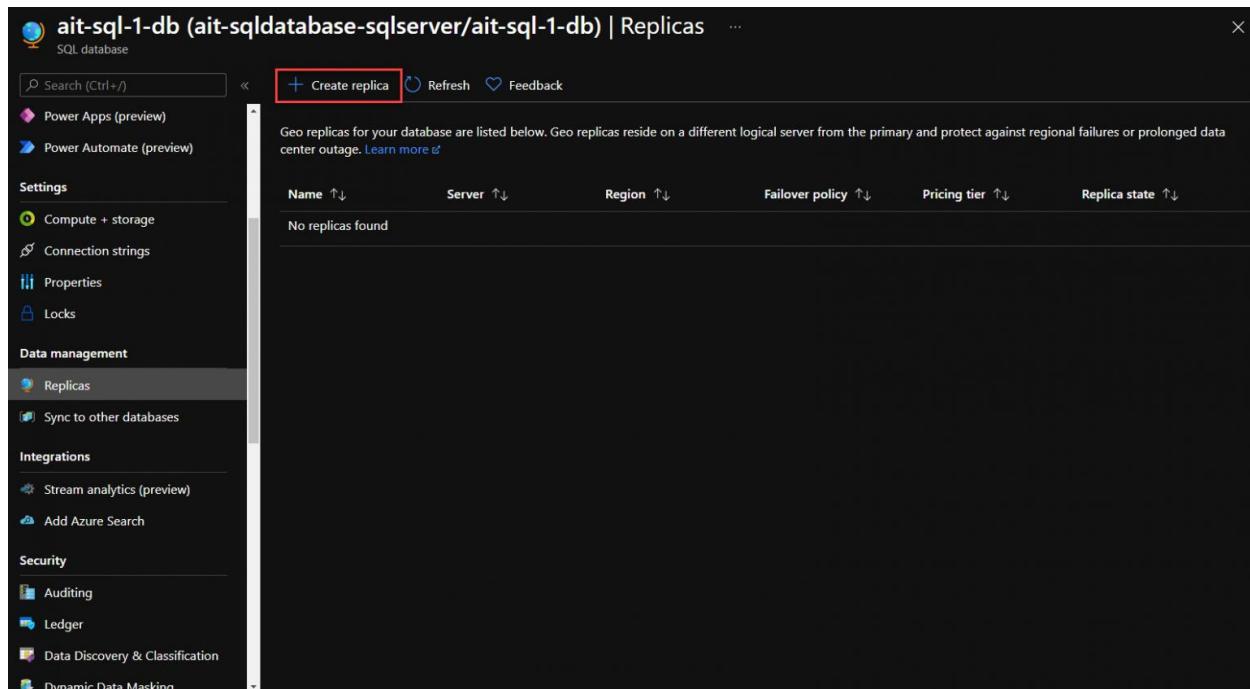
Create cross-region database replica

Within the database that we want to replicate (in this case the database is ait-sql-1-db) we go to the Data management section "Replicas":



The screenshot shows the Azure portal interface for managing a database named 'ait-sql-1-db'. The left sidebar has a dark theme with several sections: 'Power Apps (preview)', 'Power Automate (preview)', 'Settings' (with 'Compute + storage' selected), 'Data management' (with 'Replicas' selected and highlighted by a red box), 'Integrations' (with 'Stream analytics (preview)' and 'Add Azure Search'), and 'Security' (with 'Auditing', 'Ledger', 'Data Discovery & Classification', and 'Dynamic Data Masking'). The main content area is titled 'ait-sql-1-db (ait-sqldatabase-sqlserver/ait-sql-1-db) | Replicas' and displays a message: 'Geo replicas for your database are listed below. Geo replicas reside on a different logical server from the primary and protect against regional failures or prolonged data center outage.' Below this, there is a table with the following columns: Name, Server, Region, Failover policy, Pricing tier, and Replica state. A single row is shown: 'No replicas found'.

There we select the "Create replica" button:



The screenshot shows the Azure portal interface for managing a SQL database named 'ait-sql-1-db'. The left sidebar contains navigation links for Power Apps (preview), Power Automate (preview), Settings (Compute + storage, Connection strings, Properties, Locks), Data management (Replicas, Sync to other databases), Integrations (Stream analytics (preview), Add Azure Search), and Security (Auditing, Ledger, Data Discovery & Classification, Dynamic Data Masking). The main content area is titled 'Replicas' and displays a message: 'Geo replicas for your database are listed below. Geo replicas reside on a different logical server from the primary and protect against regional failures or prolonged data center outage.' Below this, there is a table header with columns: Name ↑, Server ↑↓, Region ↑↓, Failover policy ↑↓, Pricing tier ↑↓, and Replica state ↑↓. A message 'No replicas found' is displayed below the header.

In the wizard, we will select the logical server that we want to use. In this case it is the recently created: ait-sqlreplica-sqlserver (West US). On the other hand, we must choose the “Compute + storage” options and preferences, and we can even configure aspects of an SQL elastic pool:

Create SQL Database - Geo Replica

Microsoft

Database details

Enter required settings for this database, including picking a logical server and configuring the compute and storage resources

Database name: ait-sql-1-db

Server *: ait-sqlreplica-sqlserver (West US)

Create new

Region: West US

Want to use SQL elastic pool? *: Yes No

Compute + storage *:
Basic
2 GB storage
[Configure database](#)

Backup storage redundancy

Choose how your PITR and LTR backups are replicated. Geo restore or ability to recover from regional outage is only available when geo-redundant storage is selected.

Backup storage redundancy
 Locally-redundant backup storage - Preview
 Geo-redundant backup storage

[Review + create](#) [Next : Review + create >](#)

After having selected these options (we suggest that you choose them according to your criteria), we advance in the creation:

Create SQL Database - Geo Replica

Microsoft

Product details

SQL database by Microsoft

Estimated cost per month
502.36 ARS
[View pricing details](#)

Terms
By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. For additional details see [Azure Marketplace Terms](#).

Basics

Subscription	Visual Studio Enterprise – MPN [5.8k]
Resource group	ait-exp2-rg
Primary database	ait-sql-1-db
Region	westus
Database name	ait-sql-1-db
Server	ait-sqlreplica-sqlserver
Compute + storage	Basic: 2 GB storage
Backup storage redundancy	None

[Create](#) [< Previous](#) [Download a template for automation](#)

Once the replica has been generated, we are going to display them in the same section of Replicas within the ait-sql-1-db database:

ait-sql-1-db (ait-sqlreplica-sqlserver/ait-sql-1-db) | Replicas

SQL database

Power Platform

- Power BI (preview)
- Power Apps (preview)
- Power Automate (preview)

Settings

- Compute + storage
- Connection strings
- Properties
- Locks

Data management

- Replicas
- Sync to other databases

Integrations

- Stream analytics (preview)
- Add Azure Search

Security

- Auditing

+ Create replica ⏪ Refresh ⚡ Feedback

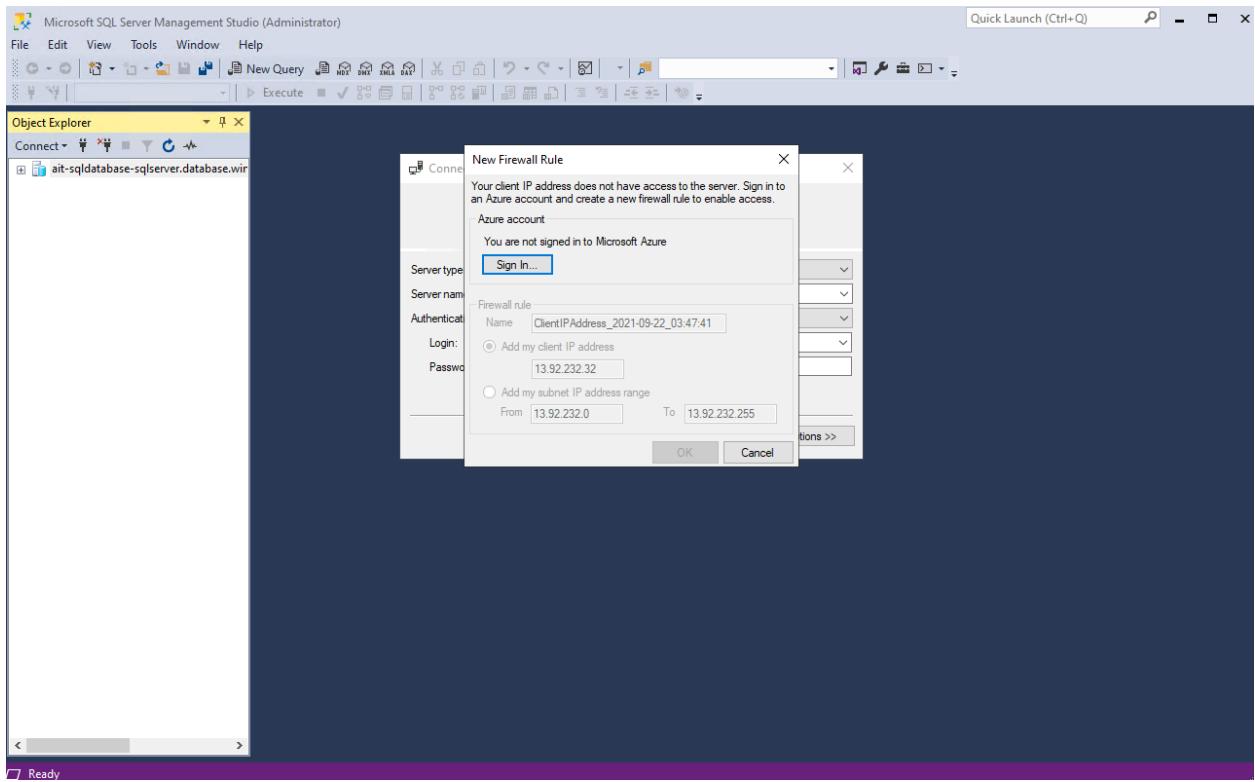
Geo replicas for your database are listed below. Geo replicas reside on a different logical server from the primary and protect against regional failures or prolonged data center outage. [Learn more ↗](#)

Name ↑↓	Server ↑↓	Region ↑↓	Failover policy ↑↓	Pricing tier ↑↓	Replica state ↑↓
Primary					
ait-sql-1-db	ait-sqldatabase-sqlserver	East US	None	Elastic Basic	Online
Geo replicas					
ait-sql-1-db	ait-sqlreplica-sqlserver	West US		Basic	Readable

Ready! Now we are going to test connecting and using the replica.

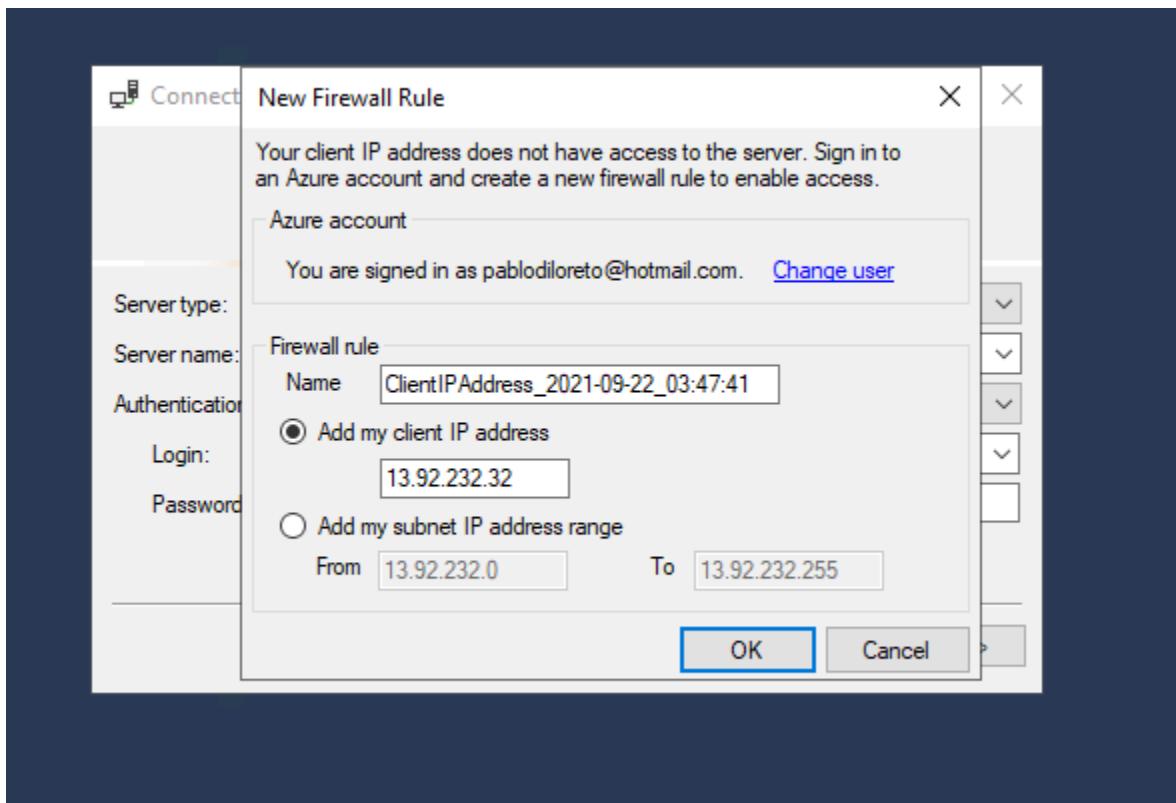
Connecting to the replica SQL Database Server

From the SQL Management Studio of our Azure team we try to enter using the replica server data, which we obtain from the Overview window (within the newly created logical server). We will find the following: we cannot connect.

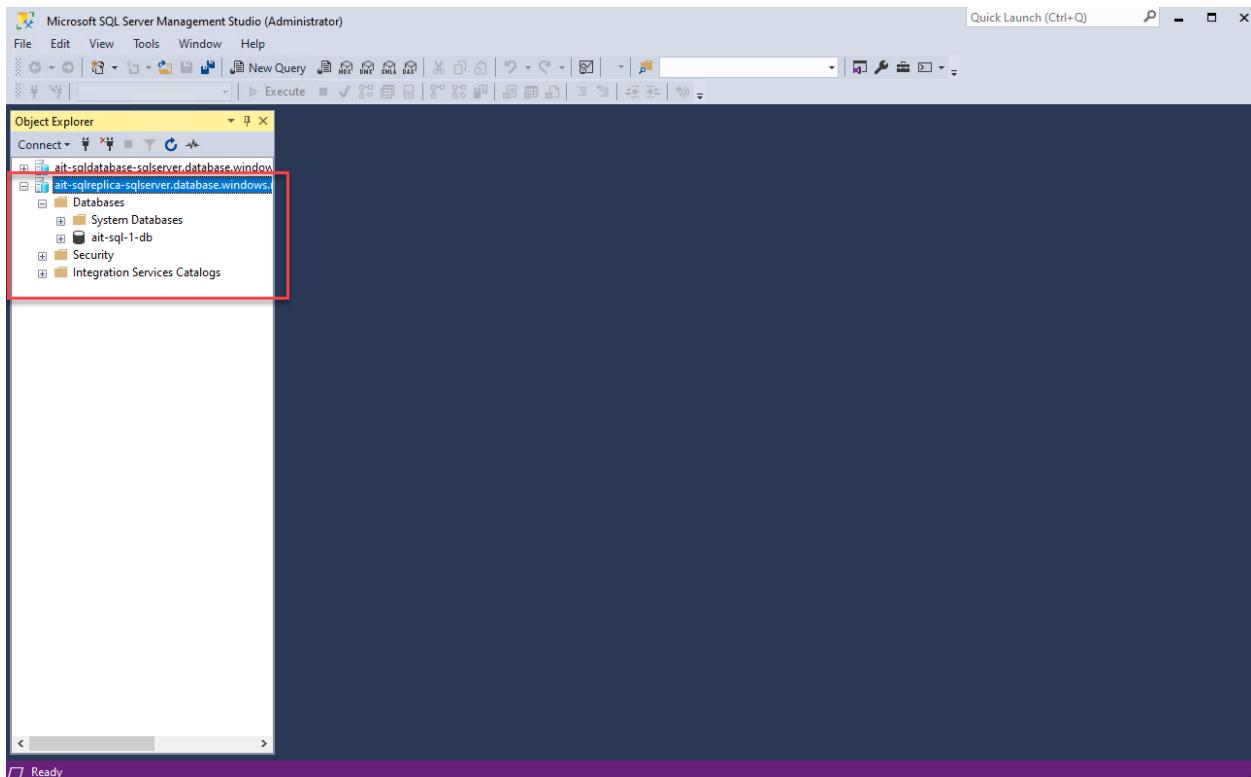


Why did this happen? If we remember, at the time of creating the new logical server we chose that said server not allow connections from Azure services. By not having Firewall exceptions either, we will not be able to establish a connection with it.

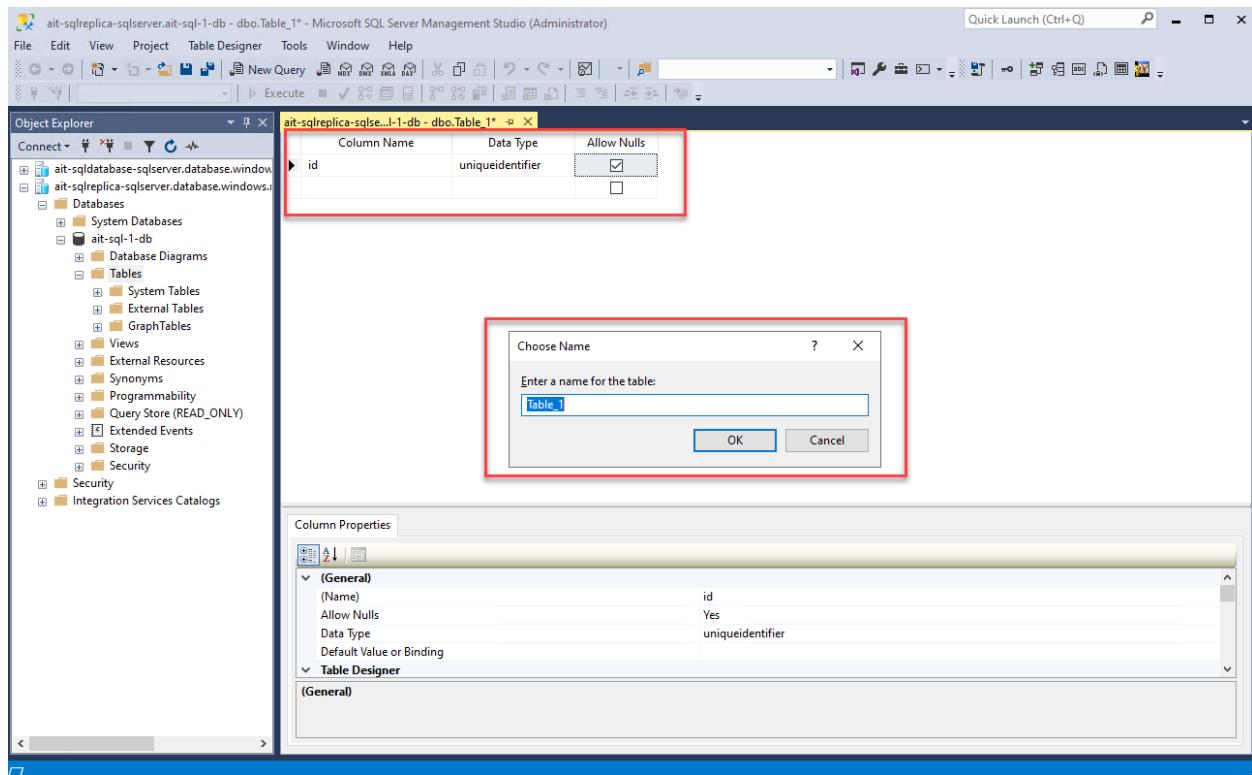
If we want, from SQL Management Studio itself, we can log in with our Azure user (as long as they have permission to modify the SQL Database Server resource) and we can add the rule with its IP exception from here:



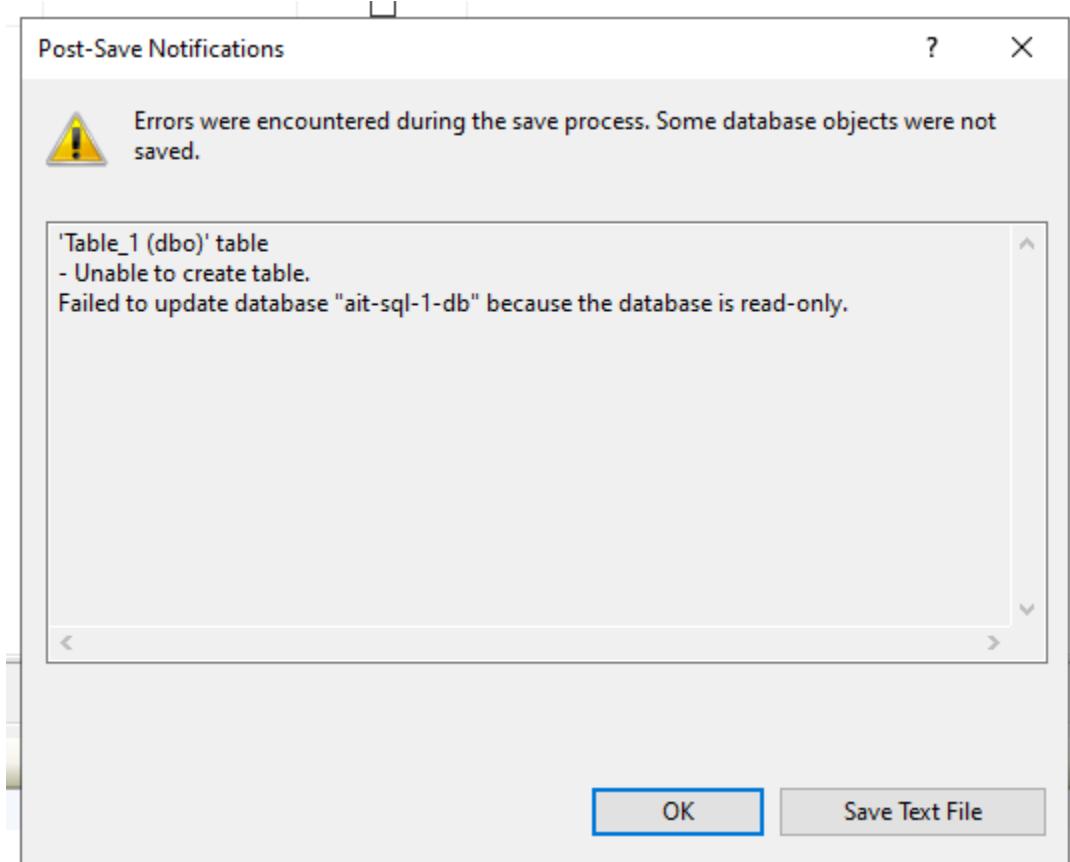
After having generated the exception, we can connect to the replica logical server:



If we try to generate a table on the replica server, we won't be able to:

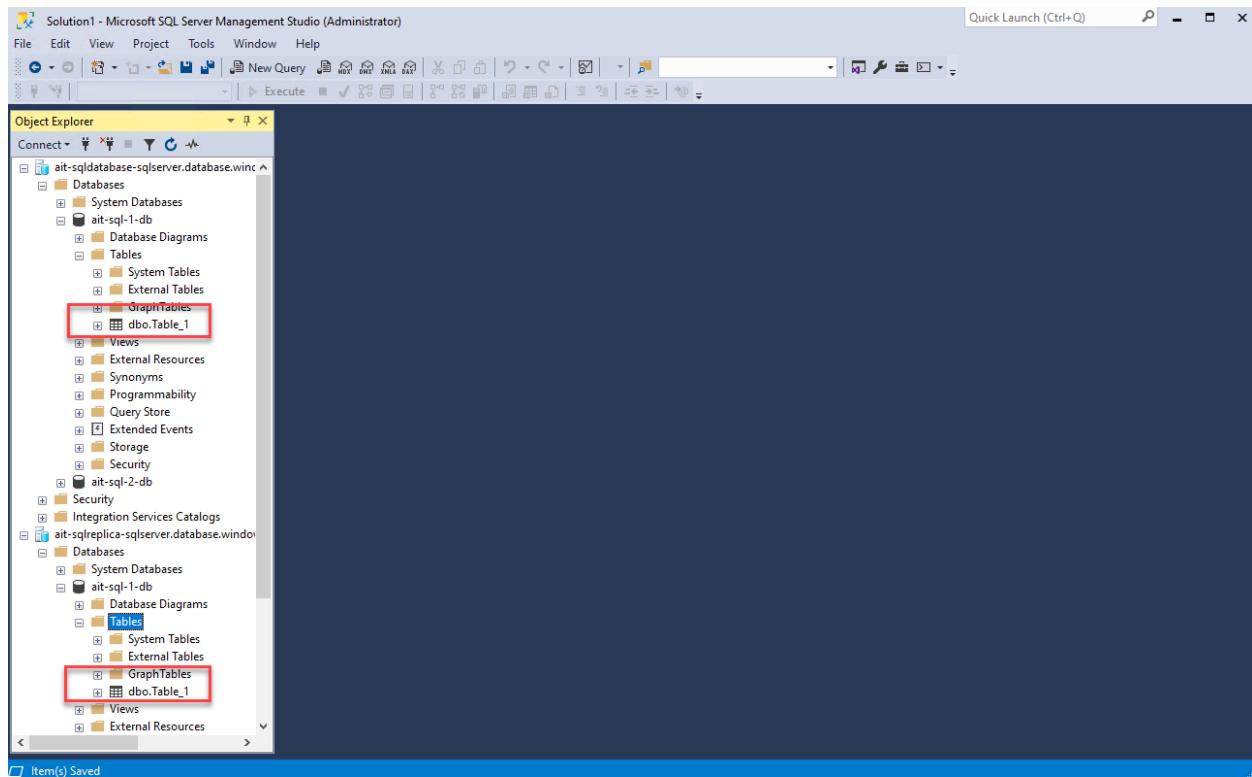


This is because that server is read-only:



Data replication validation

We are going to do the same thing we tried to do before, but now on the main server, ait-sql-1-db database. We will notice that we can create the table, and that in a few seconds it is already replicated on the West US server:



Finished experience! Now all that remains is to validate some knowledge :-).

Exercise 4: SQL Managed Instance

This section will be completed on the second day.

Exercise 5: Data migration

This section will be completed on the second day.

Links of interest

Luego del segundo día de