DP300 Administering Relational Databases on Microsoft Azure

Module 1: The role of the database administrator

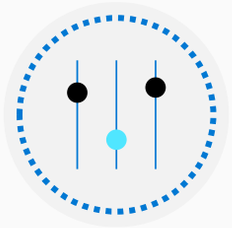
- Introduction to Azure Data Platform and overview of course

Module objectives

After this module you will be able to:

Understand the role of Azure Database Administrator as it fits in with other data platform roles

Describe the key differences between the SQL Server-based database options in Azure and other open-source database platforms available on Azure



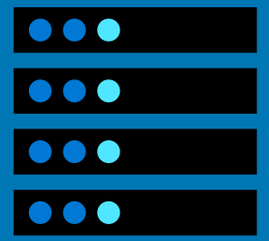
Describe the difference between versions and compatibility levels

Enable and disable preview features

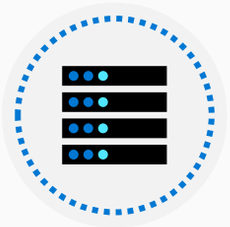
Prerequisites:

Students attending this course or taking this exam should have a solid understanding of the principals of SQL Server Database Administration, and a beginner level knowledge of the Azure Data Platform options, including Azure SQL Database, Azure SQL Database Managed Instance, Azure Virtual Machines, and Azure MariaDB/MySQL/PostgreSQL database

Lesson 1: Azure data platform roles

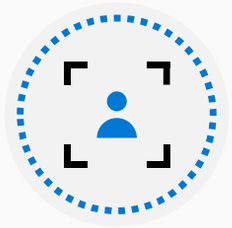


Lesson 1 objectives



Understand Azure data platform roles

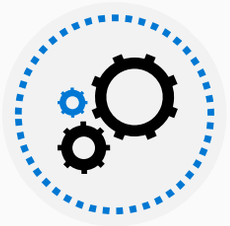
Azure Database Administrator



Azure Database Administrator:

The Azure Database Administrator implements and manages the operational aspects of cloud-native and hybrid data platform solutions built on Microsoft Azure data services and Microsoft SQL Server

Other Azure Data Platform Roles

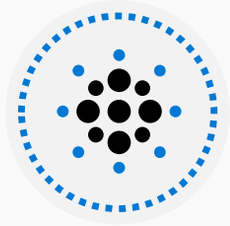


Azure Data Engineer:

Azure Data Engineers design and implement the management, monitoring, security, and privacy of data systems

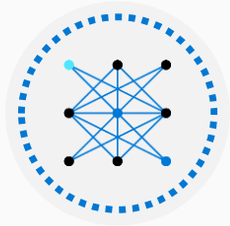
Azure Data Analyst:

Data Analysts enable businesses to maximize the value of their data assets by using Microsoft Power BI



Azure Data Scientist:

The Azure Data Scientist applies their knowledge of data science and machine learning to implement and run machine learning workloads on Azure



Azure Artificial Intelligence Engineer:

Azure AI Engineers use Cognitive Services, Machine Learning, and Knowledge Mining to build AI solutions

Course modules


Module 1 – The role of the Azure database administrator


Module 2 – Plan and implement data platform resources


Module 3 – Implement a secure environment


Module 4 – Monitor and optimize operational resources


Module 5 – Optimize query performance

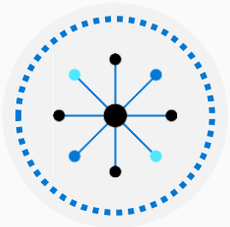

Module 6 – Automate tasks


Module 7 – Plan and implement a high availability and disaster recovery environment

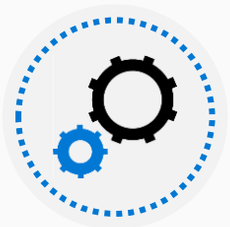
Lesson 2: Azure database platforms and options

Lesson 2 objectives

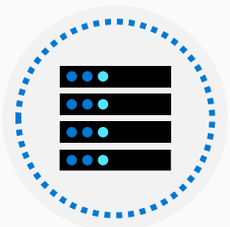
Options for SQL Server in an Azure VM



Deployment options for SQL Server on Azure

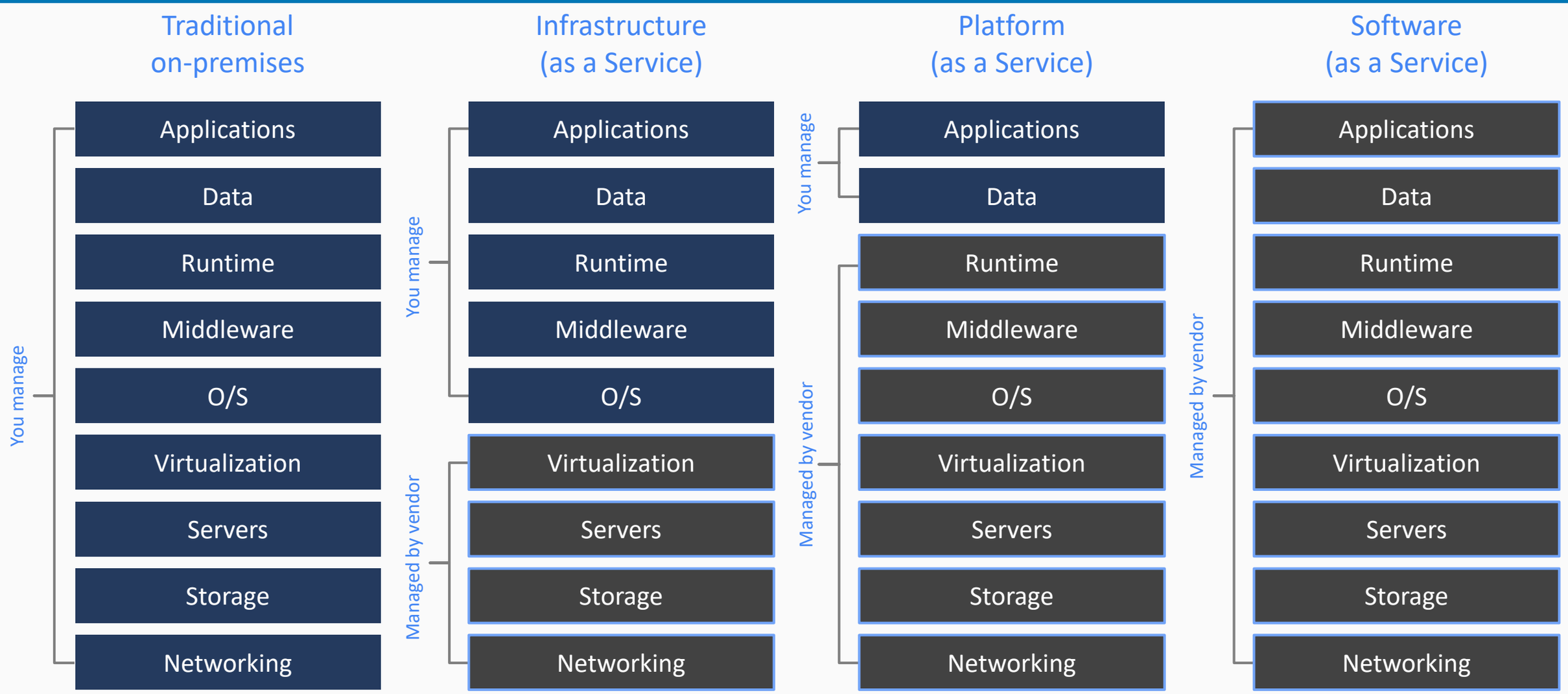


Azure SQL platform as a service offerings



Azure open source database offerings

Understanding Azure services



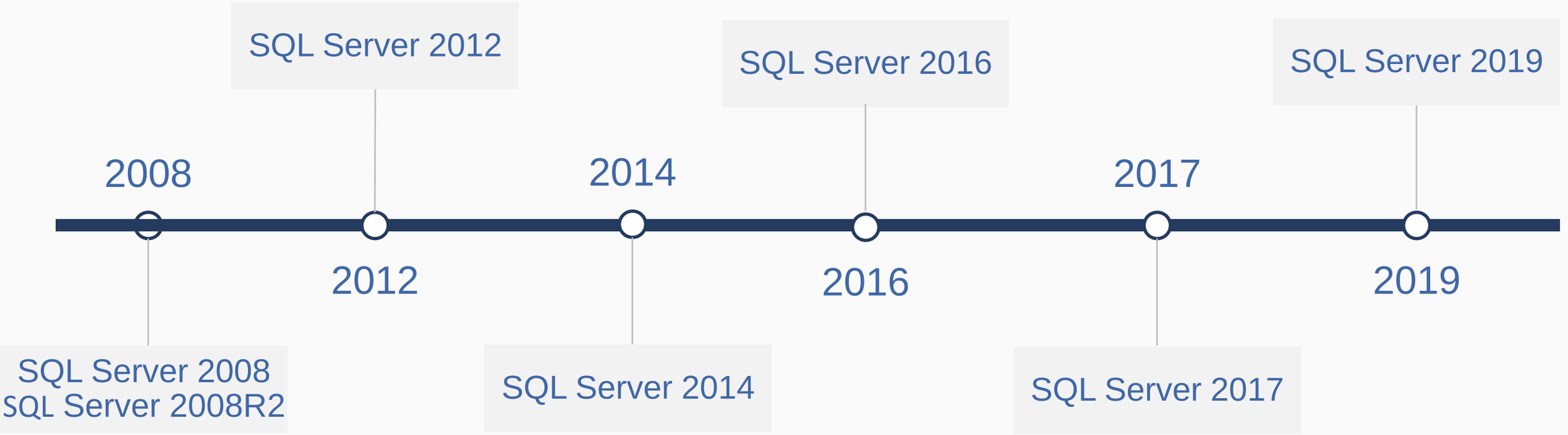
SQL Server in an Azure virtual machine

Azure Virtual Machines give you a wide range of computing power and RAM

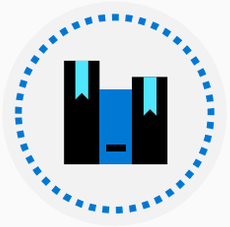
Provides flexibility for applications that may have dependency on specific versions of SQL Server

Allows you to run additional SQL Server services like Analysis Services, Reporting Services, Machine Learning Services, and Integration Services alongside database engine

SQL Server versions available in Azure VMs



SQL Server Azure VM resource provider

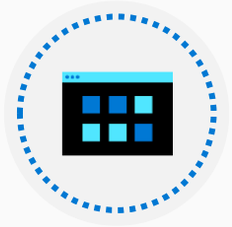


This is separate (free) Azure resource that will register your VM as a SQL Server VM

If you use a marketplace SQL Server image, this is done automatically as part of deployment

You can also register Azure VMs where you have installed SQL Server or deployed from VHD

Automatic patching



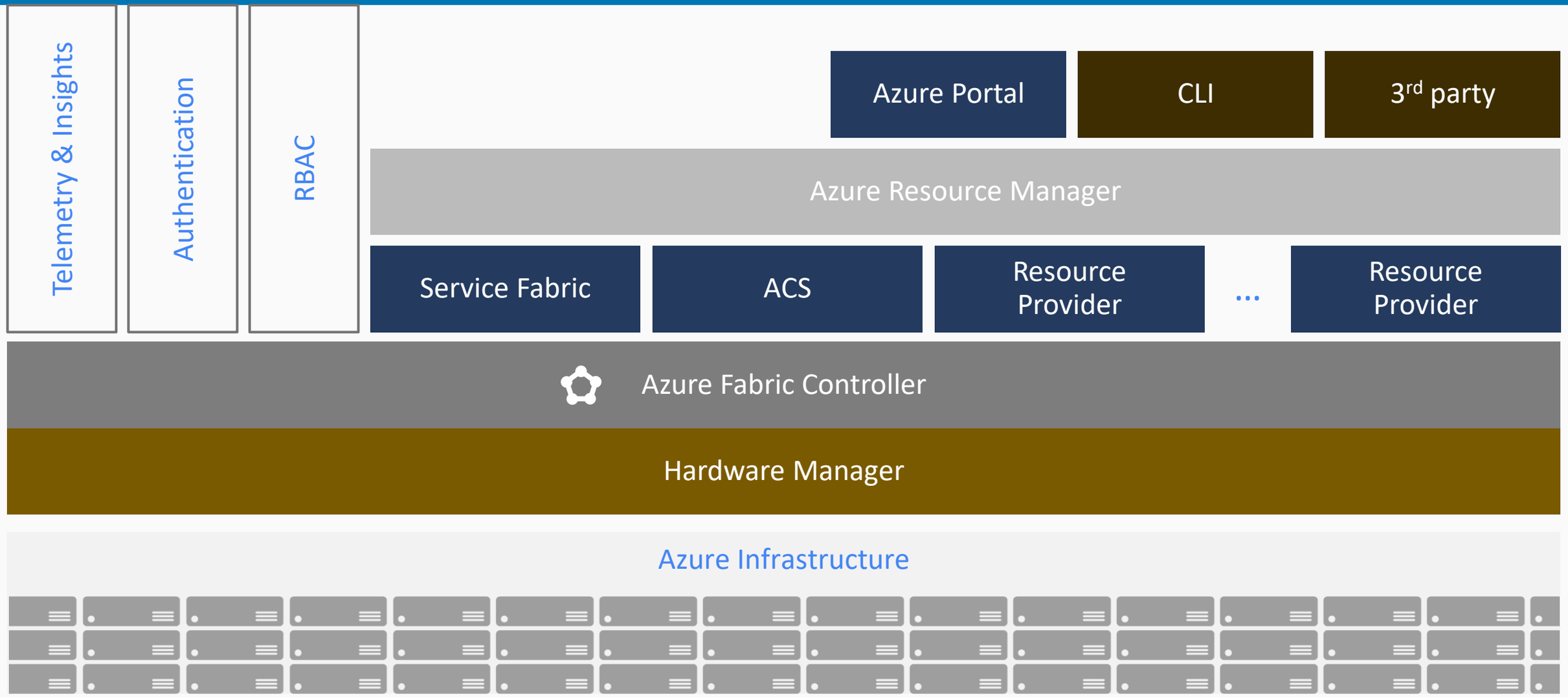
Establishes a patching window for an Azure Virtual Machine running SQL Server

Automated updating will only be installed during these patching windows:

Only Windows and SQL Server updates marked as important or critical are installed

Currently, this process does not include SQL Server cumulative updates

Azure Resource Manager templates



Azure infrastructure availability options

The Azure platform is built to be fault-tolerant

High availability is built into the platform at power, network, and compute layers

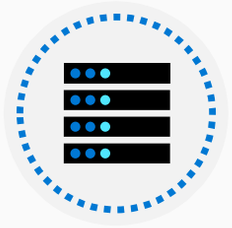
Default availability for a single Azure VM with premium managed disk is 99.9%

You can build further HA and DR solutions using SQL Server features like Always On Availability Group

In order to deploy Availability Groups in Azure, you need to deploy VMs into an Availability Zone or Availability Sets

Azure storage

The Azure Storage platform provides a number of storage services, for file and object storage, message queues, and VM disks



SQL Server uses two types of Azure storage:

Managed Disks

Blob Storage

SQL Server workloads typically use Premium SSD or Ultra Disk for database and transaction log files

Platform as a service offerings

Azure SQL Database

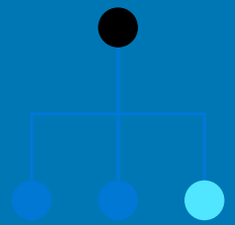
Azure SQL Database Managed Instance

Azure MySQL/PostgreSQL/Maria DB Database

PaaS offerings allow customers to get more scalability and other benefits from cloud deployments

Use an evergreen version of SQL Server binaries

Azure SQL Managed Instance



Azure SQL Managed Instance

Managed Instance is a PaaS offering that offers 99% of the functionality of SQL Server

Includes SQL Server Agent, Service Broker, and Common Language Runtime options

The Azure platform manages backups, patching, and high availability

Allows for cross database queries

Azure SQL Managed Instance service offerings

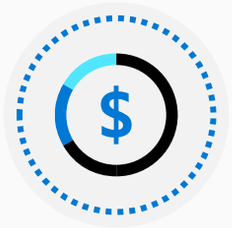
General purpose	Business critical
Uses Azure Premium storage	Supports readable secondary replicas of your database
Supports up to 8 TB of data	Direct attached storage
	In-memory OLTP
	Supports up to 4 TB of data

Hybrid licensing for PaaS services

Both Azure SQL Database and Managed Instance support the hybrid licensing benefit:

Each core of Enterprise Edition entitles you to 8 cores of General Purpose, or 1 core of Business Critical

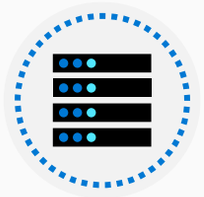
Each core of Standard Edition entitles you to 1 core of General Purpose



This does not remove all costs from the service, but lowers the cost by approximately 40%

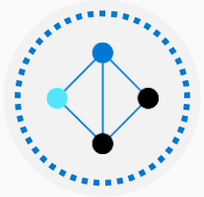
High availability architecture in Azure PaaS

Both Azure SQL Database and managed instance have similar high availability architectures



General Purpose: Relies on Azure Storage for high availability

Business Critical: Uses an architecture similar to Always On Availability Groups with multiple copies of the service and database. Also, allows for readable secondary functionality



Business Continuity: Azure SQL Database supports Availability Zones

Network connectivity architecture

Azure SQL Managed Instance is deployed within its own subnet in a virtual network

The Managed Instance service has a publicly accessible name, but is primarily accessible over a private IP address

Customers have to opt-in to having an open public IP endpoint

Azure platform does connect securely into managed instance to provide management activity

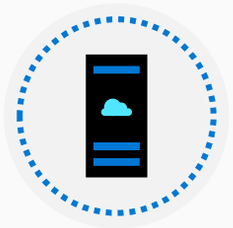
Backup and restore

Backups are taken automatically:

Full backups are taken weekly

Differentials are created every 12 hours

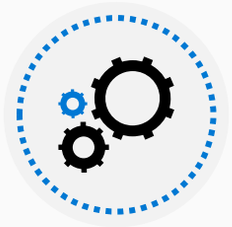
Log Backups are taken every 5-10 minutes



You can take an on-demand copy-only backup to Azure Blob Storage

Automatic tuning

Another Benefit of Azure SQL PaaS Services is the ability to leverage Azure compute to provide value added features



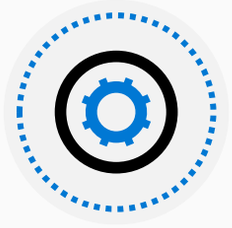
Currently, this provides the following features:

Query Store/Query Performance Insight

Force Last Good Execution Plan

Adding Indexes

Removing Unused Indexes



All these features can be configured at the service level

Migrating to Azure SQL Managed Instance

Database migration service	Backup and restore
Allows for near zero-downtime migrations to Azure SQL Managed Instance Replays transaction log to target Azure SQL Managed Instance	Restoring databases into Managed Instance is a supported migration path User restores do not support *norecovery* option, which means you can only do a full restore

Azure SQL Database for cloud native apps

Azure SQL Database

Azure SQL Database is a service offering aimed at new application development

There are several deployment options for deploying Azure SQL Database:

Single database:
Single database deployment that allows rapid deployment

Elastic pools:
Elastic pools allow a group of databases to share a common set of resources. This can be used to reduce costs and simplify management for some applications

Hyperscale: Hyperscale databases scale beyond the 4 TB limit of single databases or elastic pools to up to 100 TB and beyond

Serverless: Serverless option allows for reduced costs by enabling auto-pause for non-production workloads that do not require constant database access

Single database deployment

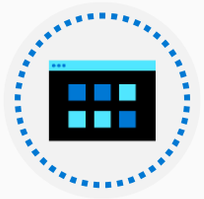
Simplest approach to deploying Azure SQL Database

Each database has its own full set of resources

All databases are isolated from each other and are portable

Service level and costs are configured at the individual database level

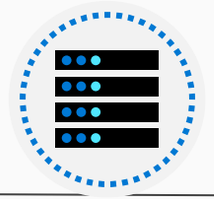
Elastic pools



Designed for multi-tenant applications where each tenant has its own databases, or data is shared across databases

Allows you to pay one price for multiple databases that can be managed together

Can significantly reduce costs for these types of applications



Best suited for databases that have similar performance requirements and non-concurrent spikes in utilization

Hyperscale

Supports up to 100 TB of database size

Nearly instantaneous backups using snapshot technologies

Fast database restores

Higher overall throughput because of distributed log writes

Horizontal scaling model

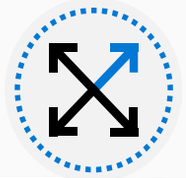
Serverless

The Serverless deployment model still requires a logical server

The easiest way to think about this is auto-pause for Azure SQL Database

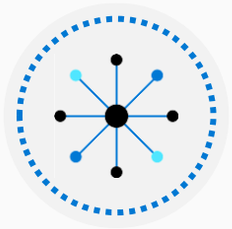
First connection to a paused database will receive an error, then the database service resumes

Serverless is more expensive per minute than normal SQL Database, but can be much cheaper for databases that are largely idle like development and testing workloads

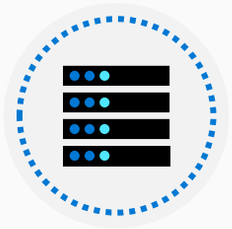


Serverless also allows for auto-scale as workloads increase by increasing the number of vCores allocated to the database

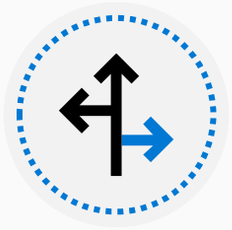
Scaling elastic pools



Resources in an elastic pool can be shared across all of the databases in the pool



You can assign a min/max vCore to each of the databases in the pool or set default values across the pool



Increasing or decreasing the total number of vCores requires a resizing activity that will incur a small amount of downtime

Open source databases on Azure platform

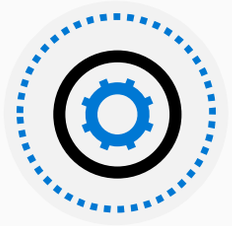
Azure Database supports open source database solutions:

Azure Database for MariaDB

Azure Database for MySQL

Azure Database for PostgreSQL

Include system managed backups and high availability

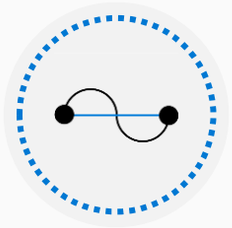


The databases have added functionality including the Query Store and Query Performance Insight in the Azure Portal

Network connectivity

Very similar to Azure SQL Database

Specific IP address or ranges



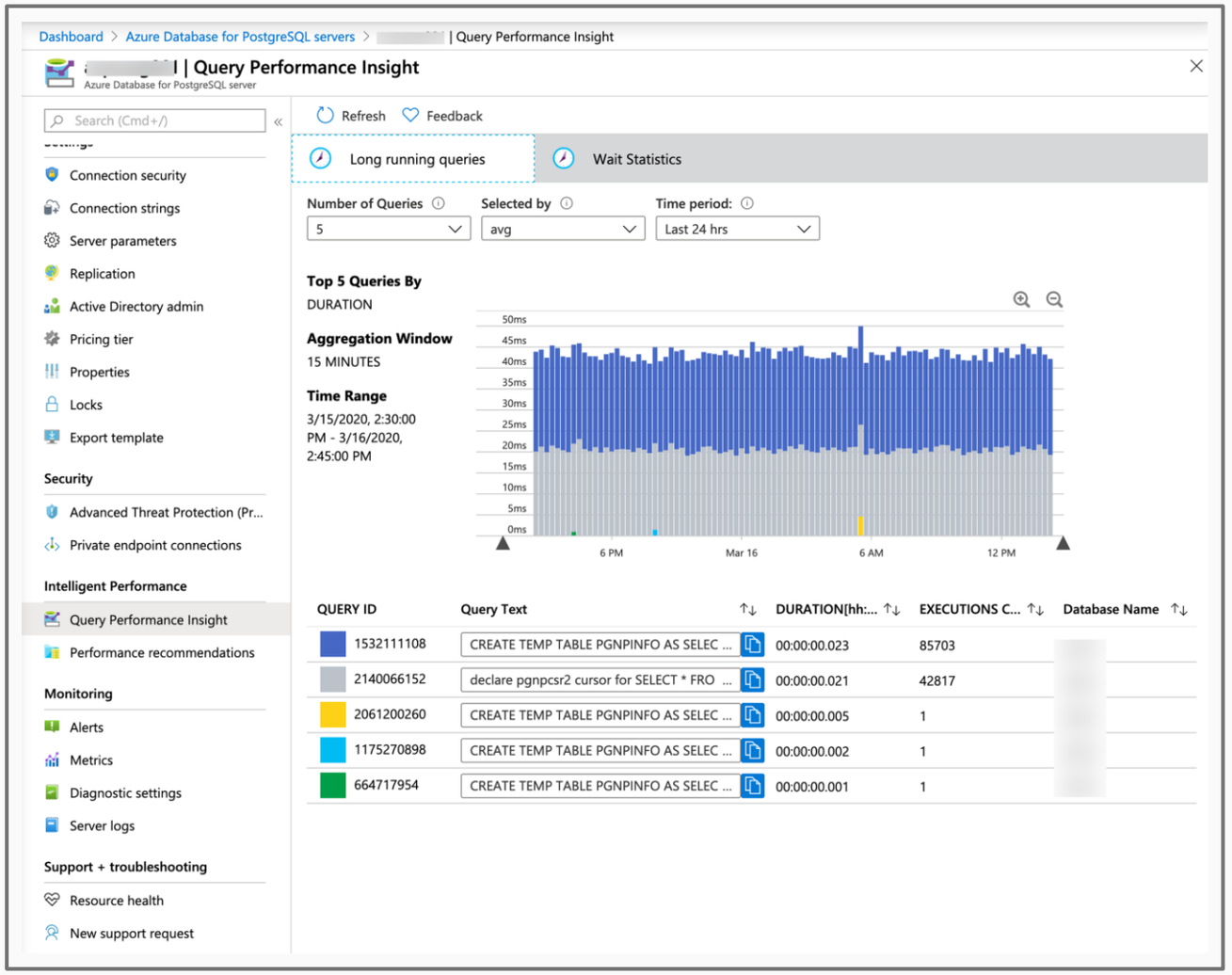
Connection can be allowed from a specific virtual network in Azure

Query Store on Azure PostgreSQL

One of the value-added features of the Azure PostgreSQL services

Similar to Query Store in SQL Server

Let's you easily identify expensive queries and opportunities for correction



Lesson 2: Knowledge check

An Azure SQL Database Managed Instance represents what kind of cloud service?

- ❑ Software as a Service (SAAS)
- ❑ Infrastructure as a Service (IAAS)
- ☑ Platform as a Service (PAAS)

Which of the following is NOT a valid reason for migrating your database into an IaaS environment?

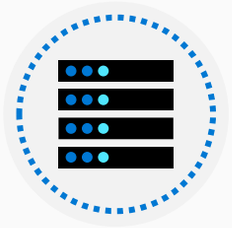
- ❑ Your applications need to run older versions of SQL Server, such as SQL Server 2016
- ❑ You want Azure to manage all the upgrades, patching and server configuration
- ☑ You need to use other SQL Server services with your application, such as SQL Server Analysis Services (SSAS), Integration Services (SSIS) and Reporting Services (SSRS)

Which of the following is NOT an Azure SQL Database deployment option?

- ☑ Availability Zones
- ❑ Serverless
- ❑ Elastic Pools

Lesson 3: SQL Server compatibility level

Lesson 3 objectives

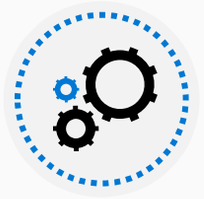


How SQL Server Compatibility Level affects database behavior

Microsoft’s support policy for SQL Server

How to certify an application based on compatibility level

Compatibility level



Database level setting

Currently (SQL Server 2019/Azure Services) supports compatibility levels
100-150 (2008-2019)

Allow query optimizer behavior and most T-SQL syntax to maintain behavior of older versions of database engine

Effects behavior of the given database, and not the entire server

SQL Server support model

SQL Server releases are in primary support for five years

This means performance, security, and functional updates in Cumulative Updates

SQL Sever provides extended support for the next five years

Security fixes will be addressed during this period

Currently supported releases of SQL Server

*Extended Support

Compatibility level based certification for applications

Applications should stop certifying for specific version or platform
(for example, SQL Server 2019 or Azure SQL Database)

Azure PaaS service versions are evergreen (always latest) so it makes the most sense to certify to a compatibility level

Any application certification process should be aimed at a certification level

Lesson 3: Knowledge check

Which version of SQL Server does compatibility level 100 equate to?

- [x] SQL Server 2008
- [ ] SQL Server 2014
- [ ] SQL Server 2019

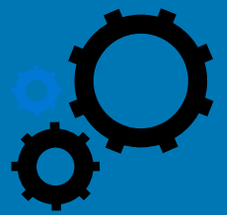
What does Microsoft guarantee if you upgrade versions of SQL Server but maintain the same compatibility level, on similar hardware?

- [ ] Elapsed Time of Queries
- [ ] Execution Plan Shape
- [x] Syntax Compatibility

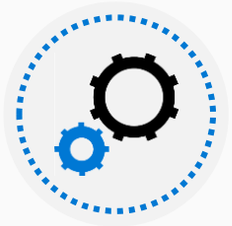
Where do you change the compatibility level settings?

- [ ] The server settings page
- [ ] The individual database properties page
- [x] Using a trace flag through the Configuration Manager

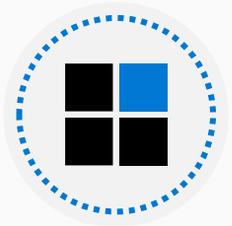
Lesson 4: Azure preview features



Lesson 4 objectives



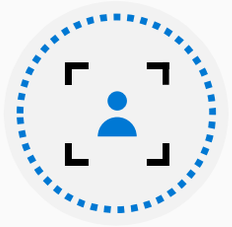
How the Azure preview feature process works



The differences between private and public preview

The support policy of preview features

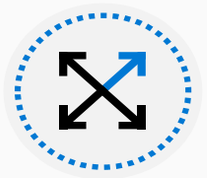
Type of Azure preview



Private preview – Your subscription needs to be added to allowed list in order use the feature. May or may not have portal support

Public preview – Visible either in the portal, or at https://azure.microsoft.com/en-us/updates/

Preview feature caveats



May be limited to specific regions

Preview features are often at discounted pricing

May not have full GUI support

Different support policies than GA features

There are features that may stay in preview for extended periods of time:

Azure Data Sync

Azure SQL DB Query Editor

Lesson 4: Knowledge check

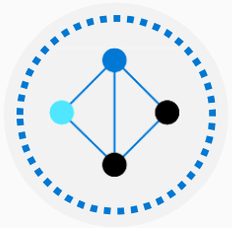
How to you get access to a private preview?

- [x] Gain access directly from Microsoft
- [ ] File a support case
- [ ] Check a box in the Azure Portal

Instructor led labs: Building an Azure VM

Create an Azure VM with SQL Server

Restore a database backup to SQL Server



Interact with the Azure Portal

Module summary

Understand the role of the Azure Database Administrator:

Understand the other Azure Data Platform roles

SQL Server in Azure Virtual Machine:

Overview of the Azure service

Azure SQL Database Managed Instance:

Learn about the benefits of PaaS database services

Understand the service tiers of Managed Instance

Azure SQL Database:

Understand Azure SQL Database service offerings

Azure Database open source options

SQL Sever Compatibility Level:

Understand the impact of changing compatibility level

Learn about the Microsoft support policies

Azure Preview Features:

Understand the benefits and restrictions of Azure preview features

References

Frequently asked questions for SQL Server running on Windows virtual machines in Azure:
https://docs.microsoft.com/en-us/azure/virtual-machines/windows/sql/virtual-machines-windows-sql-server-iaas-faq

What is Azure SQL Database managed instance?
https://docs.microsoft.com/en-us/azure/sql-database/sql-database-managed-instance

What is the Azure SQL Database service?
https://docs.microsoft.com/en-us/azure/sql-database/sql-database-technical-overview

Thanks!

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