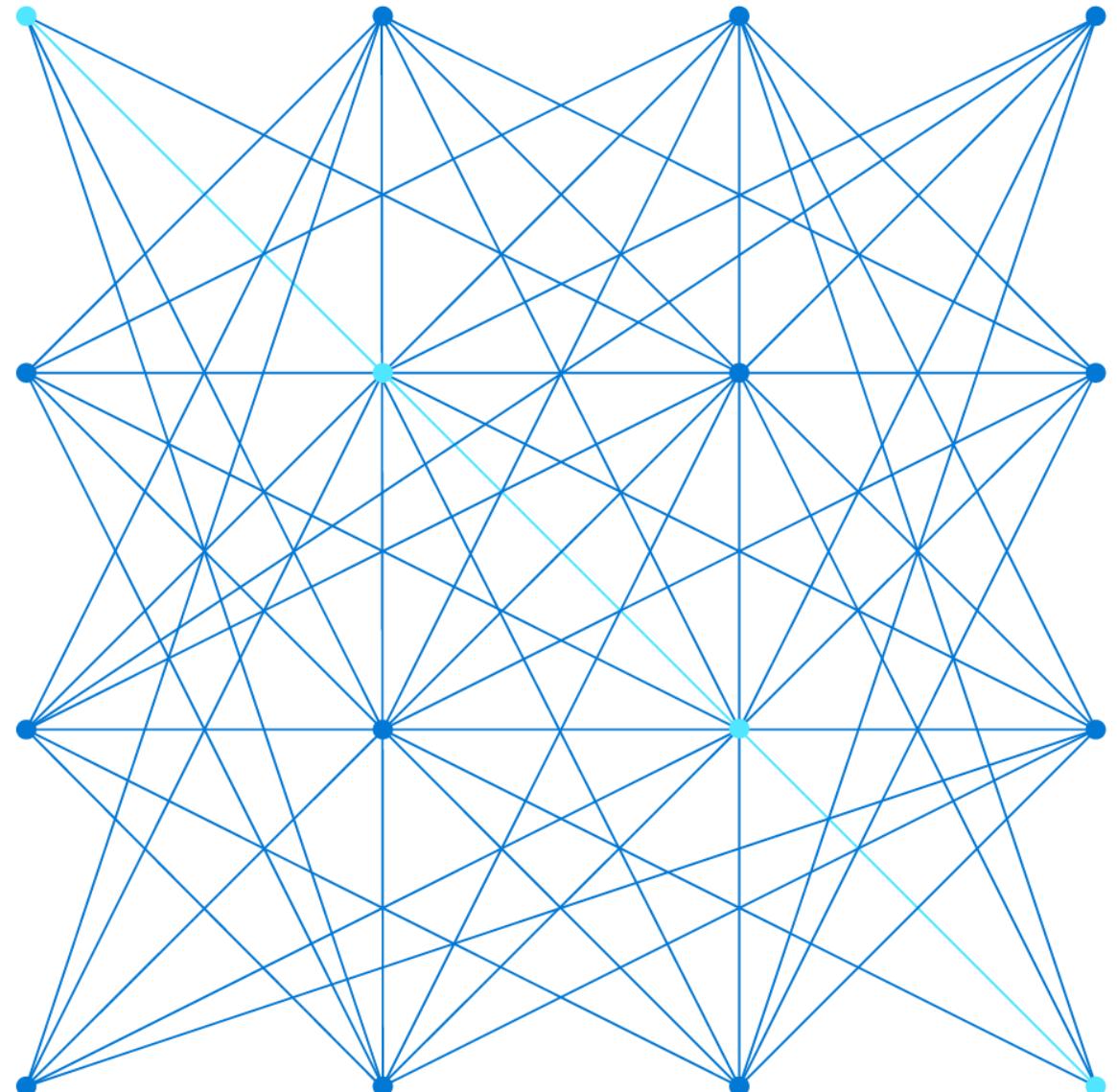


AZ-500

Microsoft Azure Security Technologies



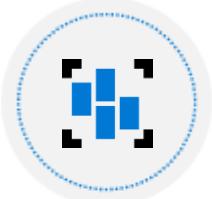
AZ-500 Agenda



Learning Path 1 Identity and Access



Learning Path 2 Implement Platform Protection



Learning Path 3 Data and Application Security



Learning Path 4 Security Operations

Learning Path: Data and Application Security



Azure Key Vault



Storage Security



Database Security

SQL



Module Labs

soft KV
hard KV

OTI

Bring your own key!

Azure Key Vault



Azure Key Vault



Azure Key Vault Features



Key Vault Access



Key Vault Example



Key Vault Certificates

X.509
~~PEM~~



Key Vault Keys

RSA, EC

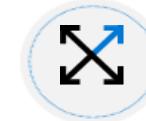


Customer Managed Keys

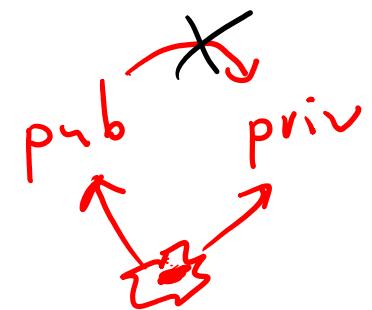


Key Vault Secrets

password
connection string



Key Rotation



3 · 5

15 =

Azure Key Vault Overview

Increase security and control over keys and passwords

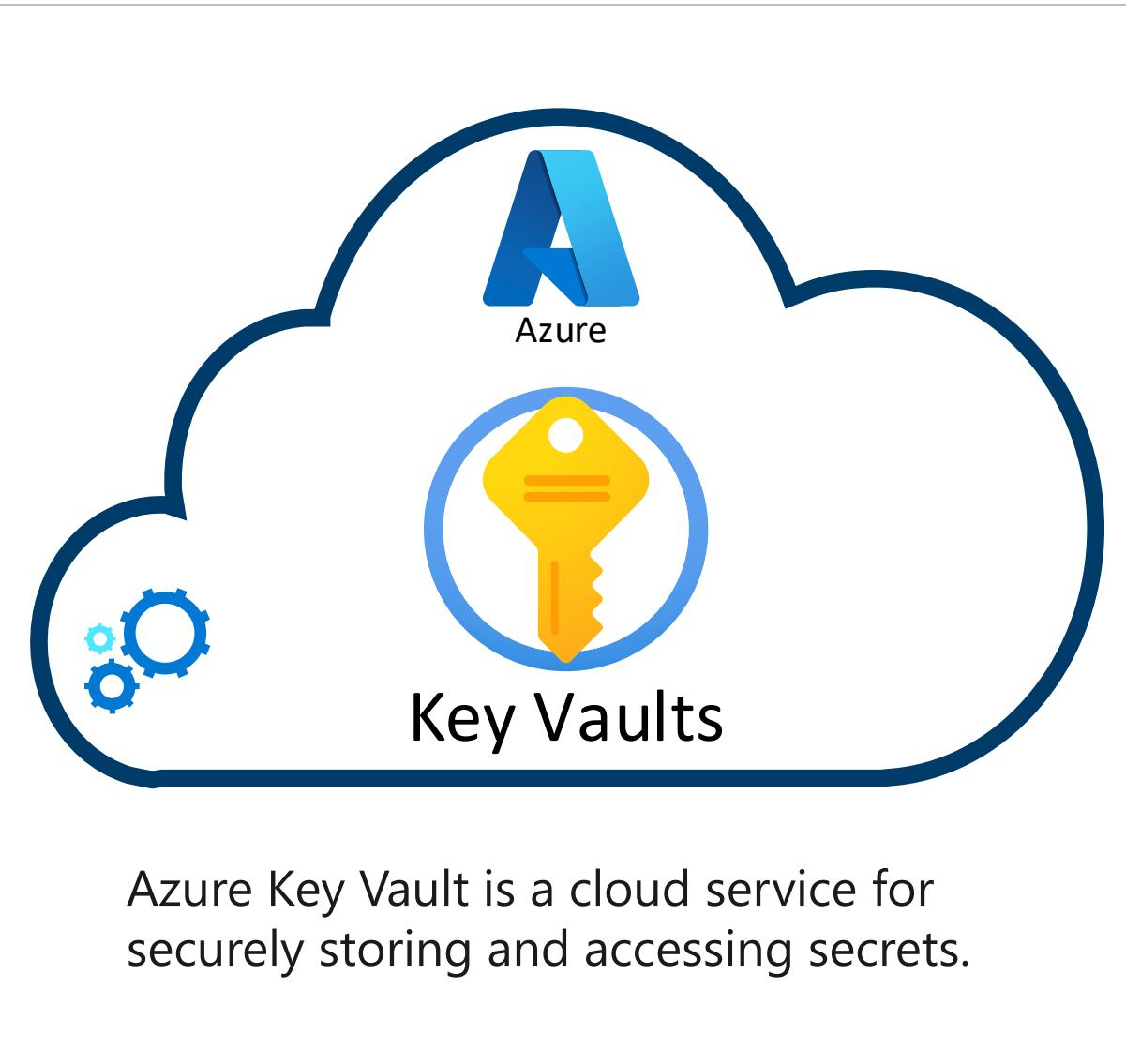
Use Federal Information Processing Standard (FIPS) 140-2 and Level 3 validated hardware security modules (HSMs)

Create and import encryption keys in minutes

Reduce latency with cloud scale and global redundancy

Applications have no direct access to keys

Simplify and automate tasks for SSL/TLS certificates



Azure Key Vault Cryptographic Keys

Resource type	Key protection methods	Data-plane base URL
Vaults	Software-protected and HSM-protected (with Premium SKU)	https://{{vault-name}}.vault.azure.net
Managed HSMs	HSM-protected	https://{{hsm-name}}.managedhsm.azure.net

Note: Vaults also allow you to store and manage several types of objects like secrets, certificates and storage account keys, in addition to cryptographic keys.

Key Types and Protection Methods

HSM-protected keys

Key type	Vaults (Premium SKU only)	Managed HSMs
EC-HSM: Elliptic Curve key	Supported (P-256, P-384, P-521, P-256K)	Supported (P-256, P-256K, P-384, P-521)
RSA-HSM: RSA key	Supported (2048-bit, 3072-bit, 4096-bit)	Supported (2048-bit, 3072-bit, 4096-bit)
oct-HSM: Symmetric key	Not supported	Supported (128-bit, 192-bit, 256-bit)

Software-protected keys

Key type	Vaults	Managed HSMs
RSA: "Software-protected" RSA key	Supported (2048-bit, 3072-bit, 4096-bit)	Not supported
EC: "Software-protected" Elliptic Curve key	Supported (P-256, P-384, P-521, P-256K)	Not supported

Key Types and Protection Methods (cont'd)

Compliance

Key type and destination	Compliance
Software-protected keys in vaults (Premium & Standard SKUs)	FIPS 140-2 Level 1
HSM-protected keys in vaults (Premium SKU)	FIPS 140-2 Level 2
HSM-protected keys in Managed HSM	FIPS 140-2 Level 3

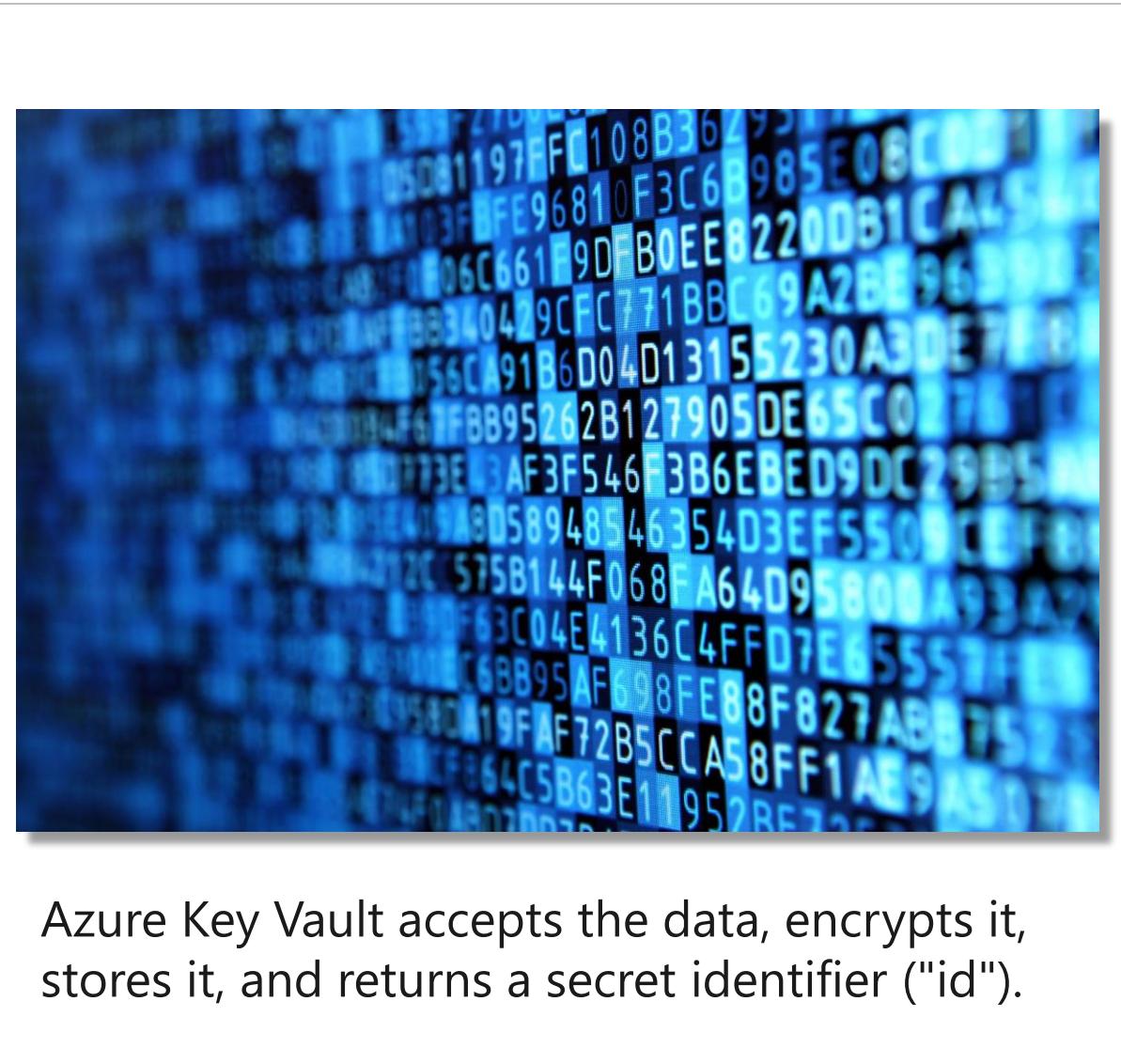
Azure Key Vault Secrets

All secrets in Key Vault are stored encrypted.

Key Vault encrypts secrets at rest with a hierarchy of encryption keys, all keys in that hierarchy are protected by modules that are FIPS 140-2 compliant.

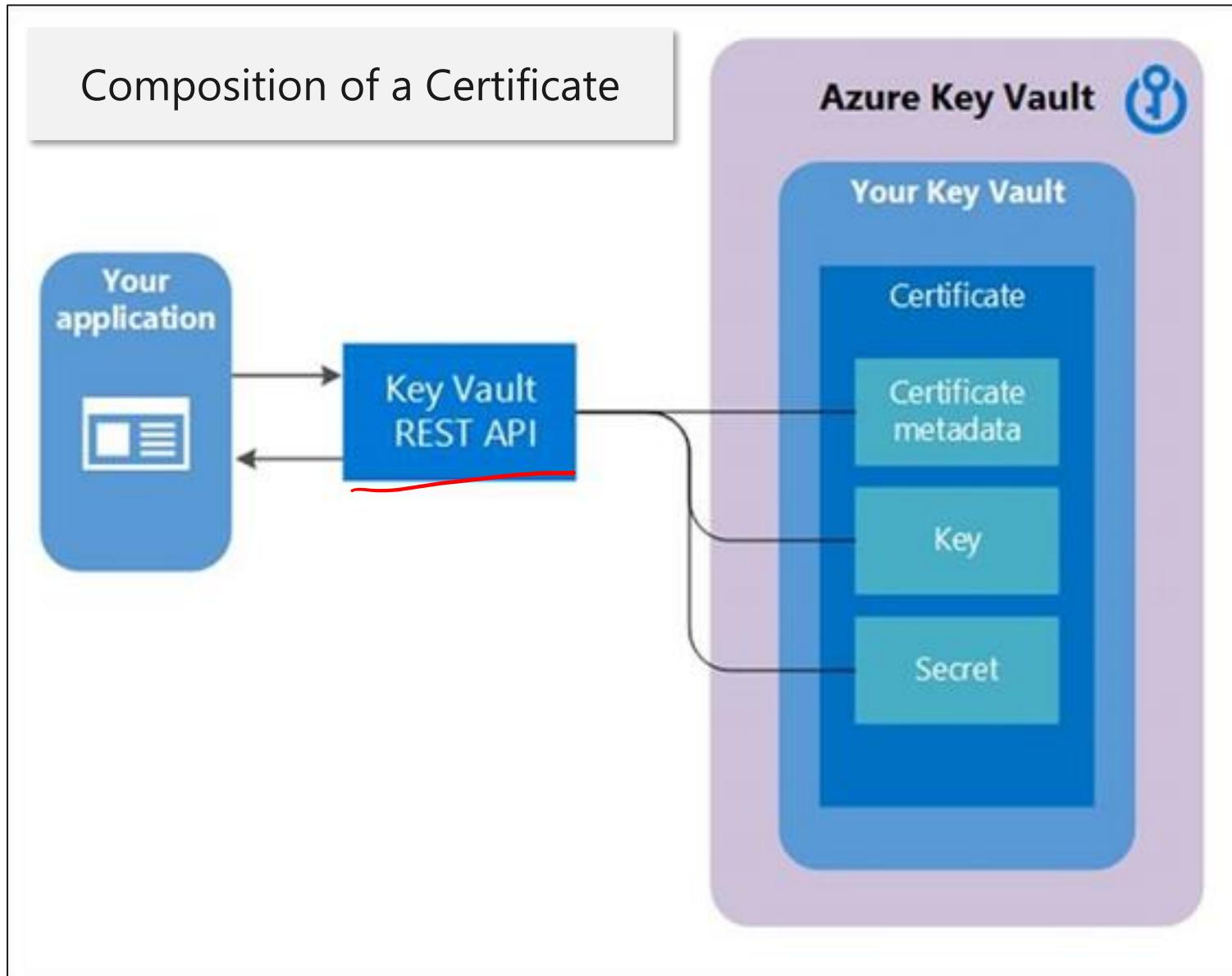
Encryption is transparent and requires no action from the user.

Azure Key Vault service encrypts your secrets when you add them and decrypts them automatically when you read them.

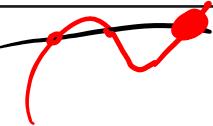


Azure Key Vault accepts the data, encrypts it, stores it, and returns a secret identifier ("id").

Azure Key Vault Certificates



Azure Key Vault Certificates - Exportable or Non-Exportable Key

Key type	About	Security
RSA	Software-protected RSA key <i>15 = 3 · 5</i>	FIPS-140-2 Level1
RSA-HSM <u> </u>	HSM-protected RSA key (Premium SKU only)	FIPS 140-2 Level 2 HSM
EC	Software-protected Elliptic Curve key 	FIPS 140-2 Level 1
EC-HSM <u> </u>	HSM-protected Elliptic Curve key (Premium SKU only)	FIPS 140-2 Level 2 HSM

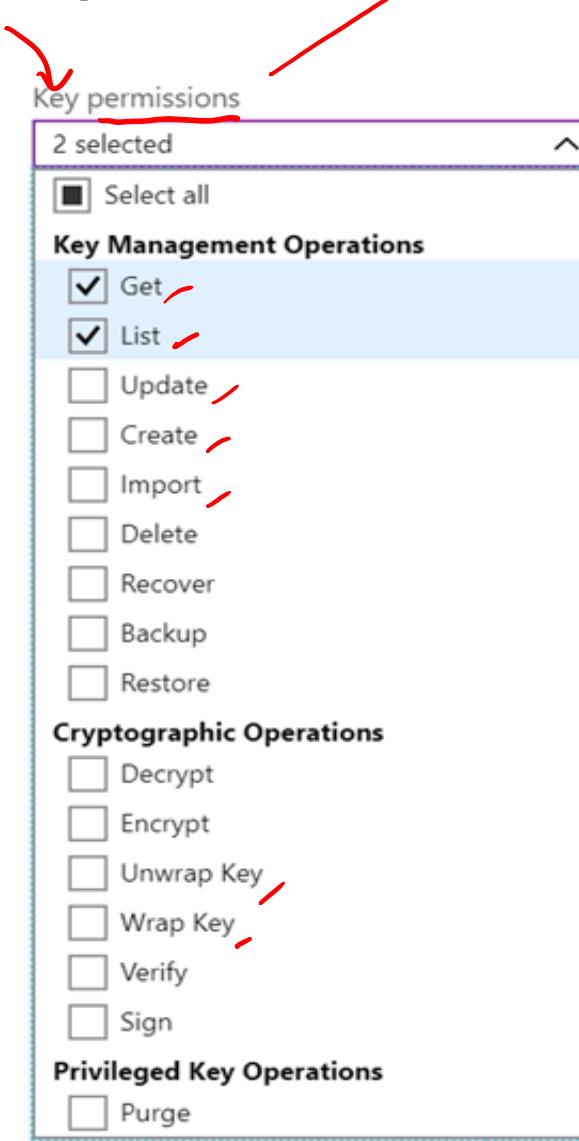
Azure Key Vault Keys (cont'd)

Role (Owner)

Soft (Key vault) and Hard (HSM) keys

Supports operations like create, delete, update, and list

Supports cryptographic operations like sign and verify, key encryption/wrapping, and encrypt and decrypt

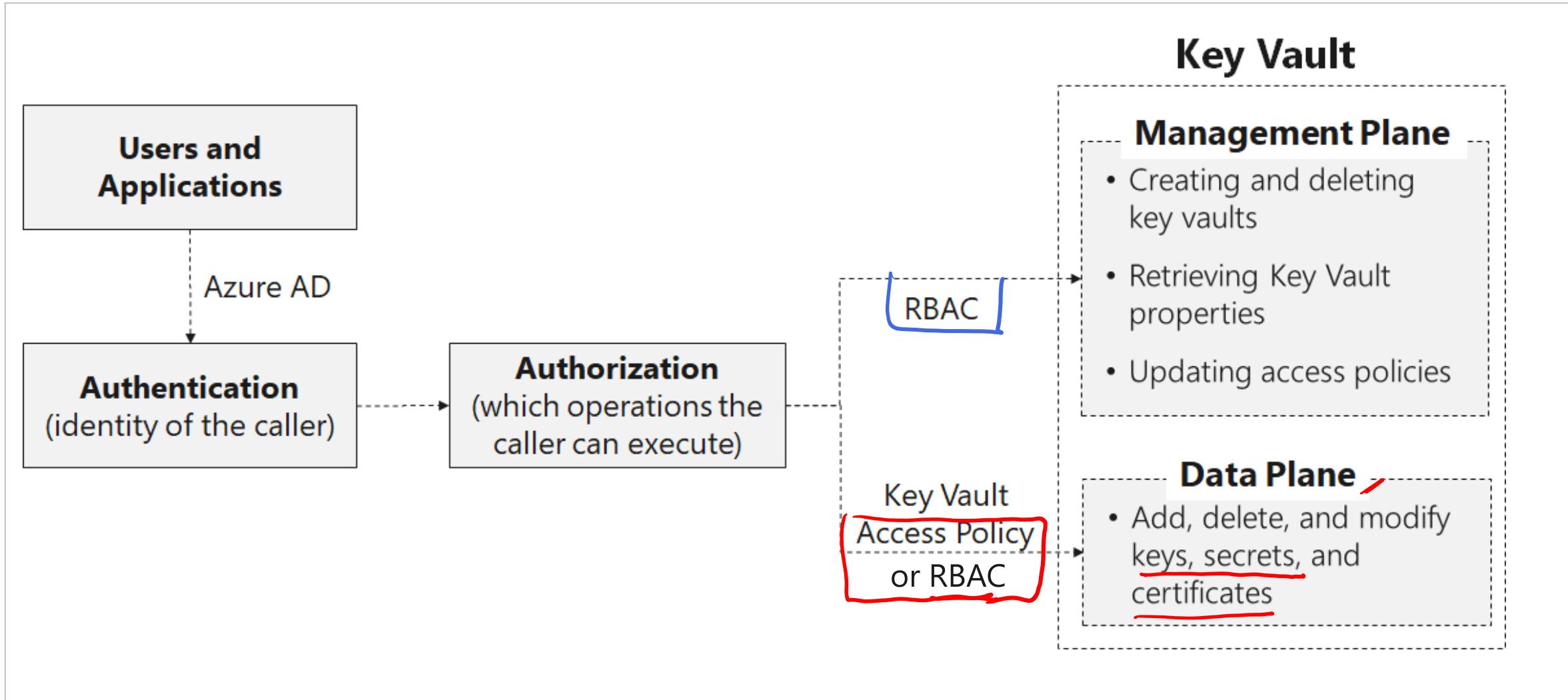


Supports secure transfer of existing keys in Bring Your Own Key (BYOK) scenarios

Premium supports HSM-protected keys

RSA and Elliptic Curve

Key Vault Access



Key Vault Example

SSL certificate for SSL

Storage key for access the Storage account

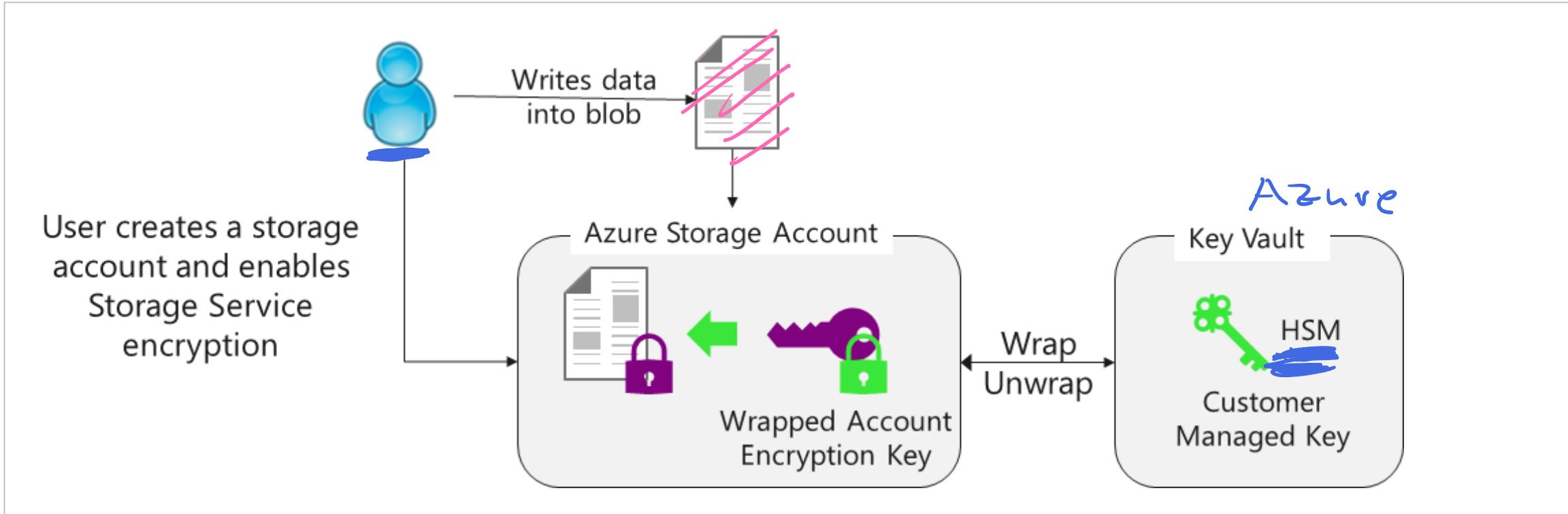
RSA 2,048-bit key for sign in operations

Bootstrap certificate for authentication to Azure AD



Role	Management Plane	Data plane
Security team	Key Vault Contributor	Keys: backup, create, delete, get, import, list, restore Secrets: all operations
Developers and operators	Key Vault deploy permission	None
Auditors	None	Keys: list Secrets: list
Application	None	Keys: sign Secrets: get

Customer Managed Keys



Update keys and secrets without affecting applications

Updates can be manual, programmatic, or automated

Key Vault Secrets

Name-value pair

Name must be unique in the vault

Value can be any UTF-8 string – max
25 KB in size

Manual or certificate creation

Home > Key vaults > AZ500DemoKeyVault | Secrets > Create a secret

Create a secret

Upload options

Manual

Upload options

Manual

Manual

Certificate

Name * (i)

Value * (i)

Enter the secret.

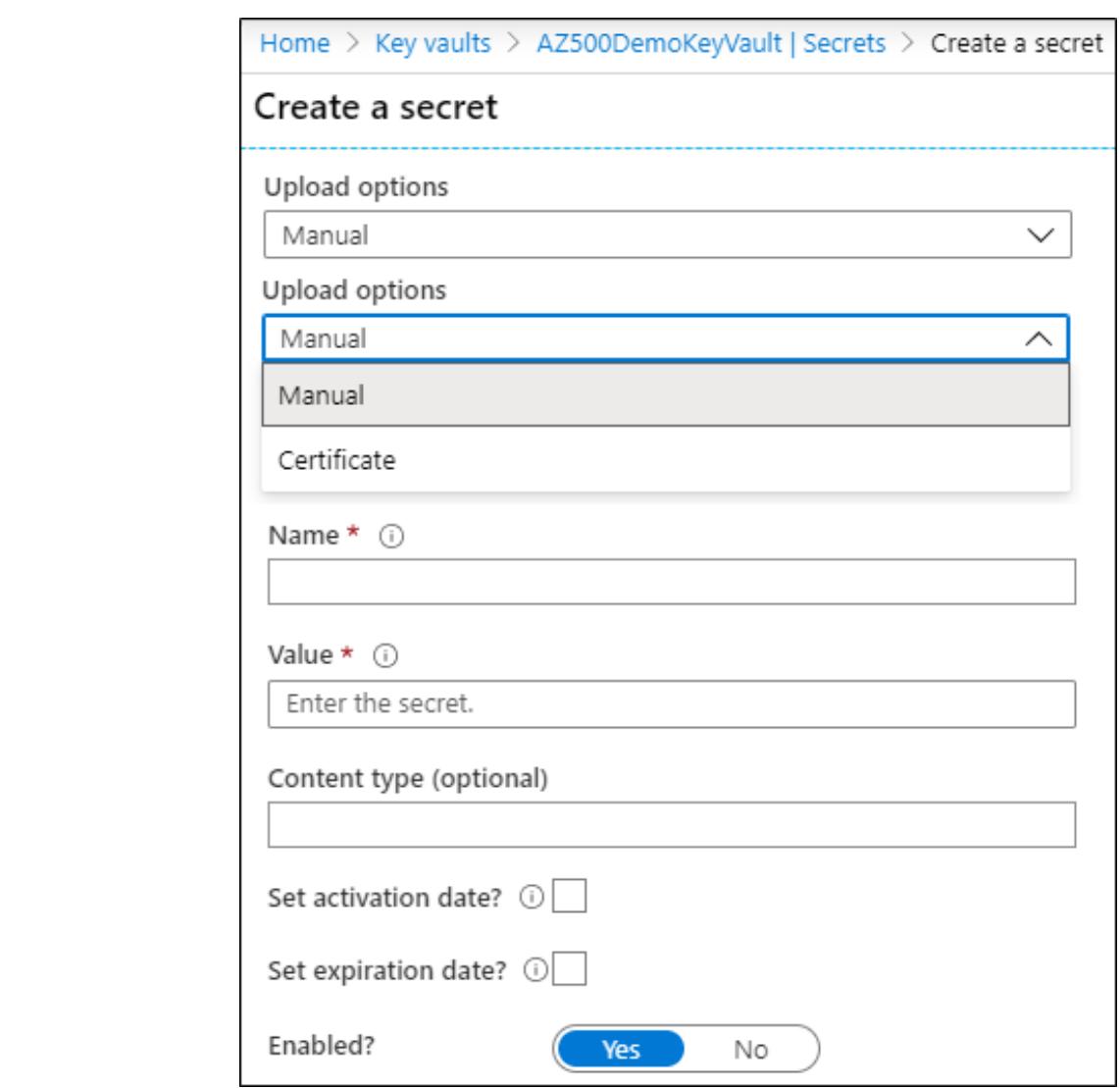
Content type (optional)

Set activation date? (i)

Set expiration date? (i)

Enabled?

Yes No

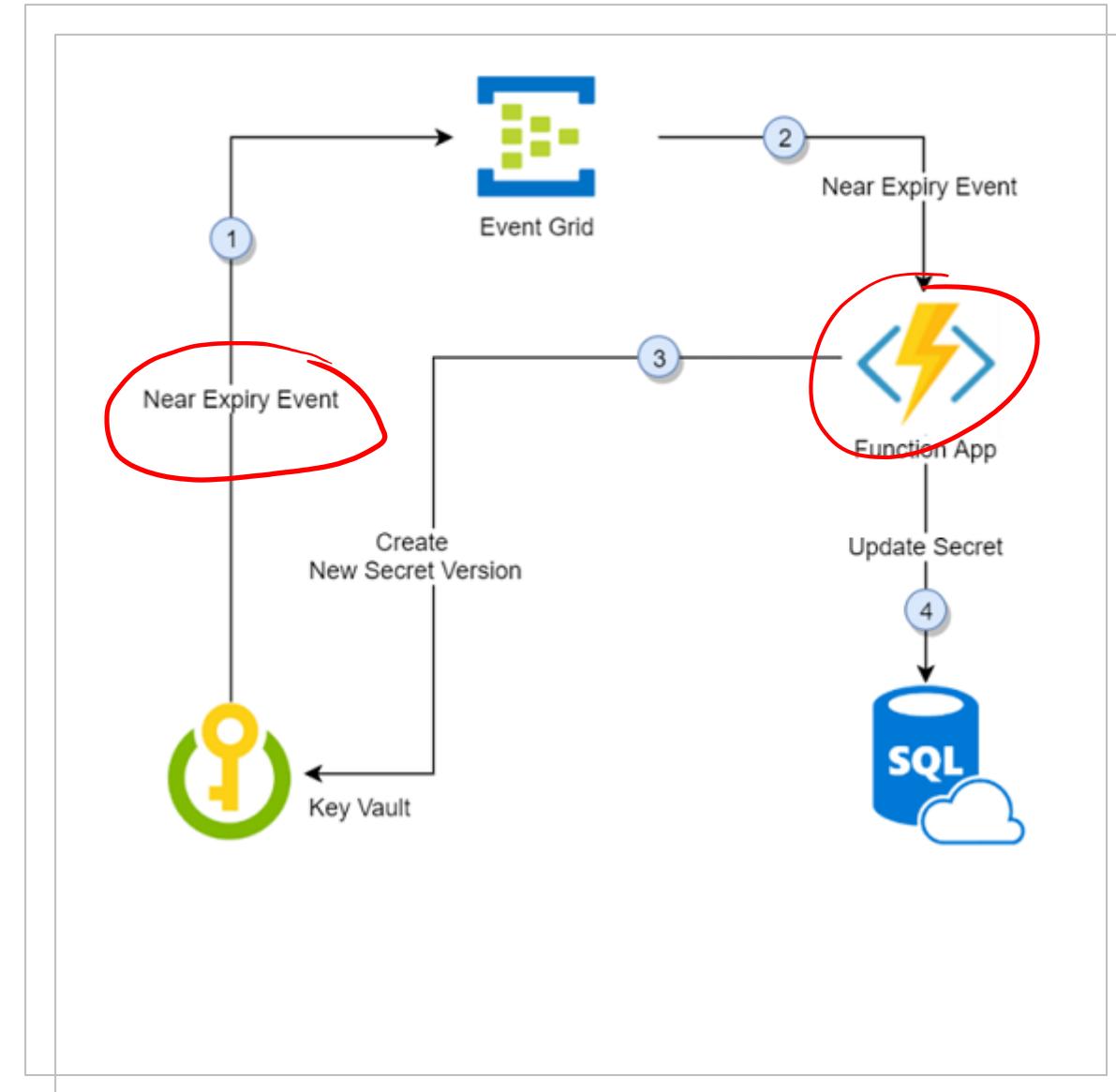


Key and Secret Rotation

Update keys and secrets without affecting your application

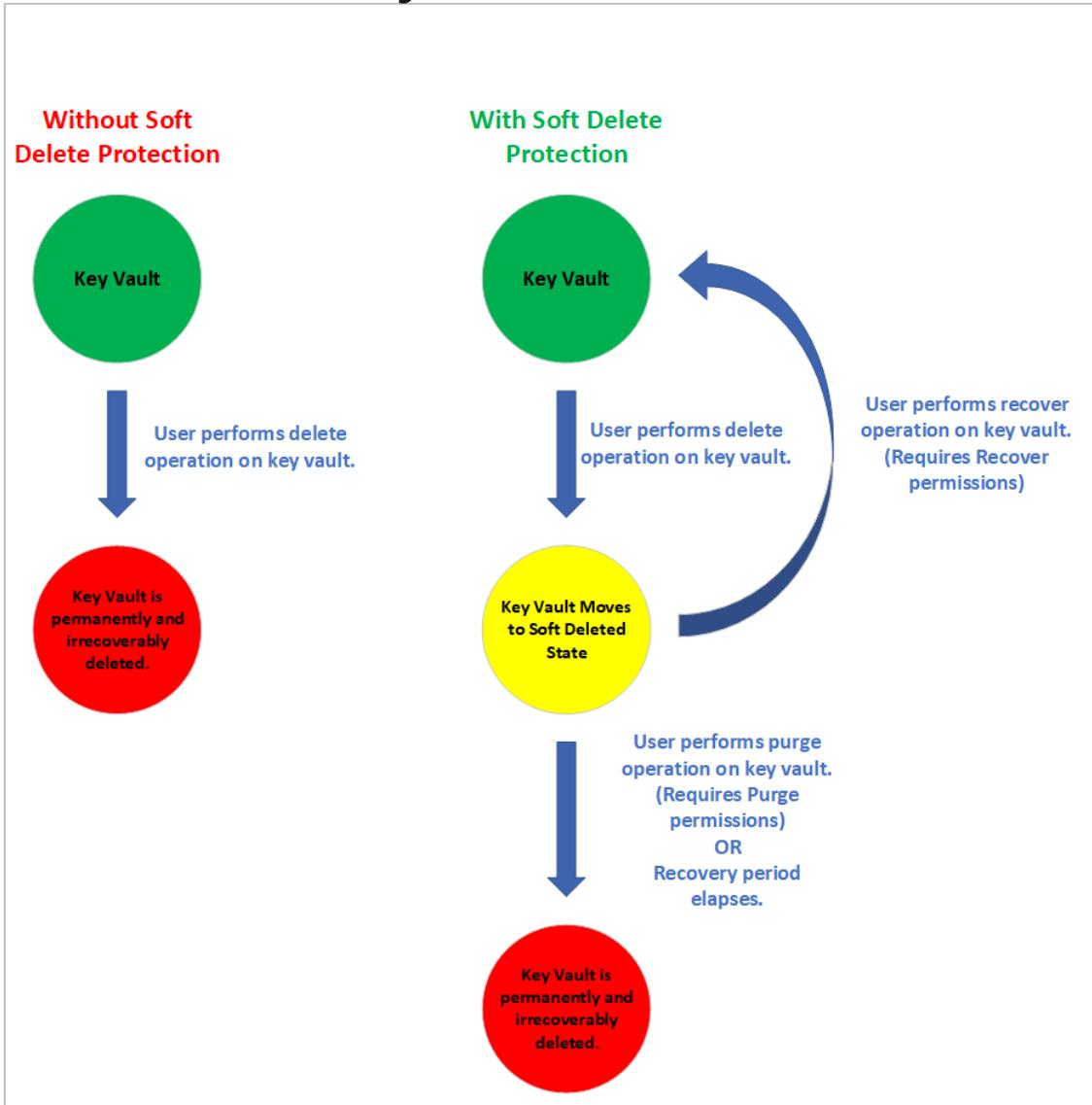
Rotate keys and secrets in several ways:

- As part of a manual process
- Programmatically with the REST API
- With an Azure Automation script



Key Vault Safety and Recovery Features

Key Vault Soft-delete



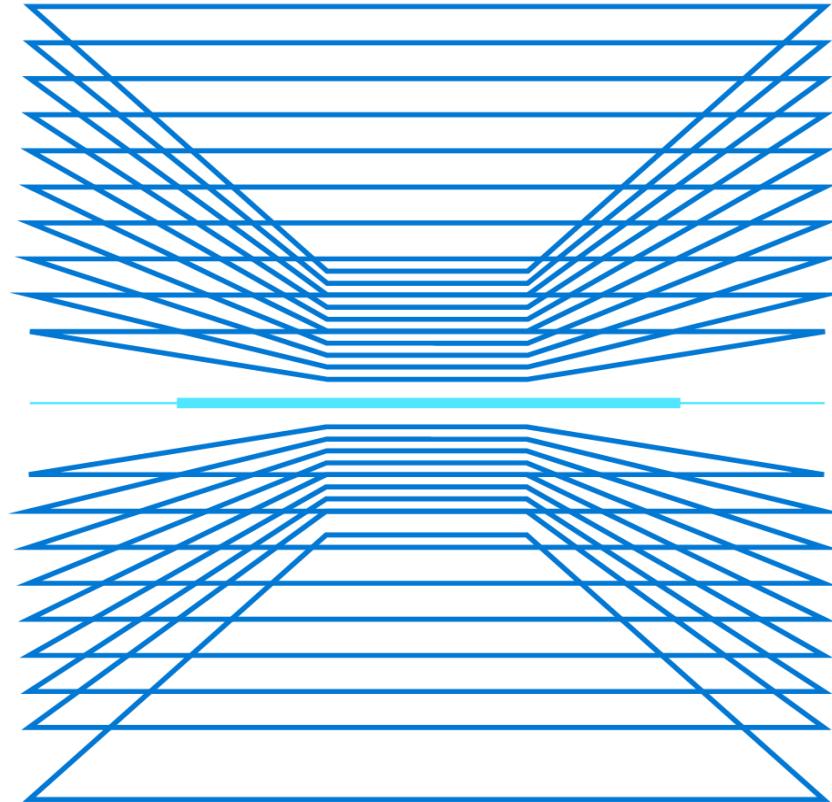
Key Vault Backup

A screenshot of the Azure Key Vault interface showing the 'test' key vault. The navigation path is Home > Key vaults > new-primary-vault | Keys > test. The 'Versions' tab is selected. At the top right, there are buttons for New Version, Refresh, Delete, and Download Backup, with 'Download Backup' highlighted by a red box. Below the buttons, the 'Version' and 'Status' columns are shown. The 'CURRENT VERSION' row contains the value 'f3c!' and a checked 'Enabled' status. The 'OLDER VERSIONS' row contains the value '0ee11' and a checked 'Enabled' status.

Version	Status
CURRENT VERSION f3c!	✓ Enabled
OLDER VERSIONS 0ee11	✓ Enabled

Demonstrations: Azure Key Vault

- Create a Key Vault
- Review Key Vault settings
- Configure access policies



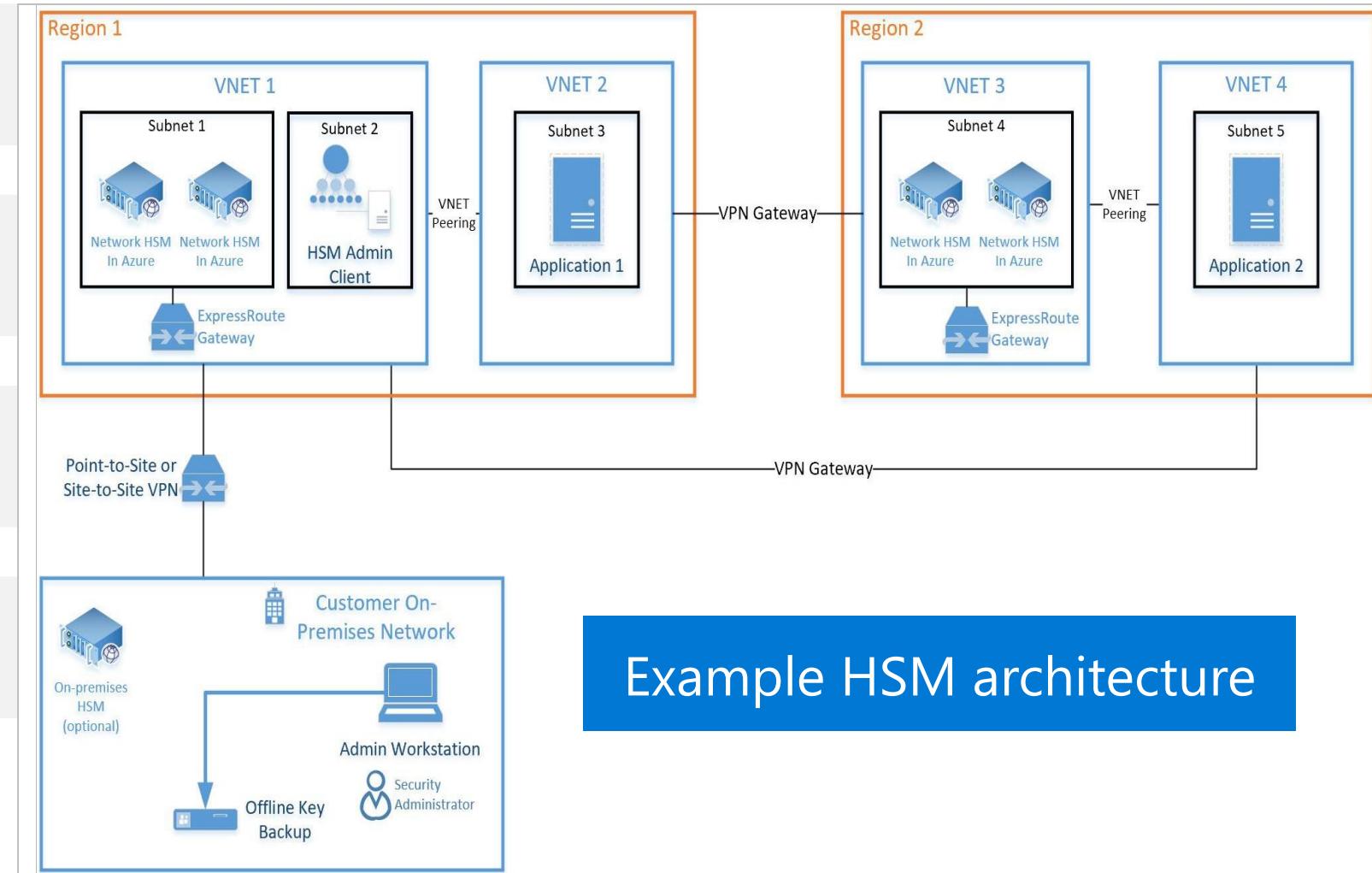
Azure Dedicated HSM (Hardware Security Module)

FIPS 140-2 Level-3 compliant

Dedicated / Single device

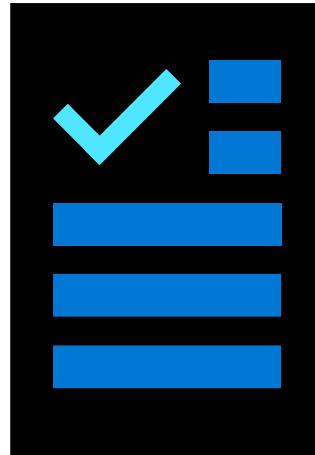
Thales Luna 7 HSM model A790

Unique cloud-based offering from Azure



Additional Study – Azure Key Vault

Module Review Questions



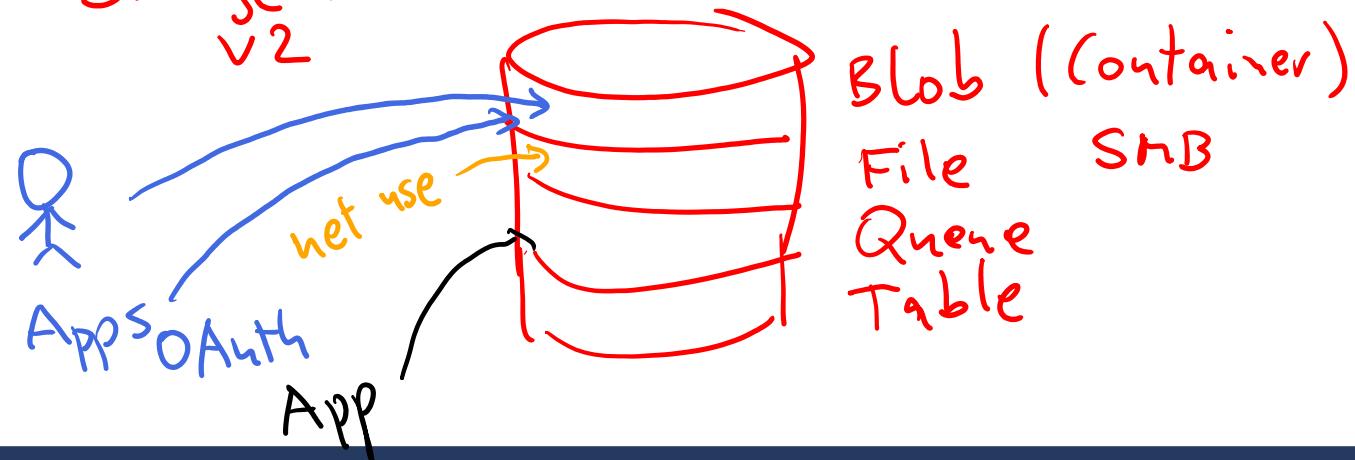
Microsoft Learn Modules (docs.microsoft.com/Learn)

Introduction to securing data at rest on Azure

Manage secrets in your server apps with Azure Key Vault (Exercise)

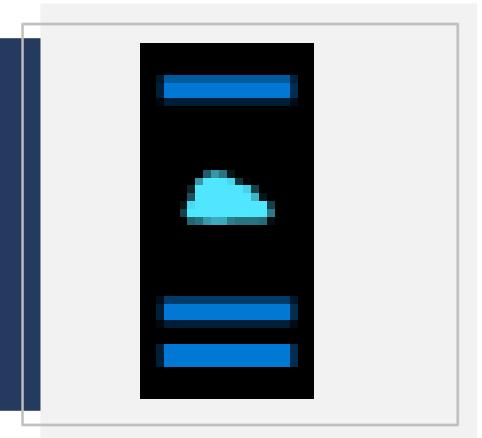
Configure and manage secrets in Azure Key Vault (Exercise)

GP Storage Account v2



Role RBAC
Connection String
Key
SMB 3

Storage Security



Storage Security



Data Sovereignty



Azure Storage Access



Shared Access Signatures



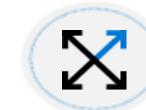
Azure AD Storage Authentication



Storage Service Encryption



Blob Data Retention Policies



Azure Files Authentication



Secure Transfer Required

Data Sovereignty

Physical isolation

Platform-provided replication

Region recovery order

Sequential updates

Data residency

Geography

Regional Pair

Region



Datacenter(s)

Region



Datacenter(s)

Facilitates compliance
with data location laws

Azure Storage Access

Every storage request must be authorized. There are various authorization methods, including anonymous.

Azure artifact	Shared Key (storage account key)	Shared access signature (SAS)	Azure Active Directory (Azure AD) Roles	On-premises Active Directory Domain Services	Anonymous public read access
Azure Blobs	Supported ✓	Supported	Supported ✓	Not Supported	Supported ✗
Azure Files (SMB)	Supported ✓	Not Supported ✗	Supported, only with AAD Domain Services ✓	Supported, credentials must be synced to Azure AD	Not Supported
Azure Files (REST)	Supported ✓	Supported	Supported ✓	Not Supported	Not Supported
Azure Queues	Supported ✓	Supported	Supported ✓	Not Supported	Not Supported
Azure Tables	Supported ✓	Supported	Supported ✓	Not Supported	Not Supported

Shared Access Signatures

Digitally signed URIs of target storage resources

Grants access to clients without sharing your storage account keys

SAS types:

- Account – multiple storage service
- Service – single storage service
- User delegation – blob only

Configure permissions, start/expiry times, IP addresses, and allowed protocols

Home > Storage accounts > mystorageaccount3182021 > mycontainer31921

mycontainer31921 | Shared access signature ...

A shared access signature (SAS) is a URI that grants restricted access to an Azure Storage container. Use it when you want to share your storage data with others without sharing your storage account keys.

Signing method

Account key User delegation key

Signing key i
Key 1 ▼

Permissions * i
Read ▼

Start and expiry date/time i

Start
03/19/2021 ▼ 11:06:37 AM
(UTC-08:00) Pacific Time (US & Canada) ▼

Expiry
03/19/2021 ▼ 7:06:37 PM
(UTC-08:00) Pacific Time (US & Canada) ▼

Allowed IP addresses i
for example, 168.1.5.65 or 168.1.5.65-168.1....

Allowed protocols i
 HTTPS only HTTPS and HTTP

Generate SAS token and URL

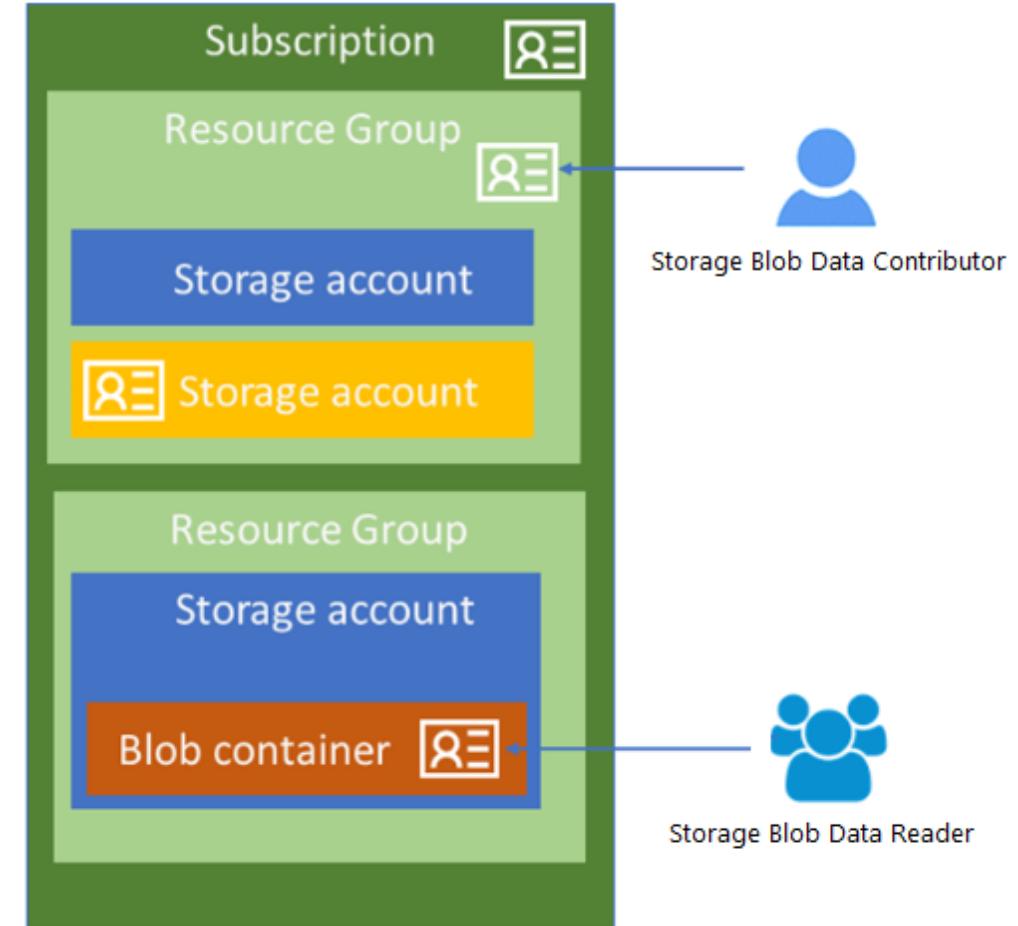
Azure AD Storage Authentication

Available for Blob and Queue storage

Several built-in roles including Data Owner, Data Contributor, and Data Reader

Two-step process: authentication (token returned) and then authorization

Scope from Management Group down to individual blob or queue



Blob Data Retention Policies

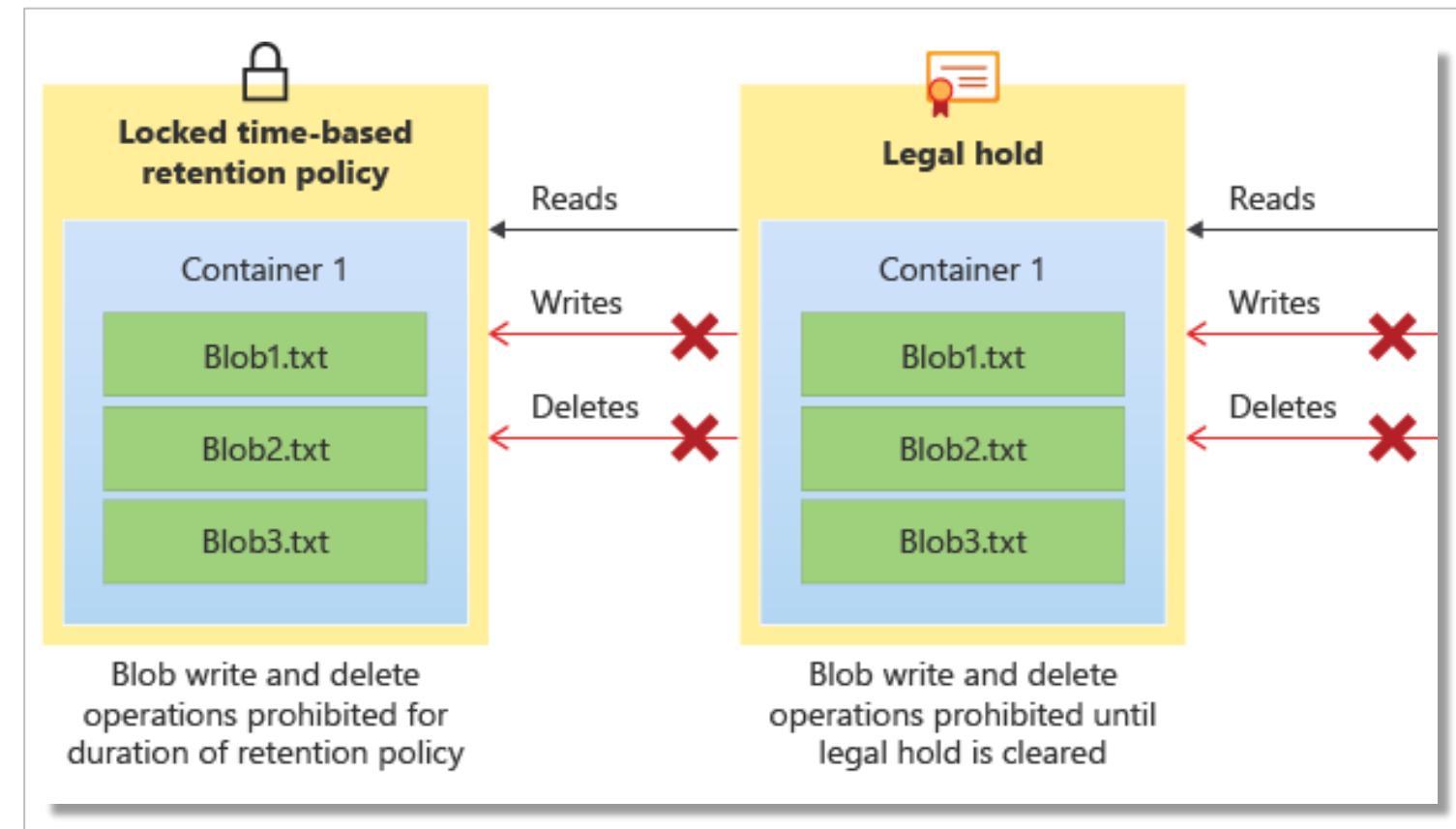
Data recovery and disposal rules

Time-based retention for a specified interval (days)

Legal-hold retention based on tags
– no editing or deleting of the content

Container policies apply to all existing and new content

Supports audit logging



Time-based Retention Policies

Immutable blob storage

Policy type ⓘ

Time-based retention

Set retention period for * ⓘ

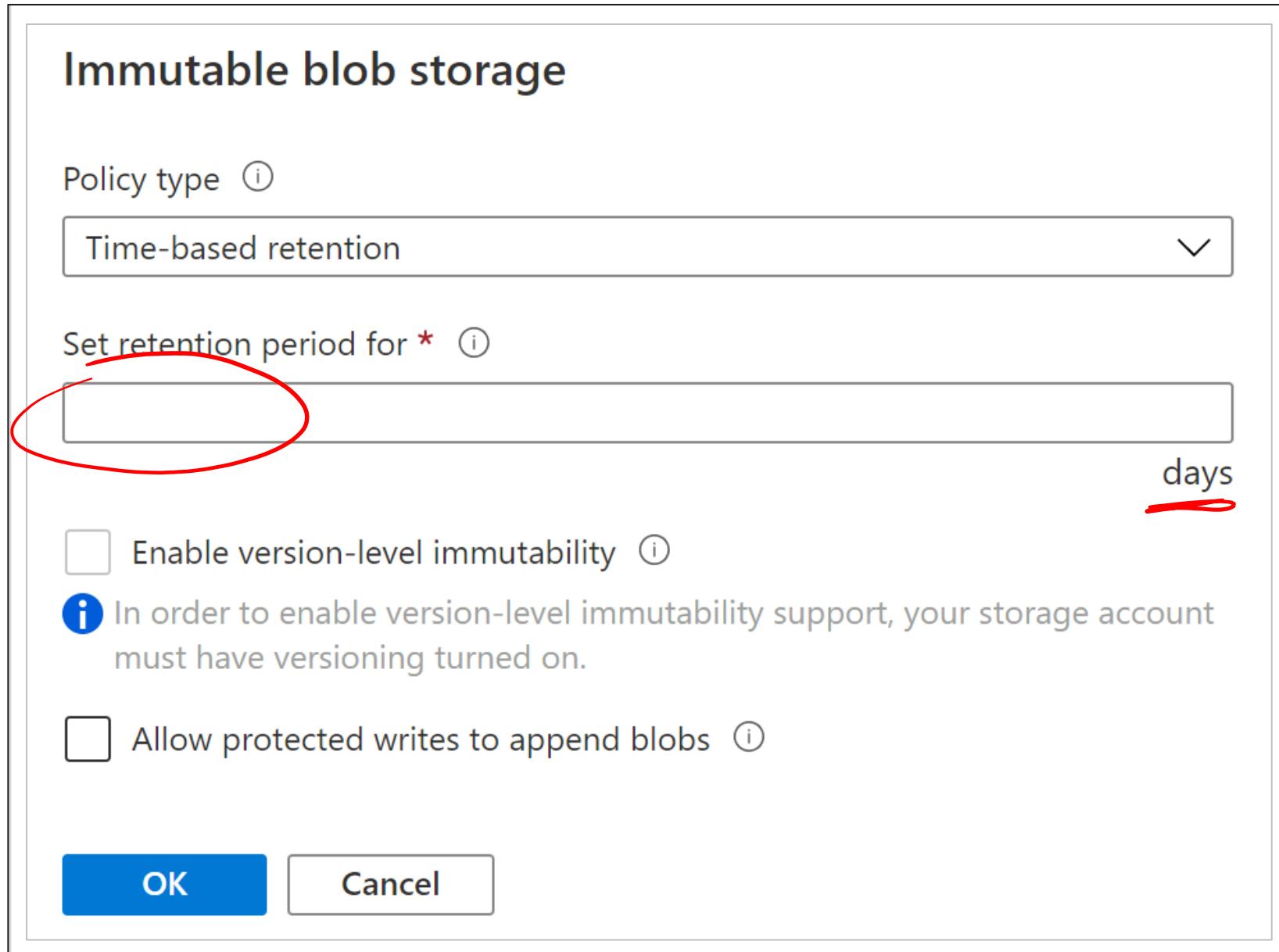
days

Enable version-level immutability ⓘ

i In order to enable version-level immutability support, your storage account must have versioning turned on.

Allow protected writes to append blobs ⓘ

OK **Cancel**



Legal Hold Policies

Immutable blob storage

Policy type i

Legal hold



- i** Each legal hold policy needs to be associated with 1 or more tags. Tags are used as a name identifier, such as a case ID, to categorize and view records. Retention policy changes may require some time to take effect.
- [Learn more about immutable blob storage ↗](#)

Tag

Add tag

OK

Cancel

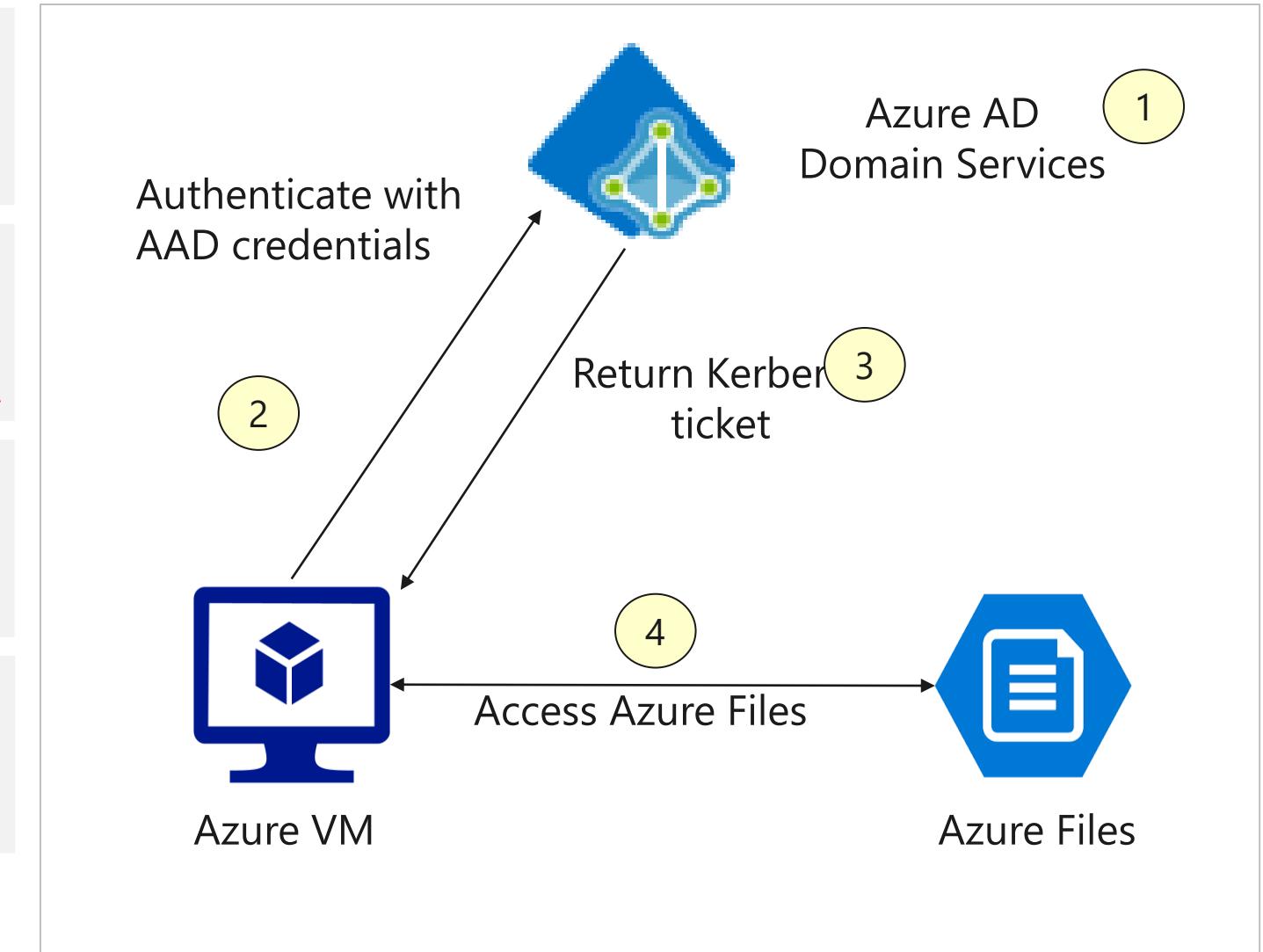
Azure Files Authentication

Enable identity-based authentication

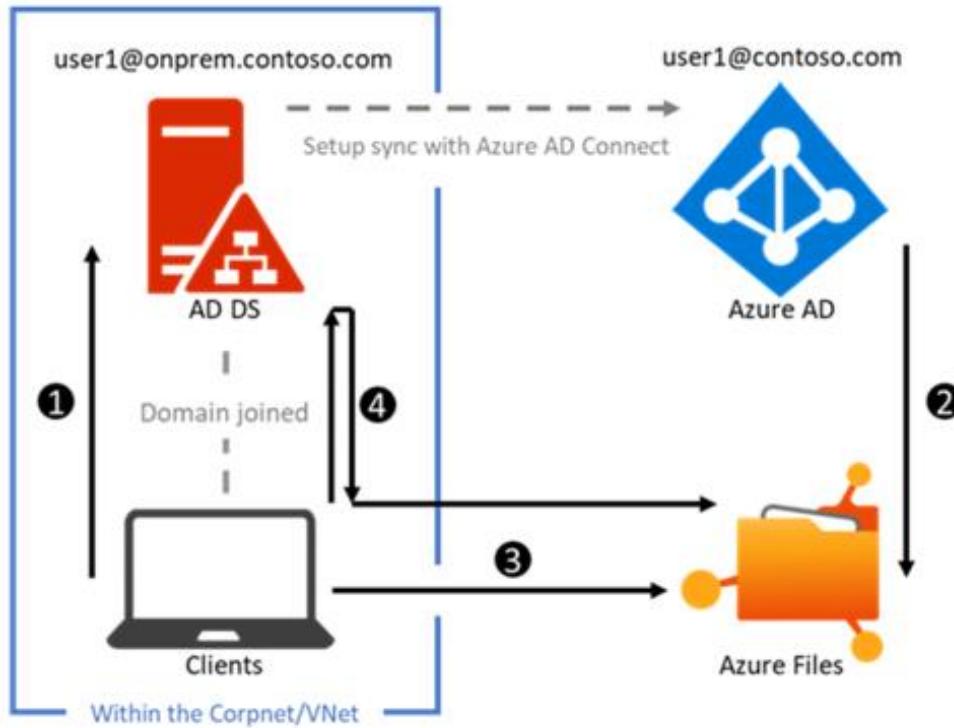
Use Azure AD DS or on-premises AD DS

Use RBAC roles to assign access rights to the file shares

Enforces standard Windows file permissions at both the directory and file level



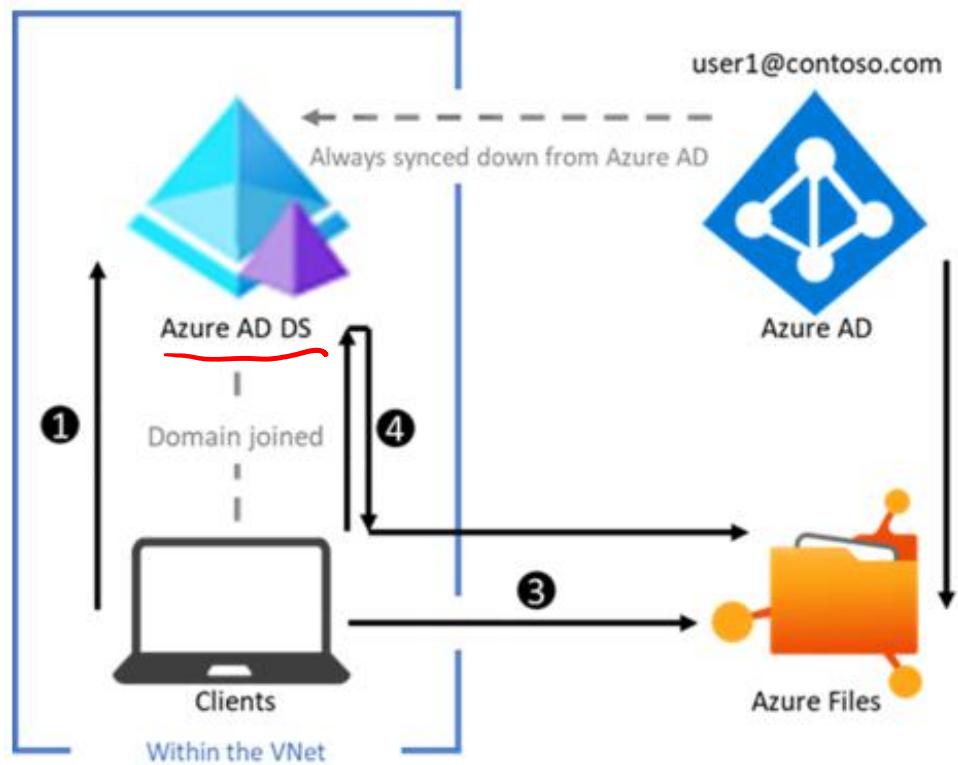
Azure Files Authentication – AD DS



- ① Enable Azure Files on-prem AD DS authentication including creating an AD identity to represent the storage account
- ② Assign the Azure AD identity that was synced from AD on share level permission to Azure Files (for example: `user1@contoso.com`)
- ③ Mount Azure Files with storage account key and configure directory/file level permissions (Windows DACLs) to the AD identity (for example: `user1@onprem.contoso.com`)
- ④ Access Azure Files using AD credentials by first authenticating against AD DS and sending the Kerberos token to Azure Files for authorization

On-premises Active Directory Domain Service (AD DS)

Azure Files Authentication – Azure AD DS



- ① Enable Azure Files Azure AD DS authentication
- ② Assign the Azure AD identity on share level permission to Azure Files (for example: user1@contoso.com)
- ③ Mount Azure Files with storage account key and configure directory/file level permissions (Windows DACLs) to the Azure AD identity
- ④ Access Azure Files using Azure AD credentials by first authenticating against Azure AD DS and sending the Kerberos token to Azure Files for authorization

Azure Active Directory Domain Services (Azure AD DS)

Secure Transfer Required

Integrate storage account with a Content Delivery Network (CDN)

Storage account connections must be secure (HTTPs)

HTTPs for custom domain names not supported

Azure Files connections require encryption (SMB)

Existing Account

The screenshot shows the 'Configuration' blade for an existing Azure Storage account. At the top, there's a 'Storage account' icon and the word 'Configuration'. Below that is a search bar labeled 'Search (Ctrl+ /)'. On the right side, there are buttons for 'Save', 'Discard', and 'Refresh'. A scrollable list on the left contains 'Settings' and 'Configuration' items. On the right, under 'Secure transfer required', there are two radio button options: 'Disabled' (unselected) and 'Enabled' (selected). The 'Enabled' option is highlighted with a blue circle.

Storage account

Search (Ctrl+ /)

Settings

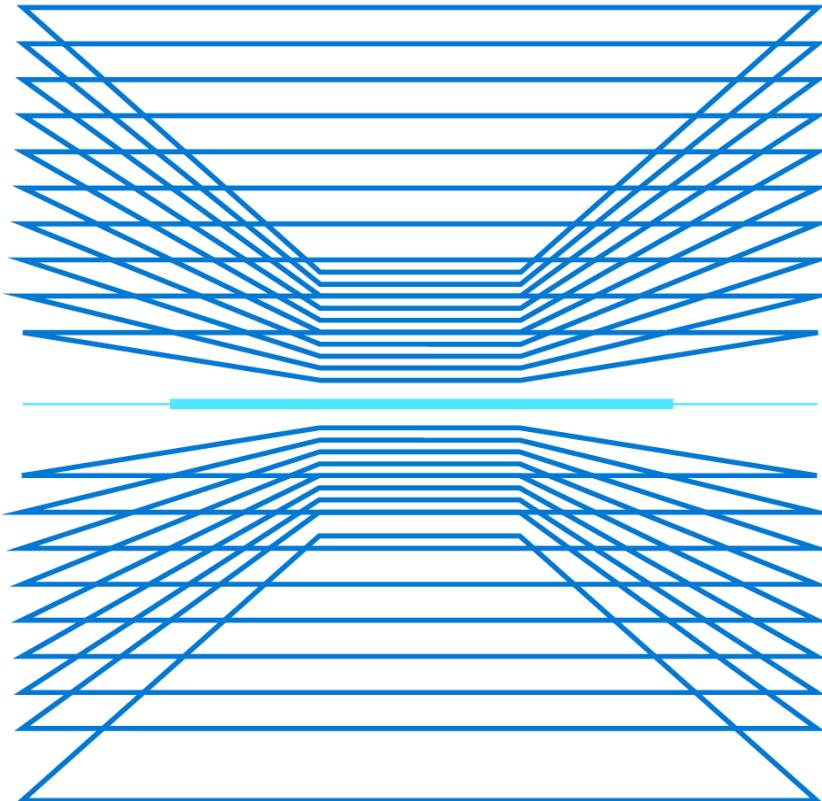
Configuration

Secure transfer required

Disabled Enabled

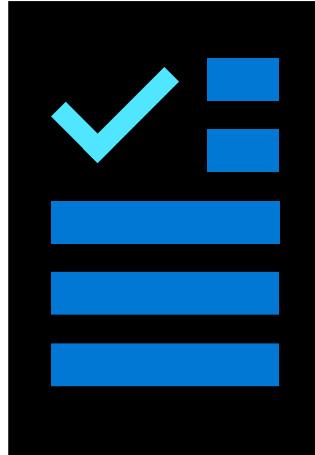
Demonstrations: Storage Security

- Generate SAS tokens
- Key rollover
- Storage access policies
- Azure AD user account authentication
- Storage endpoints



Additional Study – Storage Security

Module Review Questions



Microsoft Learn Modules (docs.microsoft.com/Learn)

Core Cloud Services - Azure data storage options

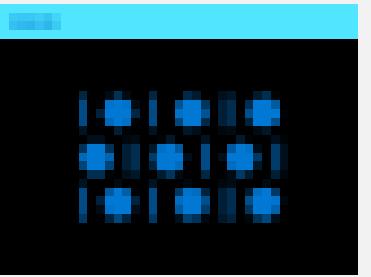
Create an Azure Storage account (Exercise)

Control access to Azure Storage with shared access signatures (Exercise)

Store and share files in your application with Azure Files (Exercise)

Secure your Azure Storage account

Database Security



Database Security

-  SQL Database Authentication
-  SQL Database Firewalls
-  Database Auditing
-  Data Discovery and Classification
-  Vulnerability Assessment
-  Advanced Threat Protection
-  Dynamic Data Masking
-  Transparent Data Encryption
-  Always Encrypted

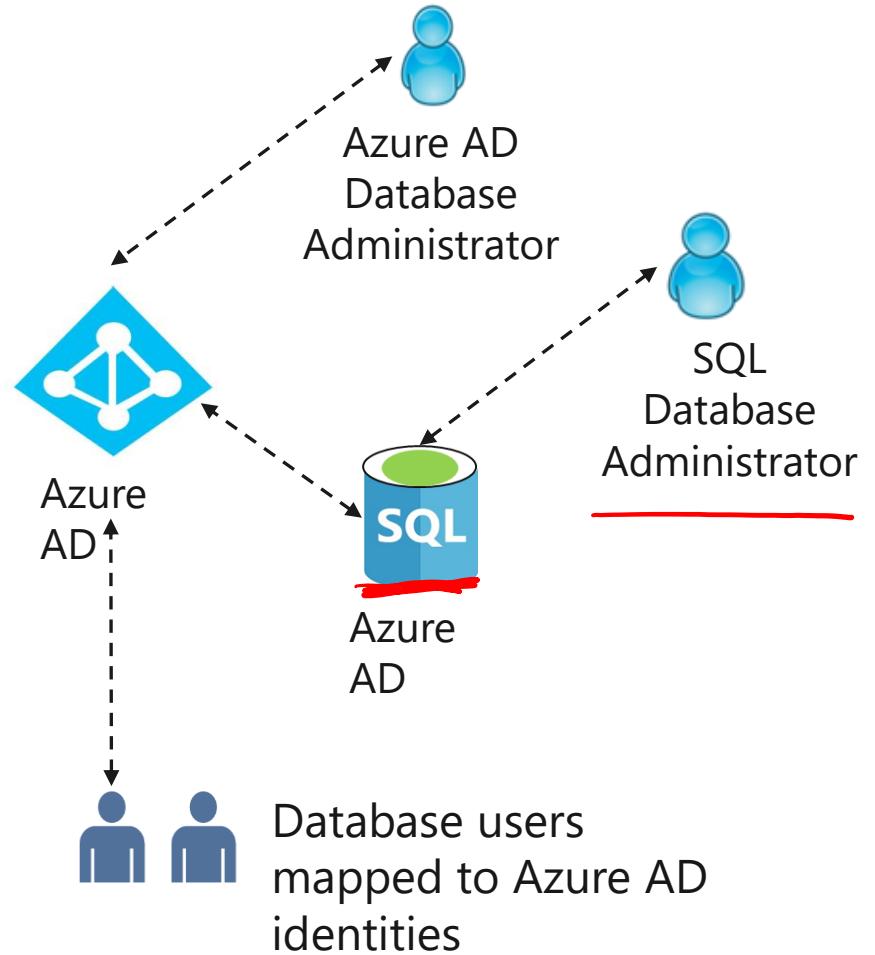
Azure AD Authentication for Azure SQL

An alternative to SQL Server authentication

Helps stop the proliferation of user identities across database servers

Allows password rotation in a single place

Customers can manage database permissions using external (Azure AD) groups



SQL Database Firewalls

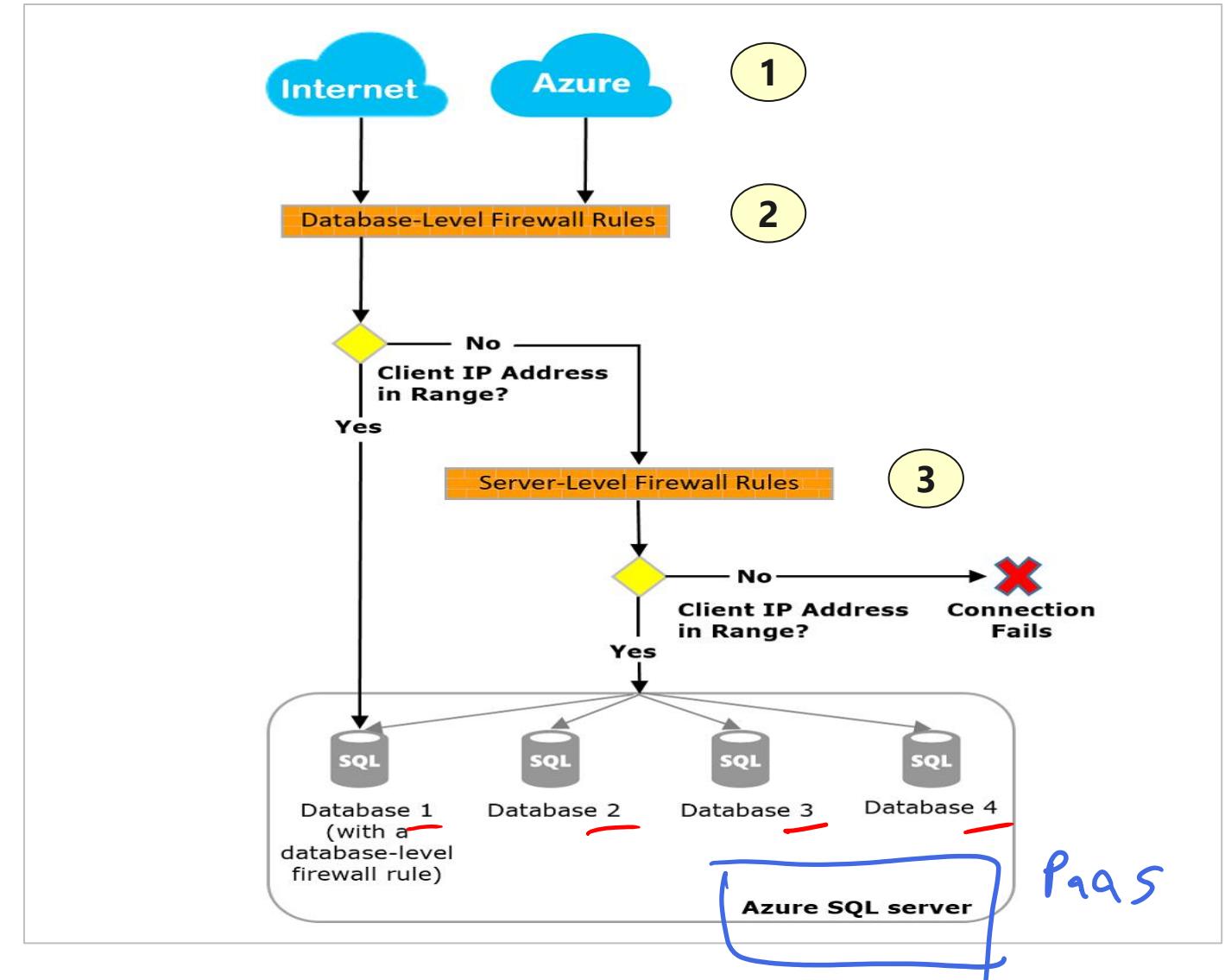
By default, firewall denies all access

→ **Database-level** firewall rules add allowed client IP addresses access to specific databases (including Master database).

T-SQL only

→ **Server-level** firewall rules enable client and Azure services access to the entire database server.

Portal, T-SQL, or PowerShell



Database Auditing

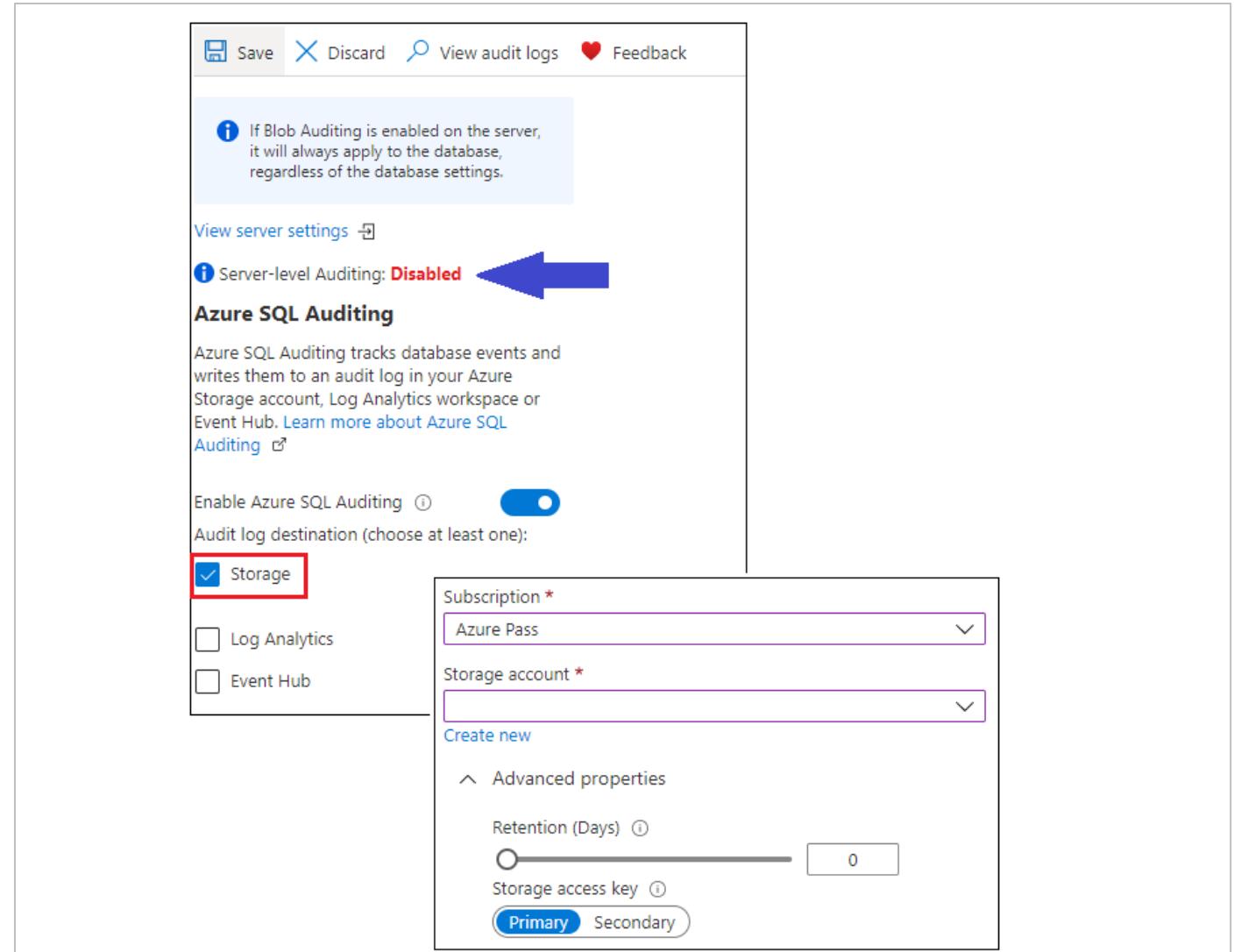
Retain an audit trail of selected events

Report on database activity and analyze results

Configure policies for the server or database level

Configure audit log destination

A new server policy applies to all existing and newly created databases



Data Discovery and Classification

Built-in to Azure SQL Database

Scans your database and identifies columns that contain potentially sensitive data

Provides classification recommendations and reports

Let's you apply sensitivity-classification labels

The screenshot shows the 'Data Discovery & Classification' interface. At the top, there is a donut chart with the number '13' in the center, representing the total count of columns. To the right of the chart is a legend with four categories: 'CONFIDENTIAL - GDPR' (dark blue), 'CONFIDENTIAL' (purple), 'HIGHLY CONFIDENTIAL' (blue), and 'PUBLIC' (red). Below the chart, a section titled 'Recommended columns to classify' lists three columns: 'AddressLine2' (Sensitivity label: Confidential), 'AddressType' (Sensitivity label: Confidential), and 'TaxAmt' (Sensitivity label: Confidential). A red box highlights the 'Confidential' label for 'AddressLine2'. A callout box labeled 'Sensitivity label: 5 selected' contains a list of six options, each with a checked checkbox: 'Select all', 'Confidential - GDPR', 'Confidential', 'Highly Confidential', 'Public', and 'Highly Confidential - GDPR'. An arrow points from the 'Confidential' label in the main table to this callout box.

Column	Sensitivity label
AddressLine2	Confidential
AddressType	Confidential
TaxAmt	Confidential

Sensitivity label: 5 selected

- Select all
- Confidential - GDPR
- Confidential
- Highly Confidential
- Public
- Highly Confidential - GDPR

Microsoft Defender for SQL

Microsoft Defender for SQL is a Defender plan in Microsoft Defender for Cloud.

Microsoft Defender for SQL includes functionality for surfacing and mitigating potential database vulnerabilities, and detecting anomalous activities that could indicate a threat to your database.

Resource types selection

Defender for cloud offers protection for a variety of database resource types, both SQL servers and managed cloud database services. [Learn more](#)

 Azure SQL Databases ⓘ Off On
Pricing: \$15/Server/Month
Resource quantity: 0 servers

 SQL servers on machines ⓘ Off On
Pricing: \$15/Server/Month - servers in Azure
\$0.015/Core/Hour - servers outside Azure
Resource quantity: 0 servers

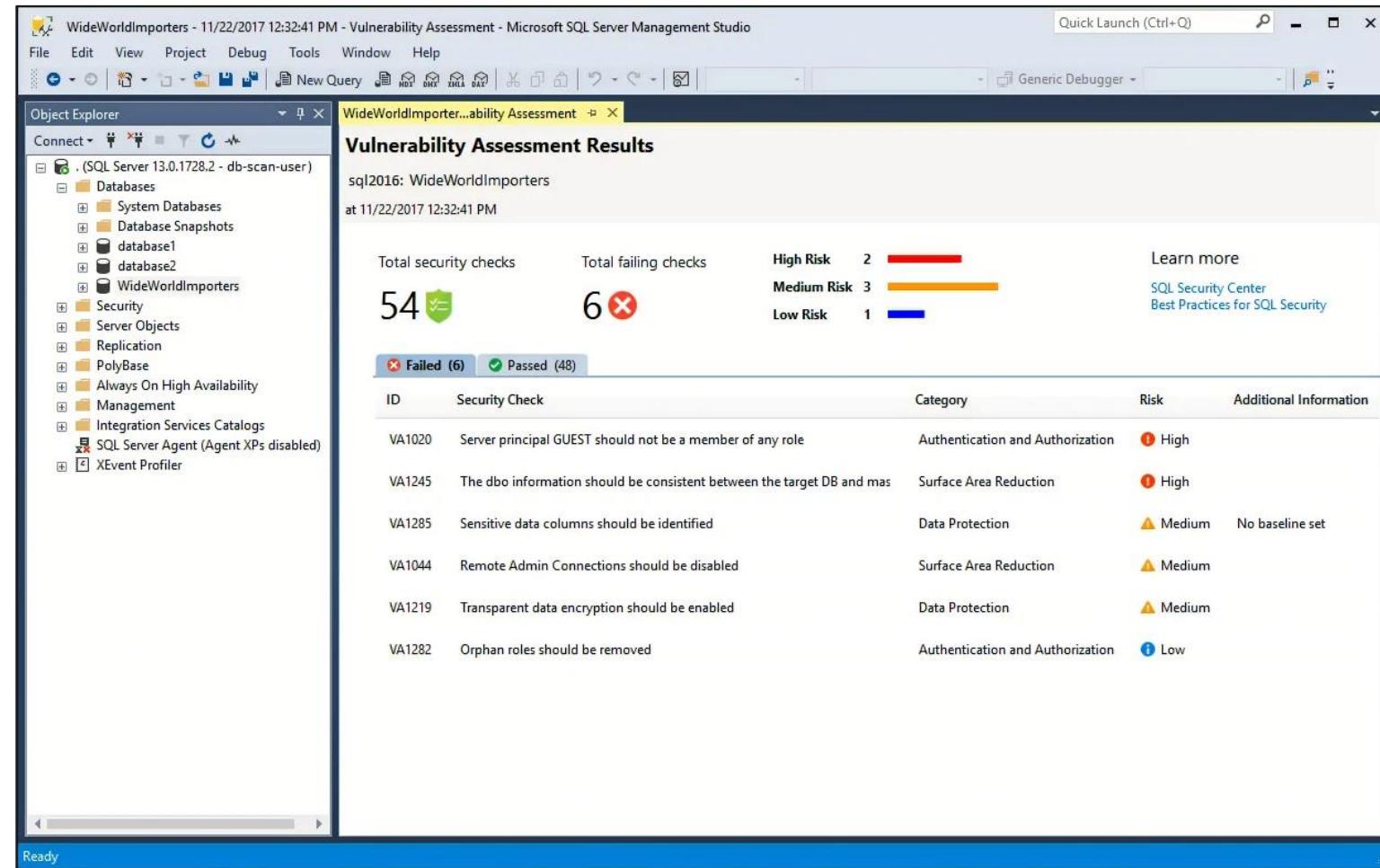
 Open-source relational databases ⓘ Off On
Pricing: \$15/Server/Month
Resource quantity: 0 servers

 Azure Cosmos DB ⓘ Off On
Pricing: \$0.0012 per 100RU/s per hour
Resource quantity: 0 Azure Cosmos DB accounts

Vulnerability assessment for SQL Server

SQL vulnerability assessment (VA) is a service that provides visibility into your security state and includes actionable steps to resolve security issues and enhance your database security.

The VA service runs a scan directly on your database and employs a knowledge base of rules that flag security vulnerabilities and highlight deviations from best practices, such as misconfigurations, excessive permissions, and unprotected sensitive data.



SQL Advanced Threat Protection

Advanced Threat Protection for Azure SQL Database, Azure SQL Managed Instance, Azure Synapse Analytics, SQL Server on Azure Virtual Machines and Azure Arc-enabled SQL Server detects anomalous activities indicating unusual and potentially harmful attempts to access or exploit databases.

The screenshot shows the 'Server settings' page in the Microsoft Azure portal. At the top, there's a navigation bar with 'Microsoft Azure' and a search bar. Below that, the path 'Home > chrisqpublictest' is shown. The main title is 'Server settings' with a '...' button. Underneath, it says 'chrisqpublictest'. There are three buttons: 'Save' (blue), 'Discard' (grey), and 'Feedback' (blue).

VULNERABILITY ASSESSMENT SETTINGS

- Subscription:** Contoso Team (highlighted with a green vertical bar). There is a 'Select Subscription' link.
- Storage account:** Select Storage account (highlighted with a green vertical bar).
- Periodic recurring scans:** A toggle switch is set to 'OFF' (blue button).
- Send scan reports to:** A dropdown menu is partially visible.
- Also send email notification to admins and subscription owners:** A checked checkbox with a tooltip.

ADVANCED THREAT PROTECTION SETTINGS

Advanced Threat Protection for SQL alerts emails are sent by Defender for Cloud. Add your contact details to the subscription's email settings in Defender for Cloud. (The last two lines are highlighted with a red border.)

Enable Auditing for better threats investigation experience (with a tooltip).

Explore detection of a suspicious event

You receive an email notification upon detection of anomalous database activities.

The email provides information on the suspicious security event including the nature of the anomalous activities, database name, server name, application name, and the event time.

In addition, the email provides information on possible causes and recommended actions to investigate and mitigate the potential threat to the database.

The screenshot shows an email from Microsoft regarding a potential SQL injection threat. The subject line is "Azure SQL database - Potential exploitation of application code vulnerability to SQL Injection was detected". The email body includes a red warning bar with the text: "Potential exploitation of application code vulnerability to SQL Injection was detected. This may indicate a SQL Injection attack on database 'samplecrmwedemo'." Below this, there's a "View recent SQL alerts" button. The main content area is titled "Activity details" and lists the following information:

Severity	High
Subscription ID	
Subscription Name	DS-THREATDETECTION_DEMO_TOMERR_R&D_60843
Server	
Database	
IP address	
Principal Name	de****
Application	.Net SqlClient Data Provider
Date	May 13, 2018 12:09:12 UTC
Threat ID	1
Potential causes	Defect in application code constructing SQL statements; application code doesn't sanitize user input and was exploited to inject malicious SQL statements.
Investigation steps	View the vulnerable SQL statement
Remediation steps	Read more about SQL Injection threat and how to fix the vulnerable application code.

Explore detection of a suspicious event

1. Click the **View recent SQL alerts** link in the email to launch the Azure portal and show the Microsoft Defender for Cloud alerts page, which provides an overview of active threats detected on the database.

Example:
View recent SQL alerts



Explore detection of a suspicious event (continued)

Security alerts
samplecrmdemo

Filter

6
5
4
3
2
1
0

1 Thu 1 Sun 1 Tue

HIGH SEVERITY MEDIUM SEVERITY

3 3

DESCRIPTION COUNT DETECTED BY ENVIRONMENT DATE STATE SEVERITY

Potential SQL Injection 3 Microsoft Azure 13/05/18 Active High

A possible vulnerability to SQL Injection 1 Microsoft Azure 09/04/18 Active Medium

Logon from an unusual location 1 Microsoft Azure 09/04/18 Active Medium

Logon by an unfamiliar principal 1 Microsoft Azure 09/04/18 Active Medium

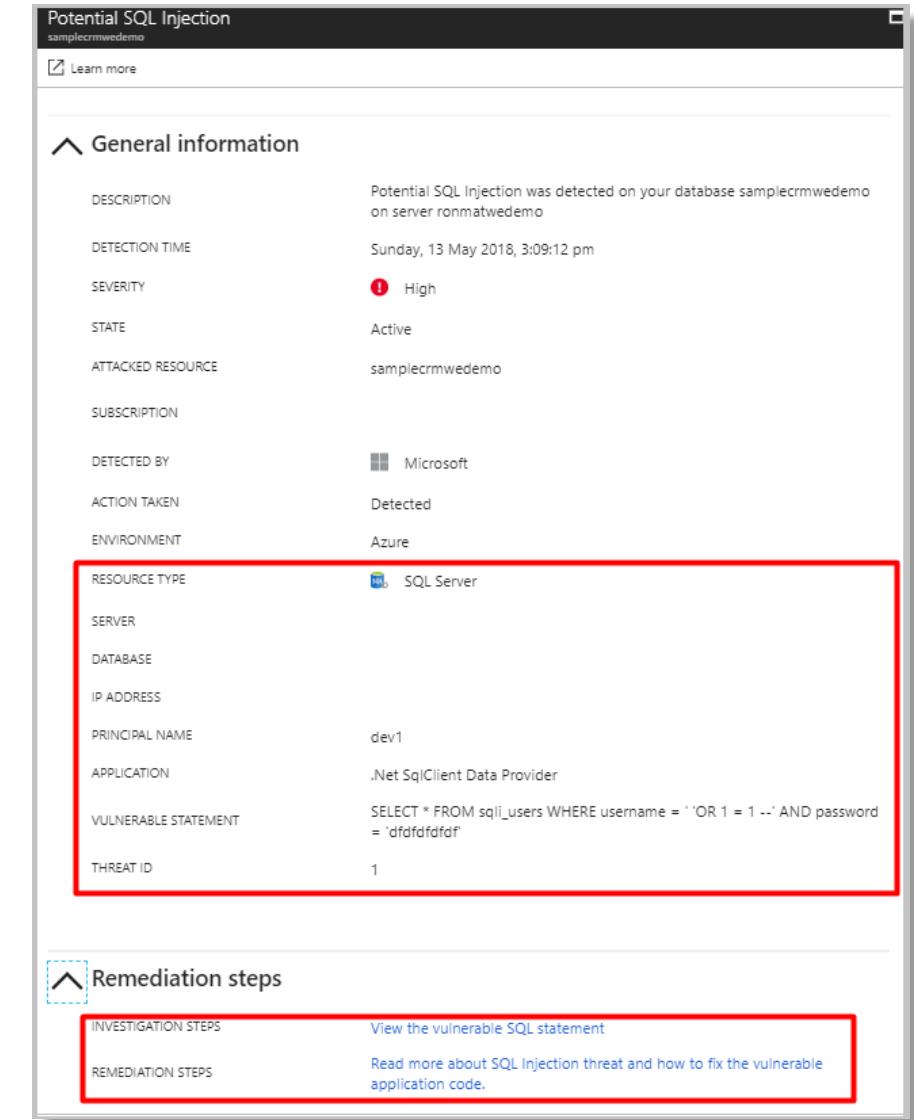
2. Click a specific alert to get additional details and actions for investigating this threat and remediating future threats.

Explore detection of a suspicious event (continued)

For example, SQL injection is one of the most common Web application security issues on the Internet that is used to attack data-driven applications.

Attackers take advantage of application vulnerabilities to inject malicious SQL statements into application entry fields, breaching or modifying data in the database.

For SQL Injection alerts, the alert's details include the vulnerable SQL statement that was exploited.



The screenshot shows a detailed alert for a potential SQL injection. The alert is titled "Potential SQL Injection" and is associated with the database "samplecrmwedemo" on the server "ronmatwedemo". The detection time is Sunday, 13 May 2018, 3:09:12 pm, with a severity of High and an active state. It was detected by Microsoft in the Azure environment. The resource type is SQL Server. The alert details the following information:

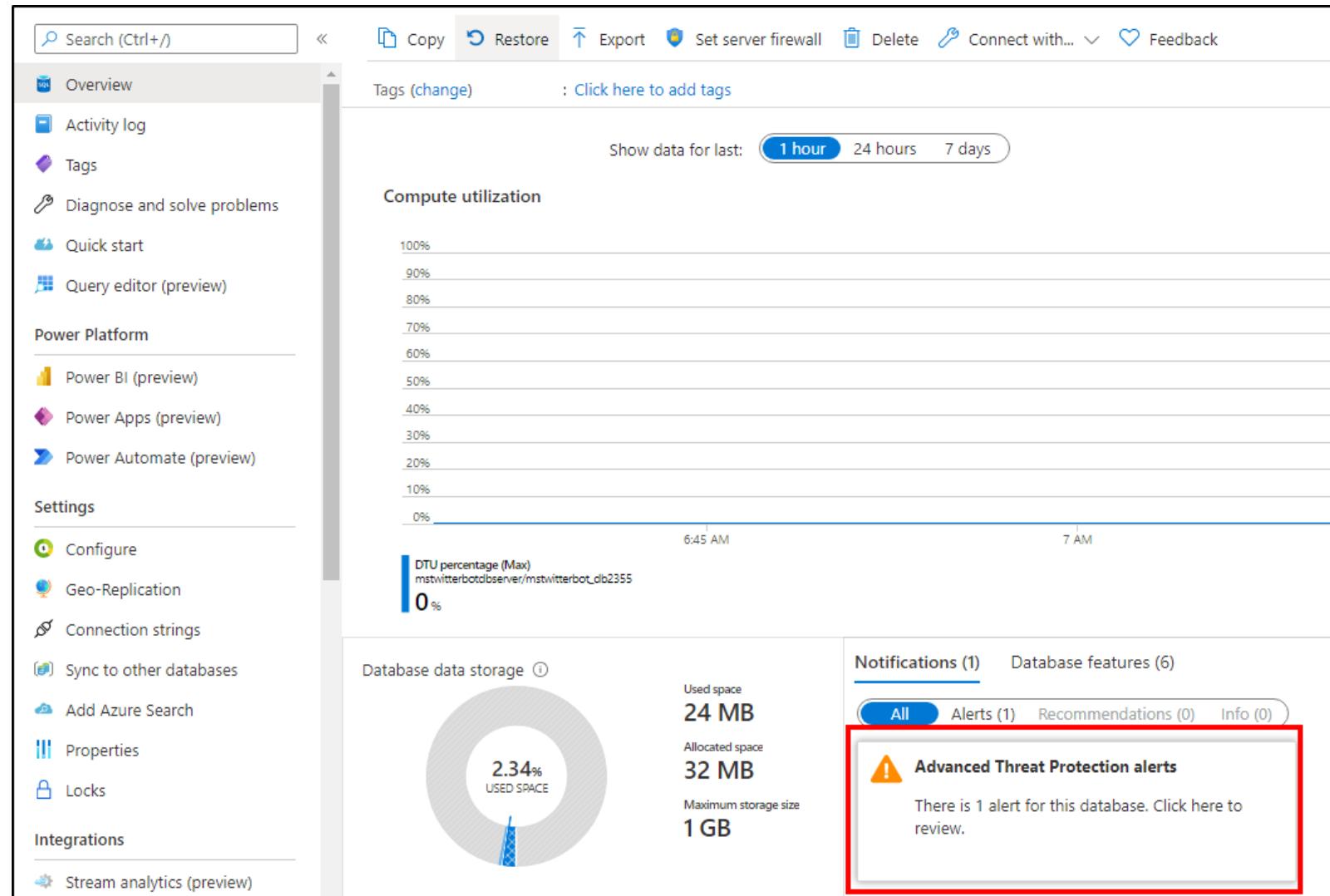
Resource Type	SQL Server
Server	
Database	
IP Address	
Principal Name	dev1
Application	.Net SqlClient Data Provider
Vulnerable Statement	SELECT * FROM sqli_users WHERE username = ''OR 1 = 1 --' AND password = 'dfdfdfdfdf'
Threat ID	1

Below the alert details, there are sections for "Remediation steps" and "Investigation steps". The "Remediation steps" section includes a link to "View the vulnerable SQL statement" and a link to "Read more about SQL Injection threat and how to fix the vulnerable application code".

Explore detection of a suspicious event -Explore alerts in the Azure portal

Advanced Threat Protection integrates its alerts with Microsoft Defender for Cloud.

Live SQL Advanced Threat Protection tiles within the database and SQL Microsoft Defender for Cloud blades in the Azure portal track the status of active threats.



SQL vulnerability assessment express and classic configurations

Parameter	Express configuration	Classic configuration
Supported SQL Flavors	<ul style="list-style-type: none">Azure SQL Database (preview)Azure Synapse Dedicated SQL Pools (formerly SQL Data Warehouse) (preview)	<ul style="list-style-type: none">Azure SQL DatabaseAzure SQL Managed InstanceAzure Synapse Analytics
Supported Policy Scope	<ul style="list-style-type: none">SubscriptionServer	<ul style="list-style-type: none">SubscriptionServerDatabase
Dependencies	None	Azure storage account
Recurring scan	<ul style="list-style-type: none">Always activeScan scheduling is internal and not configurable	<ul style="list-style-type: none">Configurable on/offScan scheduling is internal and not configurable
Supported Rules	All vulnerability assessment rules for the supported resource type.	All vulnerability assessment rules for the supported resource type.
Baseline Settings	<ul style="list-style-type: none">Batch – several rules in one commandSet by latest scan results.Single rule	Single rule
Apply baseline	Will take effect without rescanning the database	Will take effect only after rescanning the database
Single rule scan result size	Maximum of 1 MB	Unlimited
Email notifications	Logic Apps	<ul style="list-style-type: none">Internal schedulerLogic Apps
Scan export	Not supported	Excel format

Dynamic Data Masking

The screenshot shows the 'Dynamic Data Masking' interface for an 'SQL database'. On the left, under 'Recommended fields to mask', there is a table with four rows:

Schema	Table	Column	Action
SalesLT	Customer	FirstName	Add mask
SalesLT	Customer	LastName	Add mask
SalesLT	Customer	EmailAddress	Add mask

A blue arrow points from the 'Add mask' button for the 'LastName' column to a detailed 'Masking field format' dialog box. This dialog lists several options:

- Default value (0, xxxx, 01-01-1900)
- Credit card value (xxxx-xxxx-xxxx-1234)
- Email (aXXX@XXXX.com)
- Number (random number range)
- Custom string (prefix [padding] suffix)

An arrow points from the 'Custom string (prefix [padding] suffix)' option to another dialog box titled 'Masking Field Format' with the dropdown set to 'Custom text'. This second dialog contains three input fields:

Exposed Prefix	Padding String	Exposed Suffix
3	X*X*X	2

Masks sensitive data for
non-privileged users

Administrators are excluded;
you can add others

Rules apply the masking
logic; several formats are
available

Transparent Data Encryption

Protects databases, backups, and logs at rest – server level

Real-time page level encryption and decryption - service or customer managed keys

Supports Azure SQL Database (enabled by default), SQL Managed Instance, and Azure Synapse Analytics

ads-server | Transparent data encryption
SQL server

Transparent data encryption

Transparent data encryption encrypts your databases, backups, and logs at rest without any changes to your application. To enable encryption, go to each database.

Transparent data encryption ⓘ **Service-managed key** Customer-managed key

OR

Transparent data encryption ⓘ **Service-managed key** **Customer-managed key**

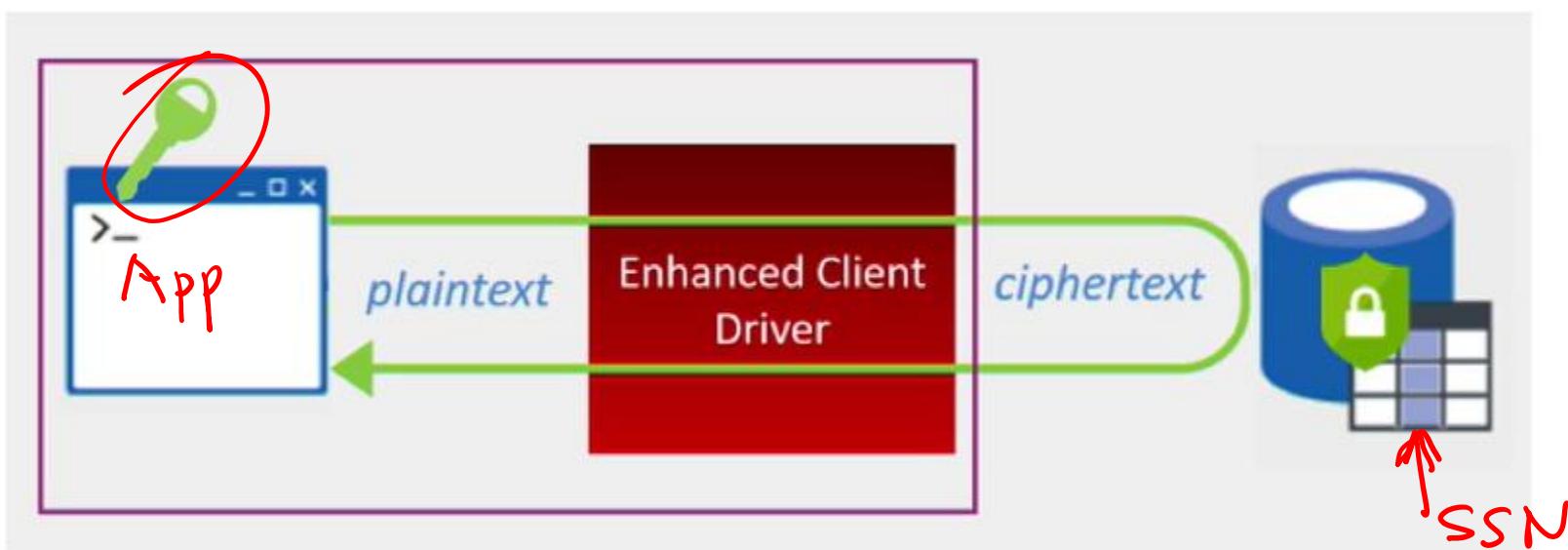
Key selection method **Select a key** Enter a key identifier

Key vault * **Select a key vault** Change key vault

Key * **Select a key** Change key

Make the selected key the default TDE protector.

Always Encrypted



Protects sensitive data at rest, in transit, and in use

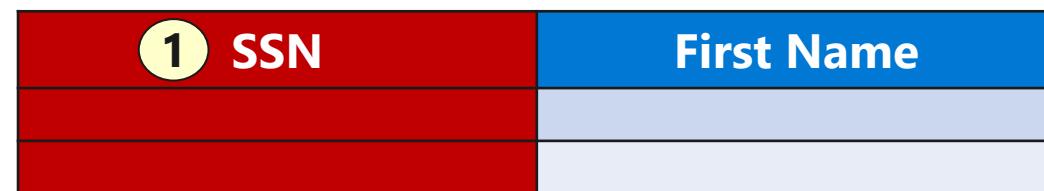
Database data always remains encrypted

Data access is only from client applications and servers

Uses client-side encryption – enhanced client driver

Separates data owners from data managers

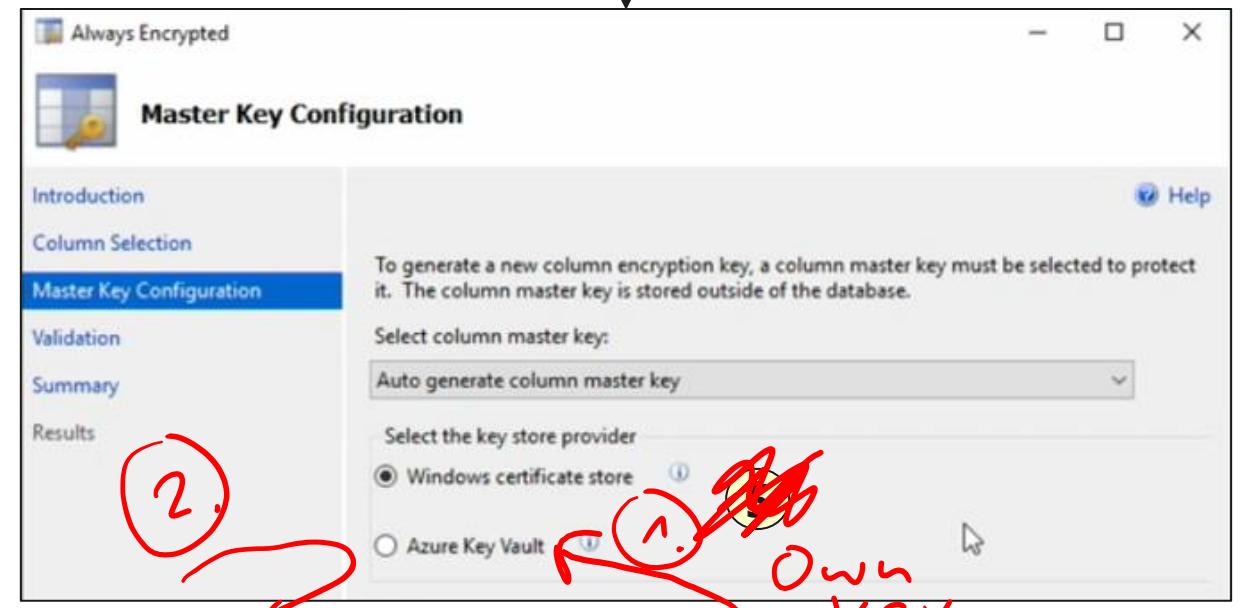
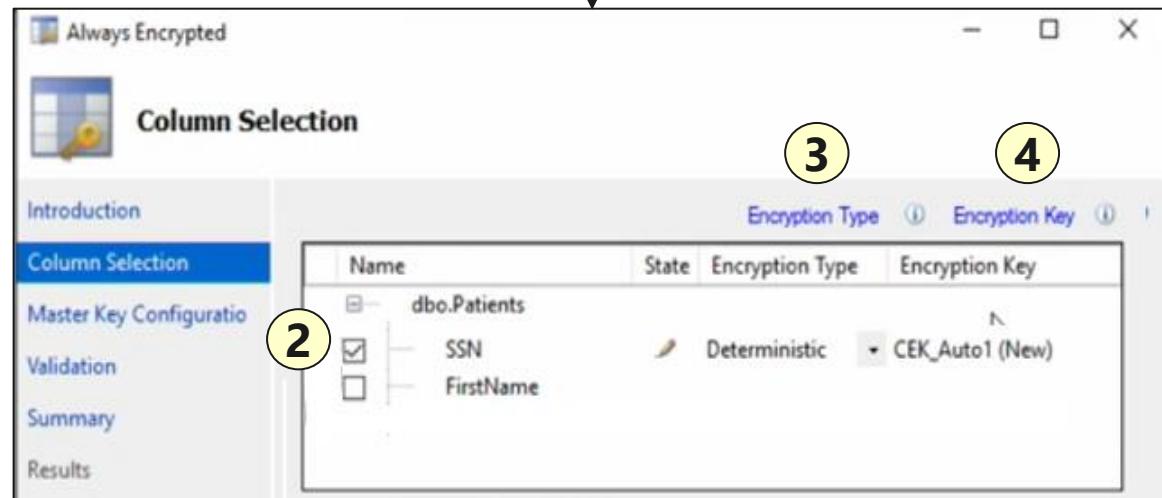
Always Encrypted - Implementation



Always Encrypted Wizard

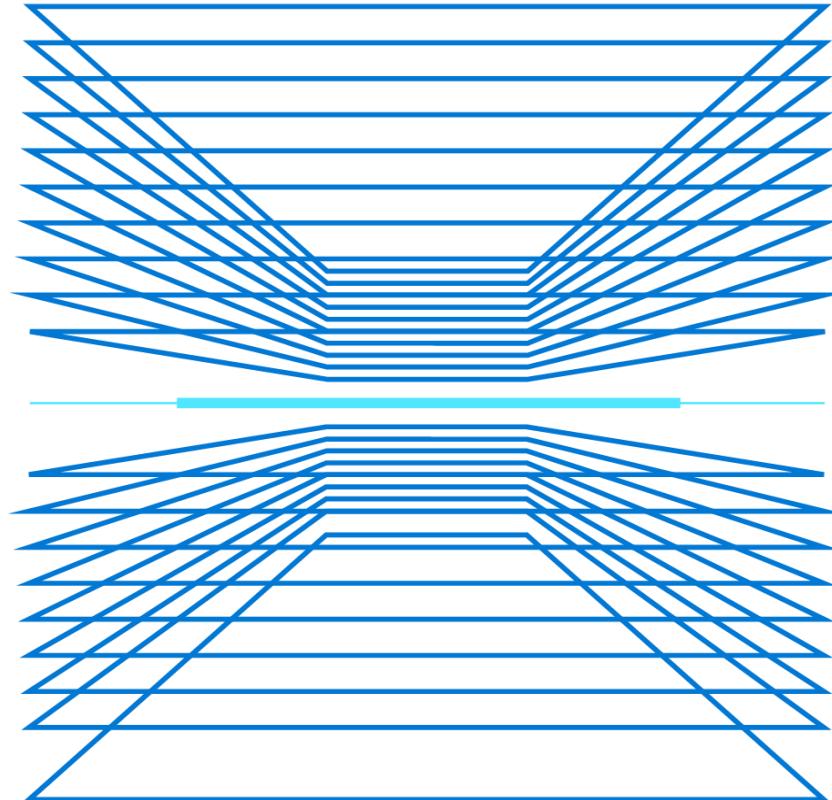
Column Master Keys
encrypt the data

Master Key protects the
column master keys



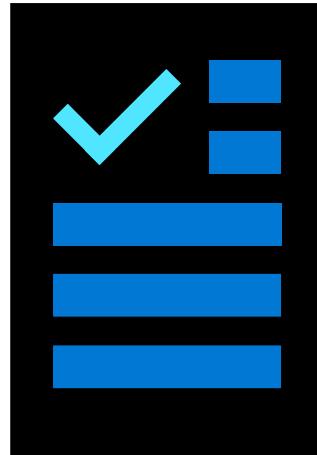
Demonstrations: Database Security

- Advanced Data Security and Auditing
- Diagnostics
- AAD Authentication



Additional Study – Database Security

Module Review Questions



Microsoft Learn Modules (docs.microsoft.com/Learn)

Provision an Azure SQL database to store application data (Exercise)

Secure your Azure SQL Database (Exercise)

Configure security policies to manage data (Exercise)

Migrate your relational data stored in SQL Server to Azure SQL Database (Exercise)

Module Labs



Lab 10 – Key Vault

Create a Key Vault and configure permissions

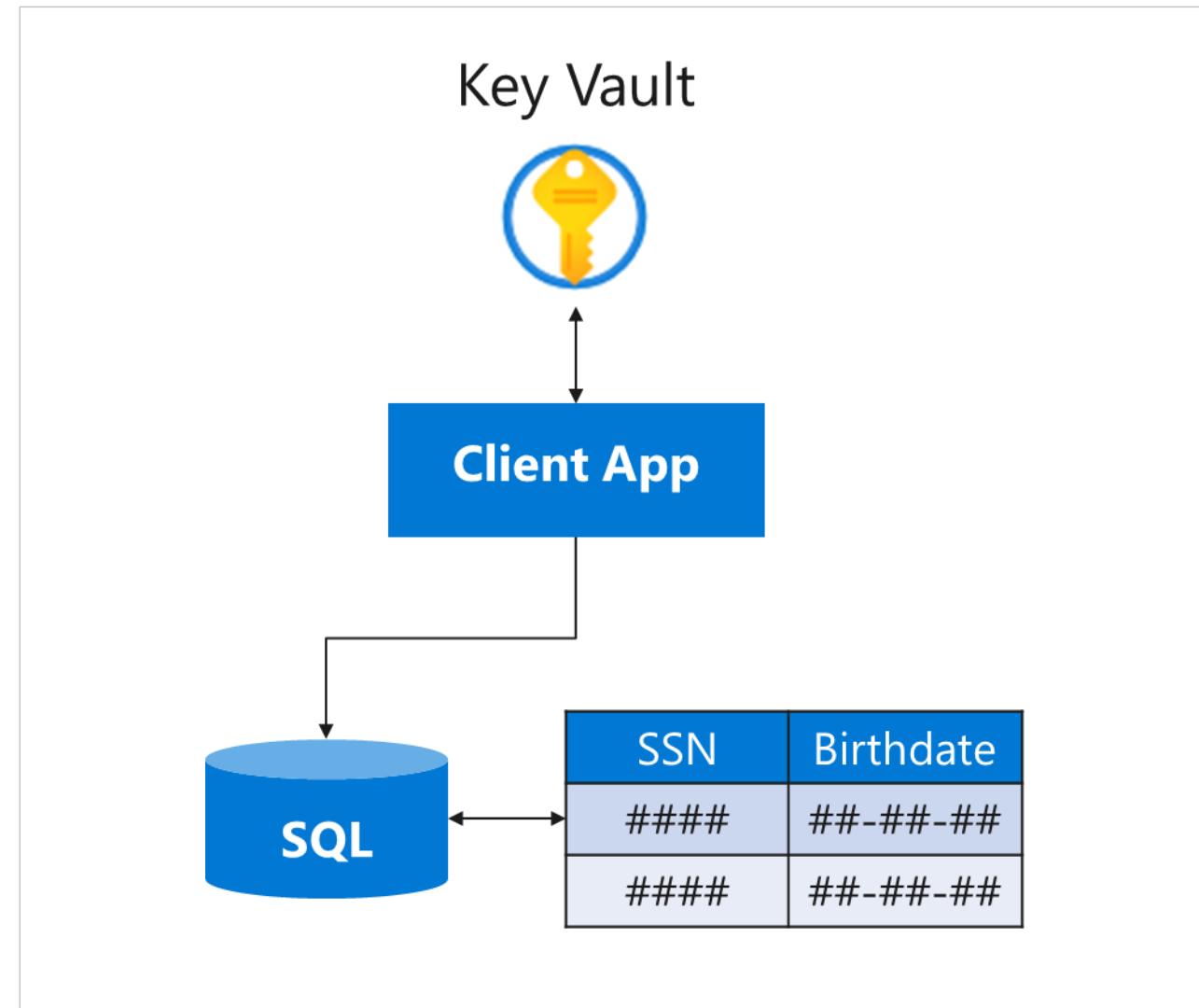
Add a key and a secret to the vault

Register a client app that uses the key

Create a SQL database

Encrypt columns in a table

Build a console app to test the encryption



Lab 10 - Key Vault

Exercise1, Task1

AZ500LAB10

az500-10-vnet1 10.110.0.0/16

Subnet0 10.110.0.0/24



az500-10-vm1
10.110.0.4

SQL Server Management Studio
Visual Studio

Exercise2, Task5

OpsEncrypt

Exercise1, Task2, Task3, Task4

az500kvxxxx



MyLabKey



SQLPassword

Exercise2, Task2

Key Vault Access policy



Exercise2, Task1



sqlApp

Exercise2, Task3, Task4



medical

DB



SQL Server

always
encrypted

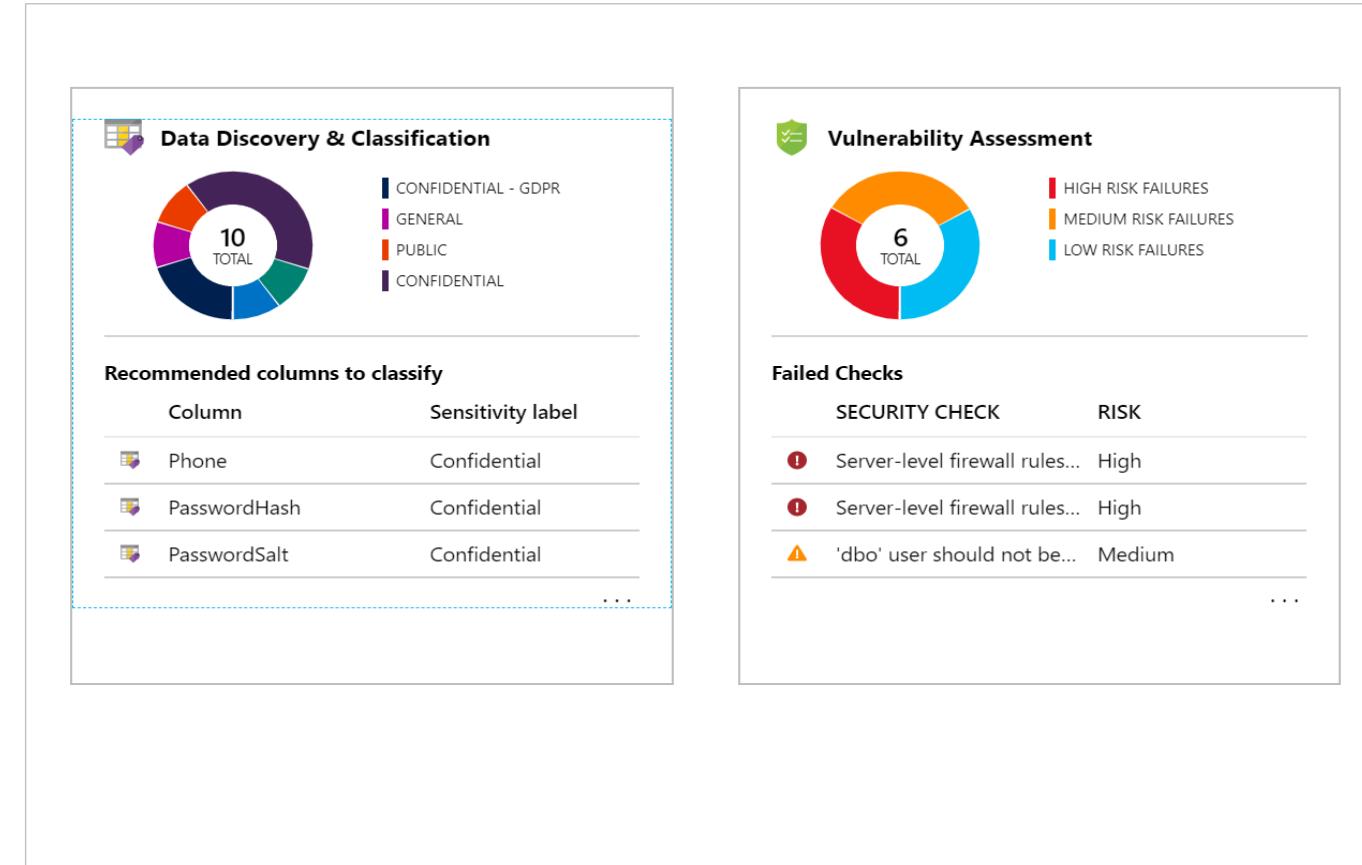
Lab 11 – Securing Azure SQL Database

Deploy an Azure SQL Database

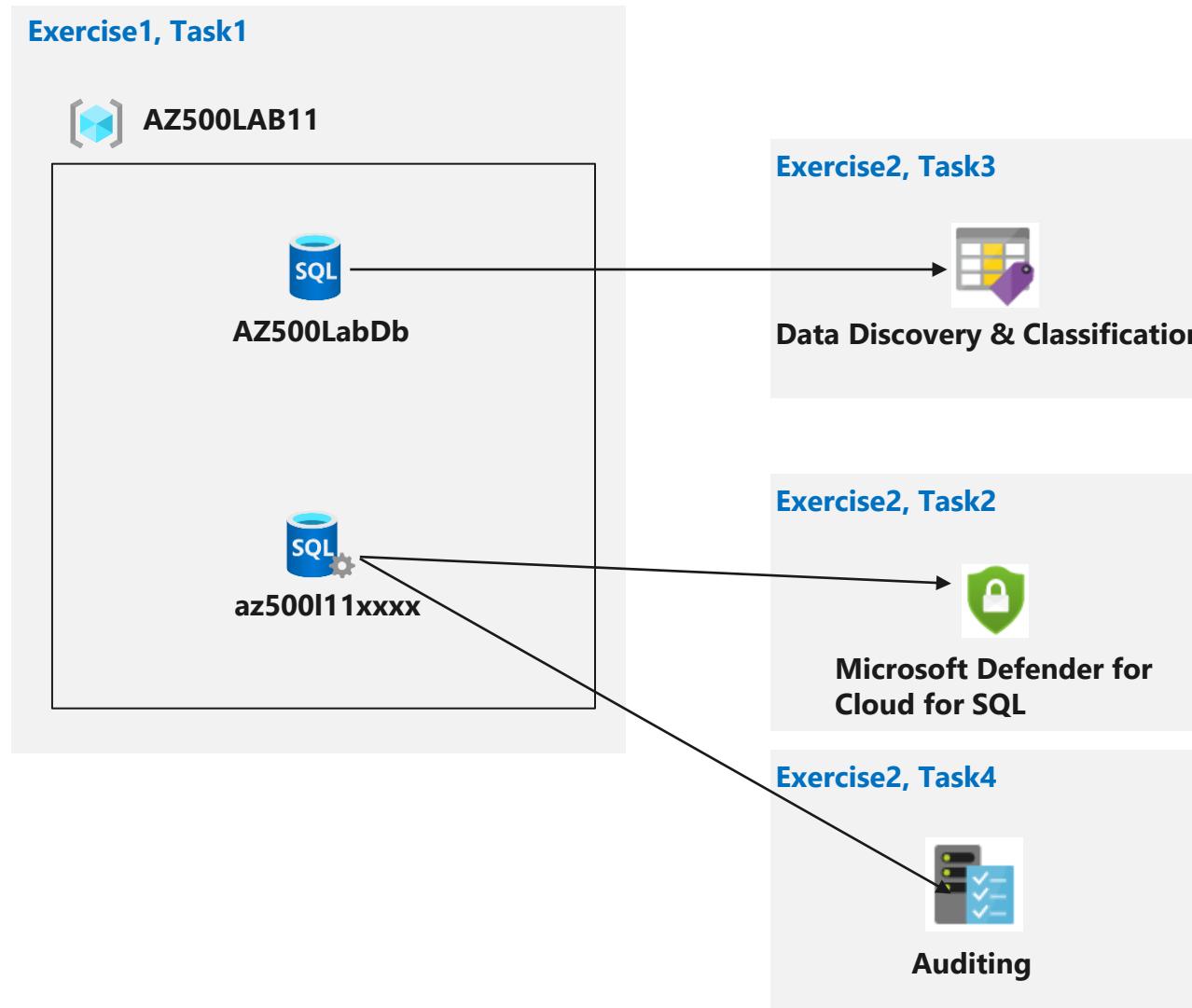
Configure Advanced Data Protection

Configure Data Classification

Configure Auditing



Lab 11 – Securing Azure SQL Database



Lab 12 – Service Endpoints and Securing Storage

Create a virtual network with a Public and Private subnet

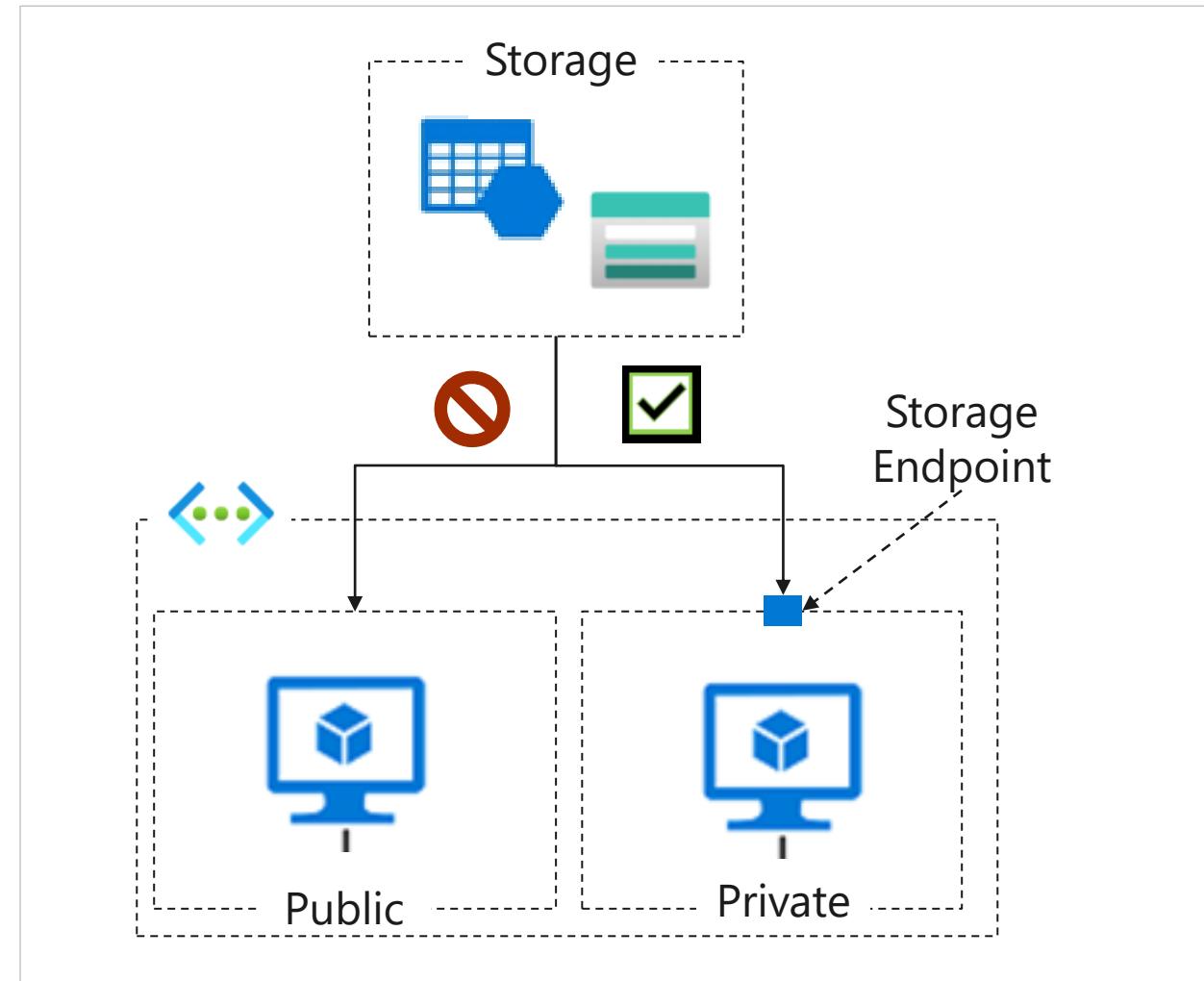
Create a storage endpoint for the Private subnet

Create a storage account with a file share

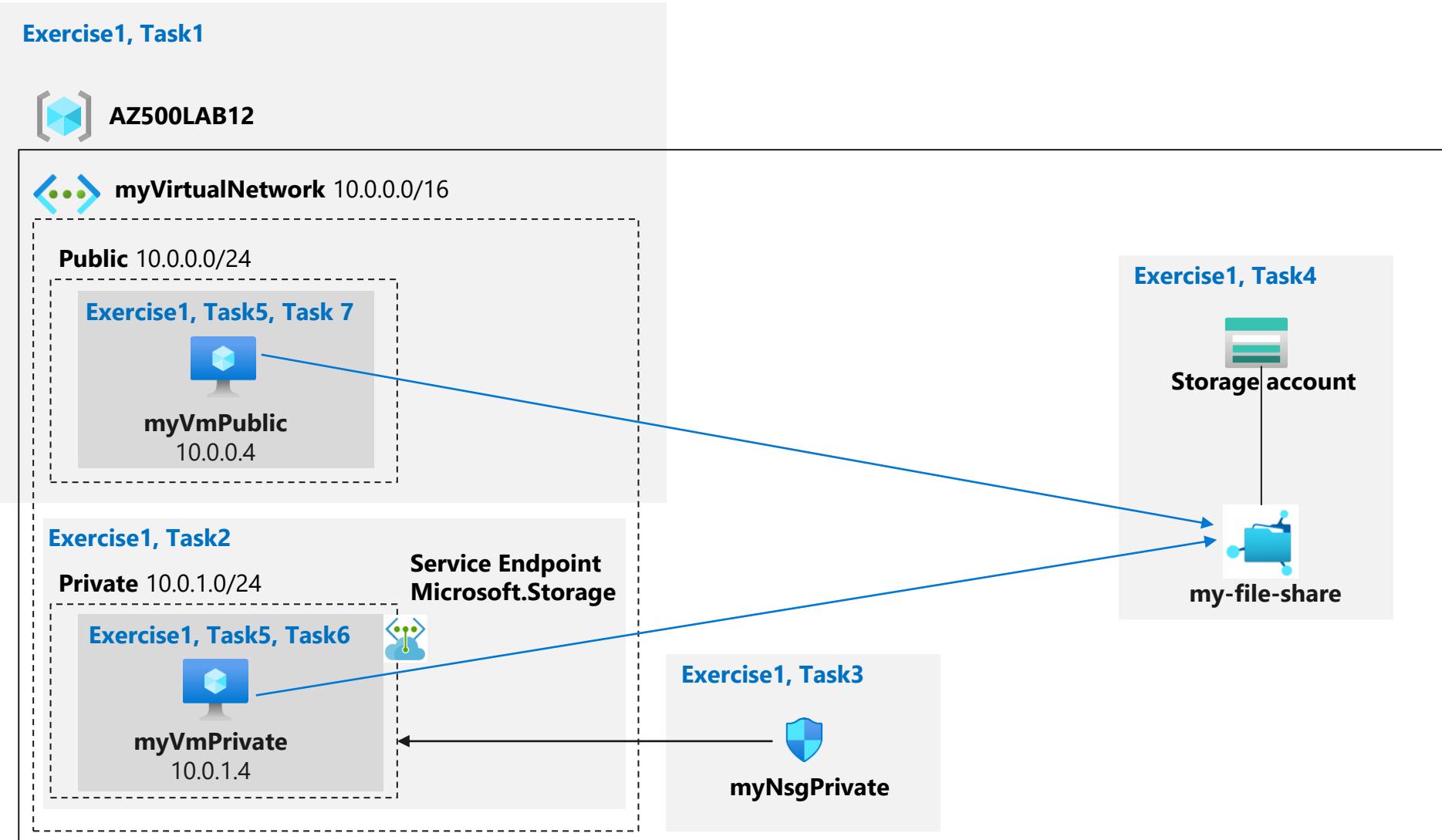
Configure a NSG with rules to allow access to storage and internet

Confirm storage access from the private subnet

Confirm storage access is denied from the public subnet



Lab 12 – Service Endpoints and Securing Storage



End of presentation