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Administer Azure Storage

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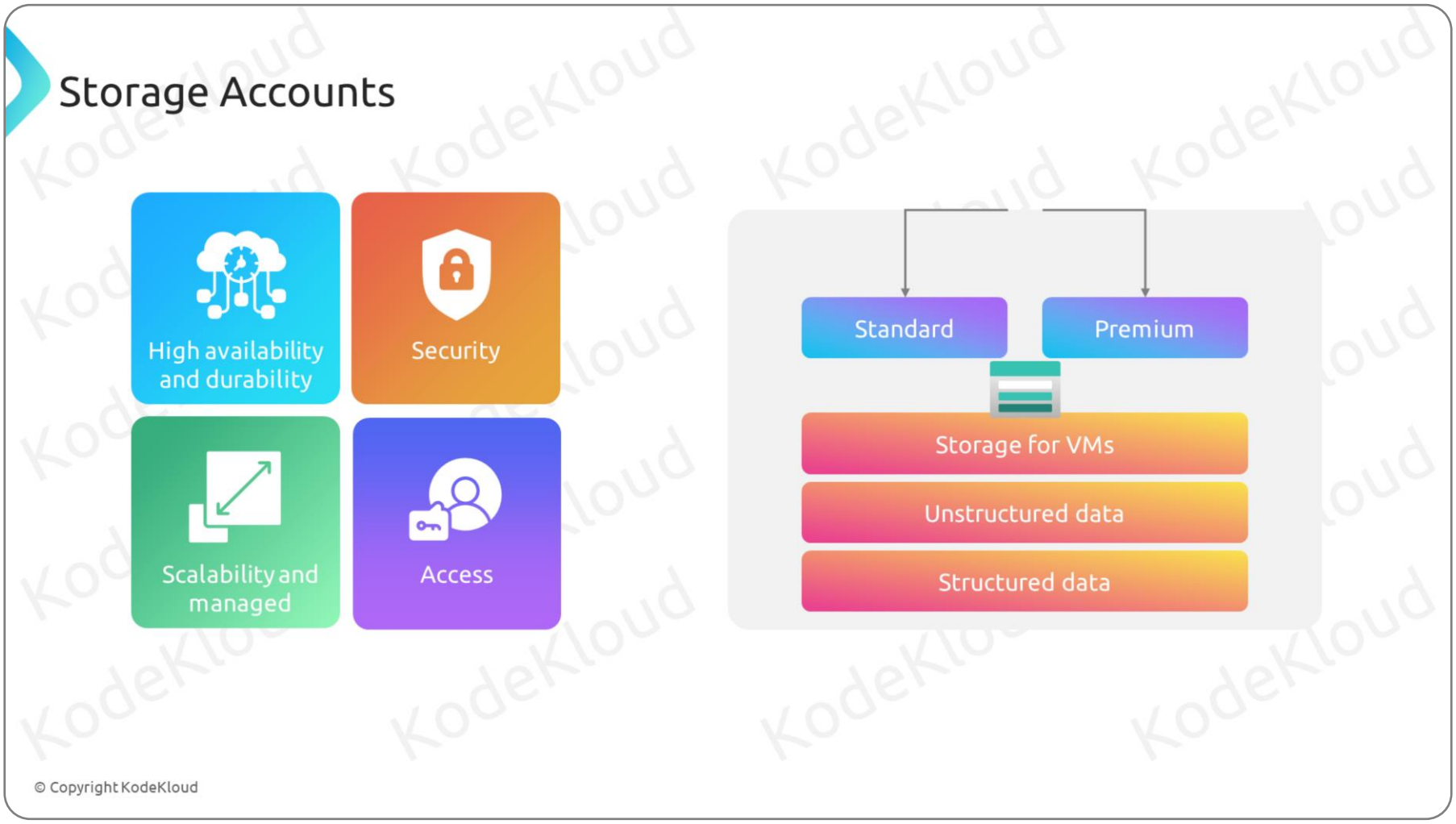
These Learn modules are part of the AZ-104: Implement and manage storage in Azure (https://docs.microsoft.com/learn/paths/az-104-manage-storage/) learning path.

Module overview

- A repeatable way to deliver software and infrastructure code to its destination
- Build and test code
- Deploy to on-prem or cloud resources
- CICD isn't just for software developers. It's also for infrastructure pros



High availability and durability
Storage account comes with different redundancies to fulfill your durability requirements. Data stored in the storage account can be replicated to different datacenters and even across regions ensuring high availability for the data.

Security
By default, all data written to the storage account is encrypted by Storage Encryption Service. To access the data storage

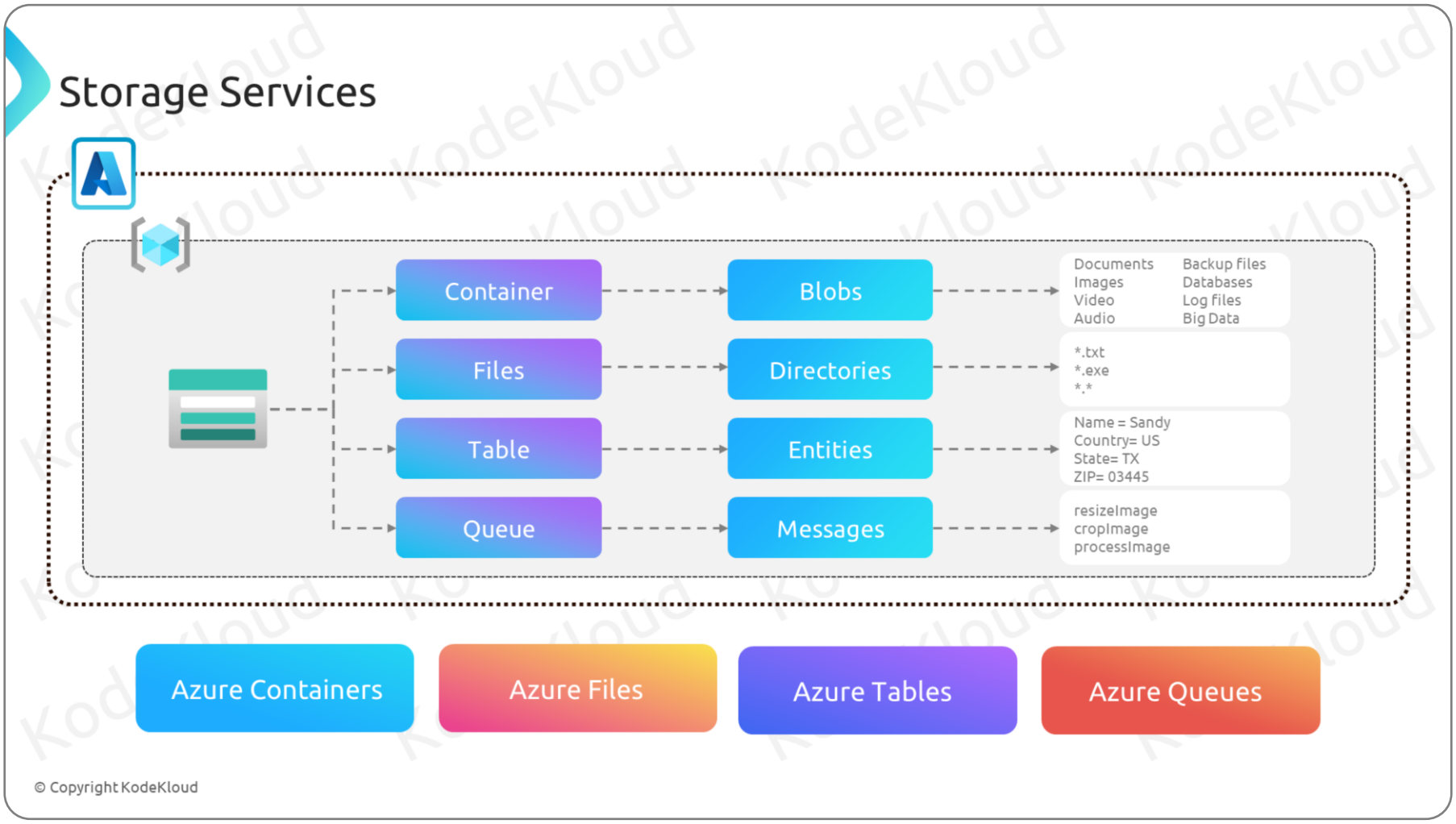
accounts, provide different authorization methods such as storage keys, shared access signature, and Azure AD.

Scalability and Managed

Azure Storage is a platform managed service, depending upon the requirement it will automatically scale the storage and performance.

Access

HTTP or HTTPS can be used to access the data that is stored in Azure Storage. With the help SDKs provided by Microsoft, developers can easily integrate Azure Storage with their code. Azure Storage also supports Azure PowerShell, Azure CLI and REST API.



Azure Containers
An object store with immense scaling capability.

Ideal for storing unstructured data such as text or binary data.

Azure Files
Managed file share

Used to provision highly available file shares in cloud that can be mounted to cloud and on-premises machines.

Azure Tables
NoSQL datastore

Ideal for storing structured non-relational data

Azure Queues
Messaging store

Used to store messages and retrieve messages between application components that needs to be processed asynchronously.

Storage Account Types

Type	Services	Performance tiers	Replication options
Blob storage	Blob	Standard	LRS, GRS, RA-GRS
General Purpose V1	Blob, File, Queue, Table, and Disk	Standard, Premium	LRS, GRS, RA-GRS
General Purpose V2	Blob, File, Queue, Table, and Disk	Standard, Premium	LRS, ZRS, GRS, RA-GRS, GZRS, RA-GZRS
Block blob storage	Blob	Premium	LRS, ZRS
File storage	Files	Premium	LRS, ZRS

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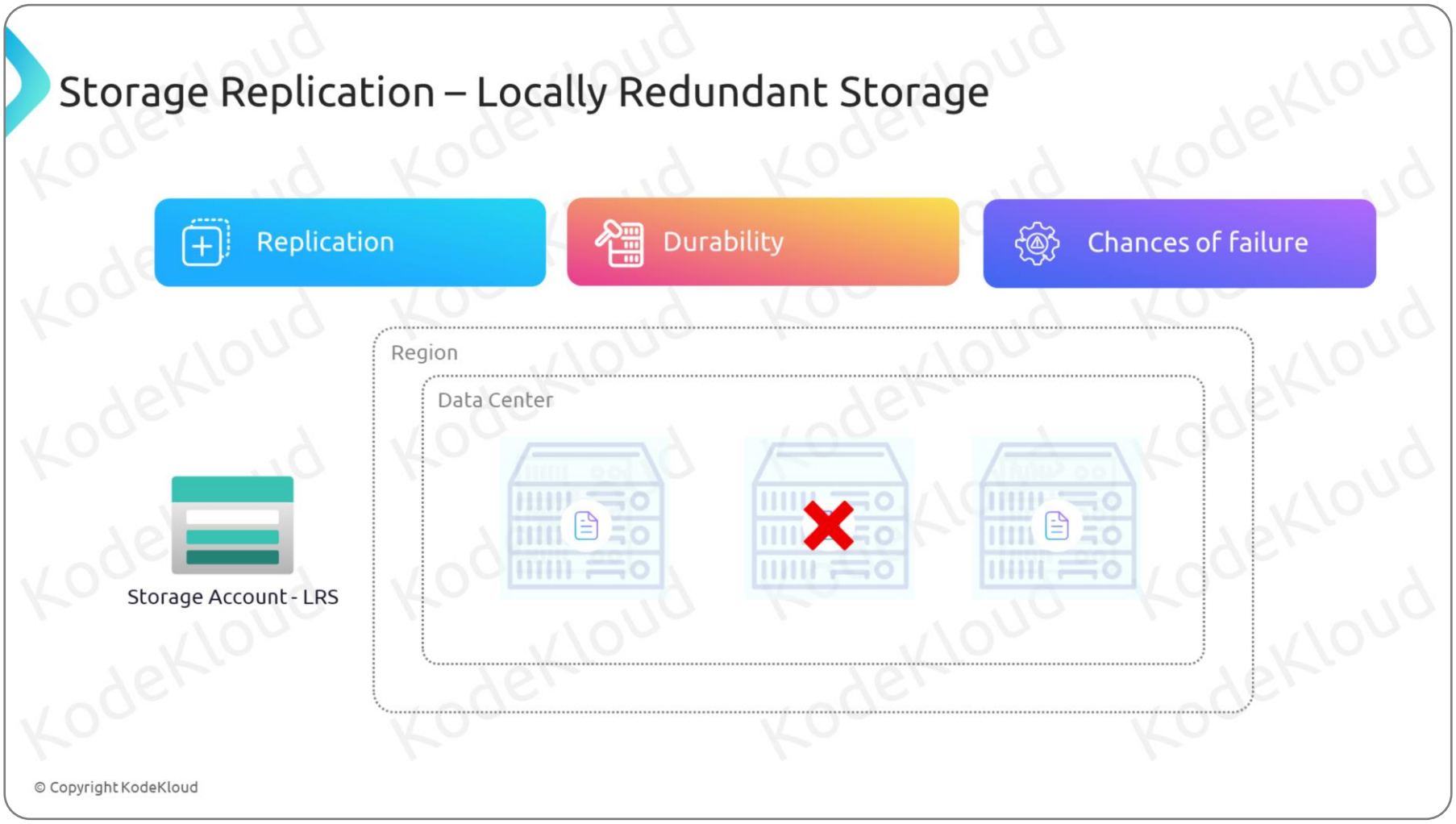
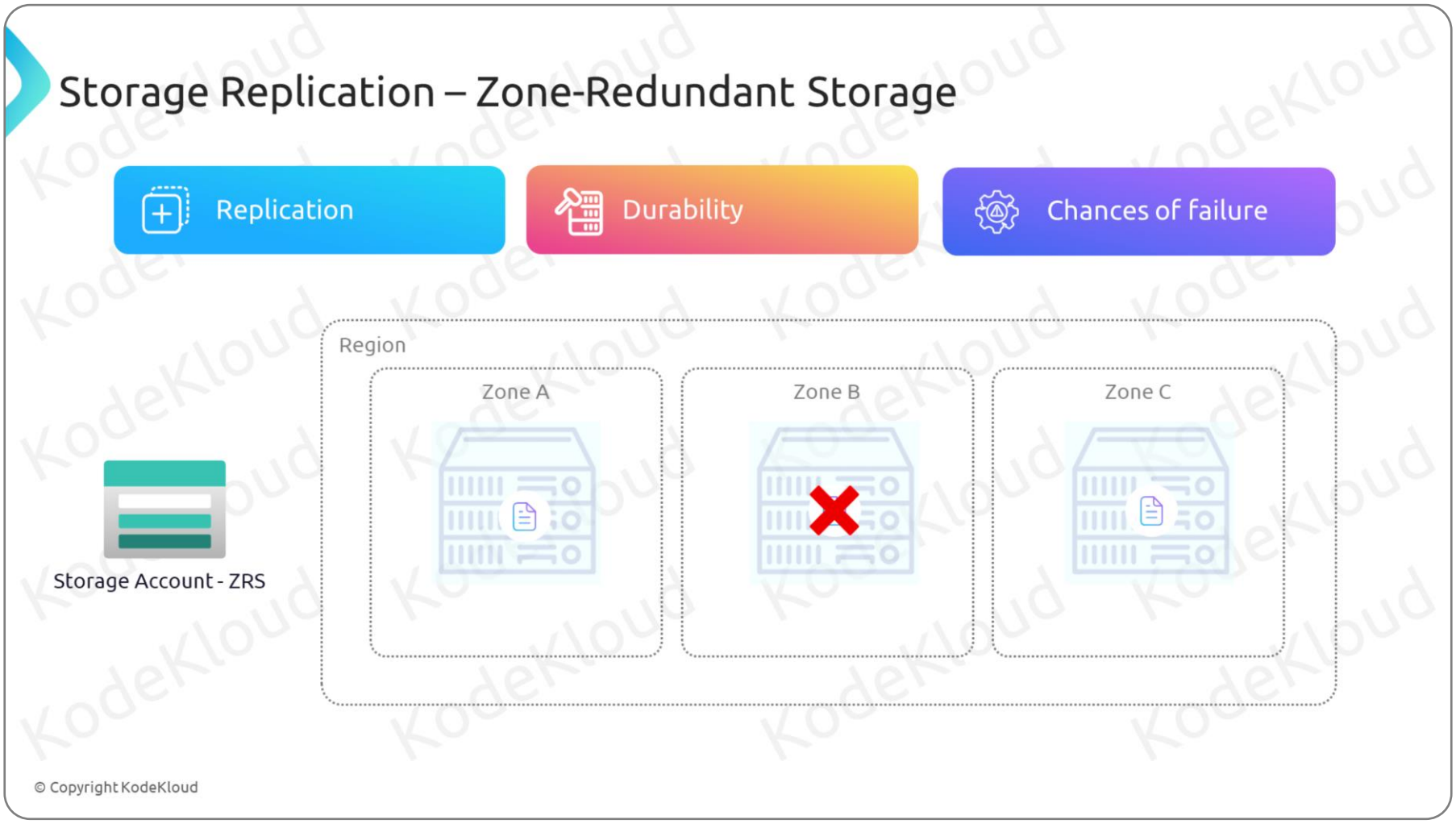


Replication
Data is replicated and will retain three copies of data across fault domain within a single datacenter. Since the data is replicated only within a single data center, LRS is the cheapest option.

Durability
LRS offers 99.99999999999 (11 9's) of durability. Data stored in LRS is protected from hardware failures as the data is

stored in different fault domains.

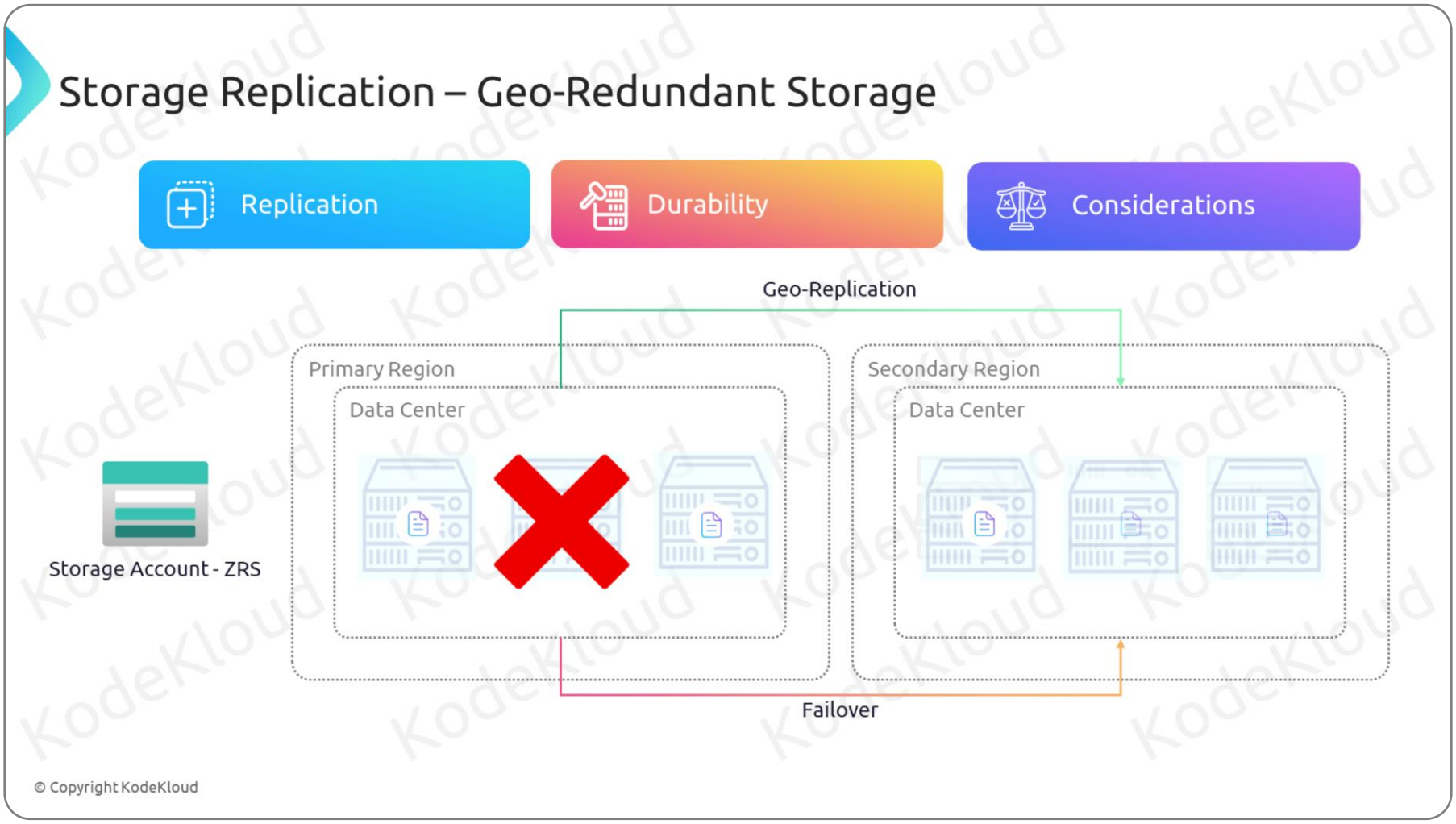
Chances of failure
As the replicated copies are stored within a single datacenter, if the entire datacenter is down, then the data will not be available



Replication
Data is replicated and will retain three copies of data across availability zones within a single region.

Durability
ZRS offers 99.999999999999 (12 9's) of durability. Data stored in ZRS is protected from datacenter failures as each zone where the datacenter resides is physically separated from each other.

Chances of failure
As the replicated copies are stored within a single region, if the entire region goes down, then the data will not be available

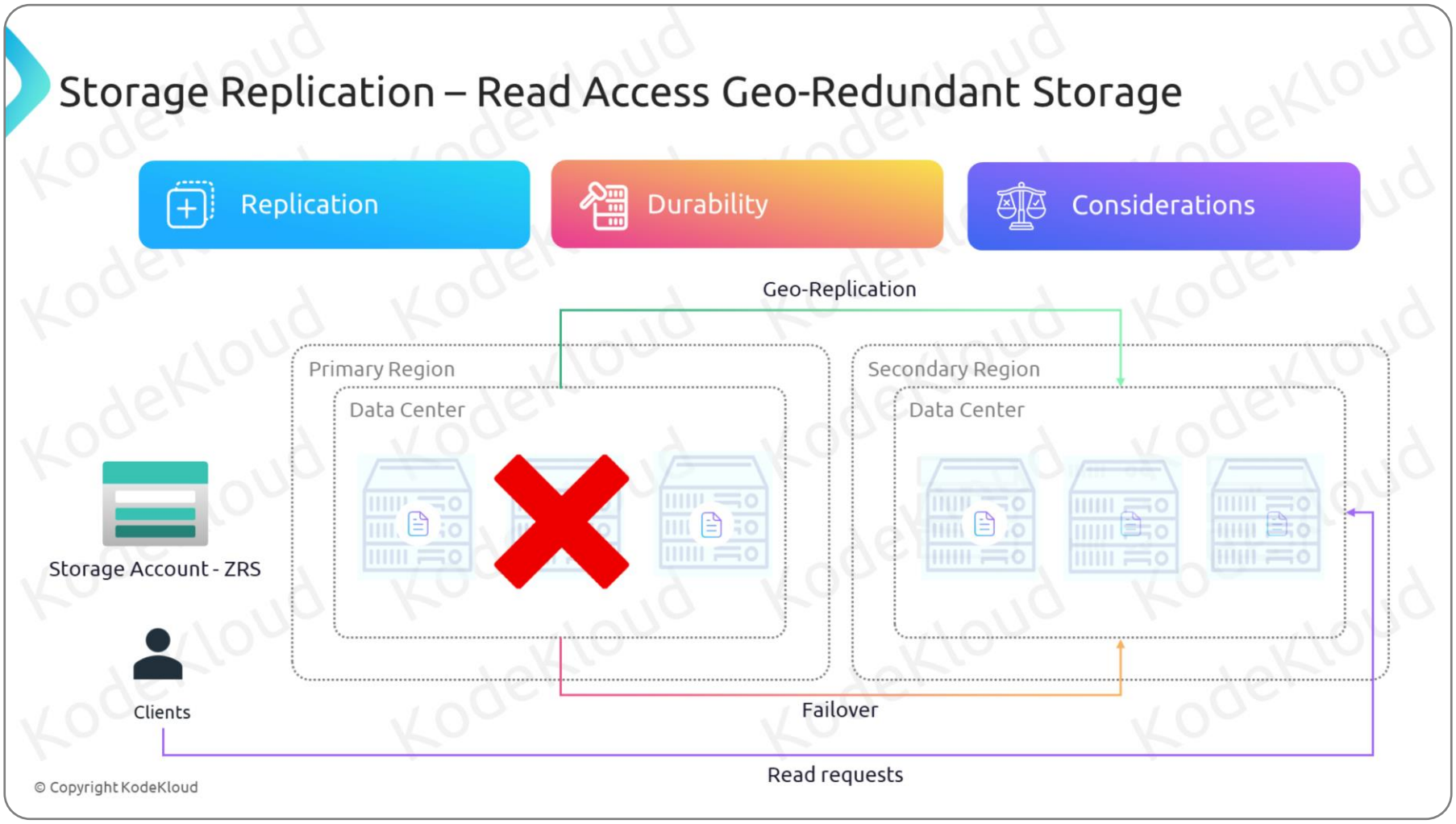


Replication
Data is replicated across three fault domains in a datacenter which is part of the primary region and is asynchronously replicated to secondary region where we will have three copies across fault domains.

Durability
GRS offers 99.9999999999999999 (16 9's) of durability. If the primary region goes down, a failover will happen, and

secondary region will become available for read requests.

Considerations
The primary region will be available for all operations and secondary will be only available after failover. The failover can be Microsoft initiated or customer initiated.



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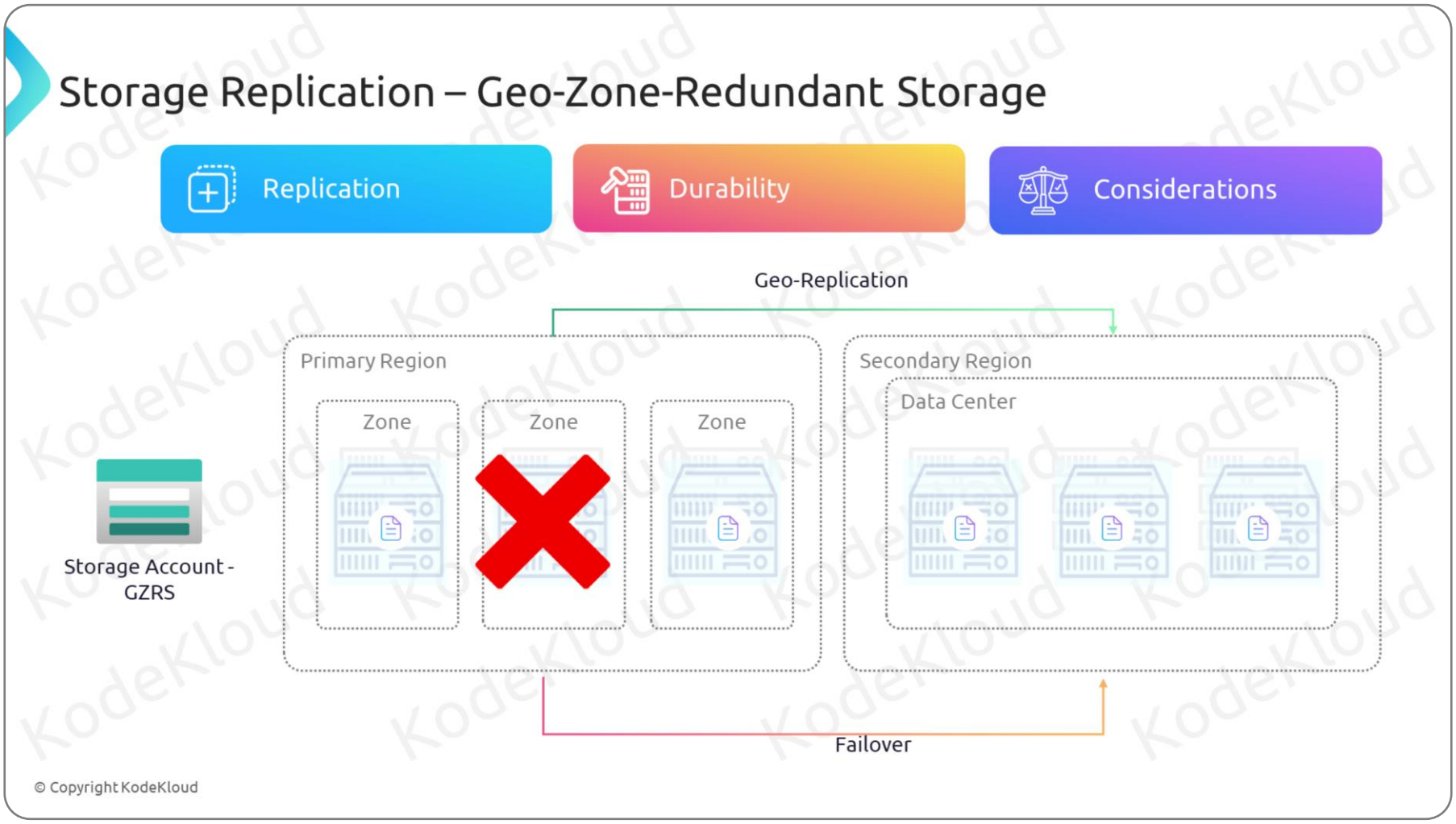
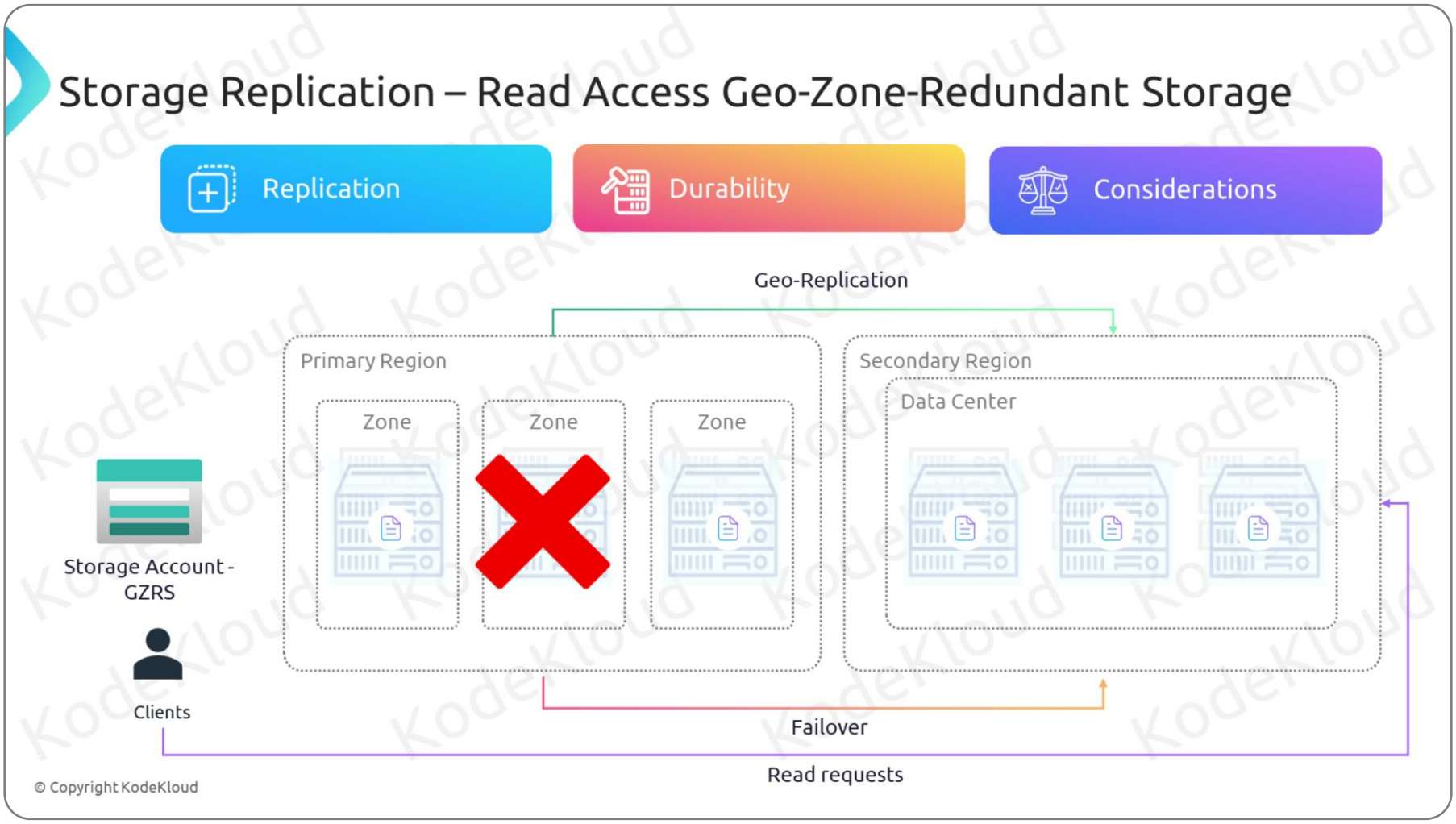


Replication
Three copies will be spread across availability zones within the primary region and is asynchronously replicated to secondary region where we will have three copies across fault domains.

Durability
GZRS offers 99.9999999999999999 (16 9's) of durability

Considerations
Here secondary region will be always available regardless of whether there is a failover or not.



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Accessing Storage Endpoints

Based on the storage account name and the service, every service has its own unique endpoint.

```
<protocol>://<storage account name>.<service>.core.windows.net
```

`http, https` — `Your storage account name` — `blob, queue, file, table`

For a storage account named “kodekloud”, the endpoints will be:

Service	Endpoint
Container service	https://kodekloud.blob.core.windows.net
Queue service	https://kodekloud.queue.core.windows.net
File service	https://kodekloud.file.core.windows.net
Table service	https://kodekloud.table.core.windows.net

If needed, we can use our own custom domain with CNAME mapping.

DNS CNAME entry	Alias
blobs.kodekloud.com	kodekloud.blob.core.windows.net

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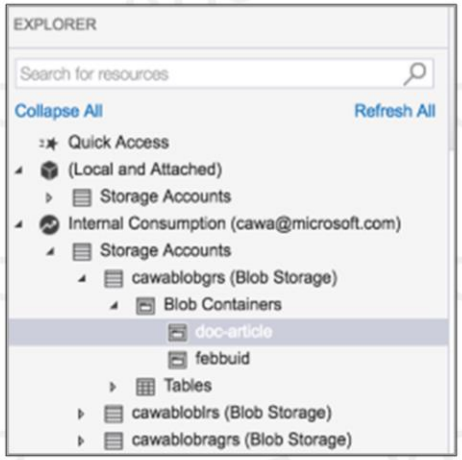
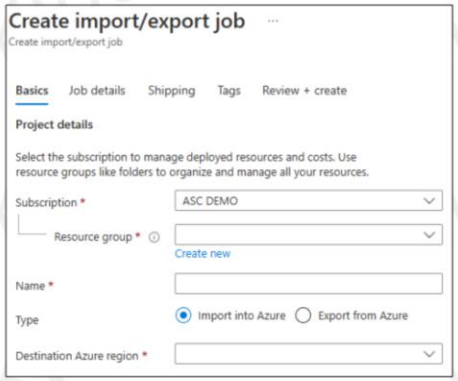
Configure Storage With Tools (optional)

Azure Storage Explorer



Import and Export Service



AzCopy

```
azcopy copy [source] [destination] [flags]
```

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This used to be an entire Learn module. Now it is a summary slide. The removed slides are at the end of the presentation.

Get started with Storage Explorer - https://docs.microsoft.com/azure/vs-azure-tools-storage-manage-with-storage-explorer

Upload, download, and manage data with Azure Storage Explorer - https://docs.microsoft.com/learn/modules/upload-

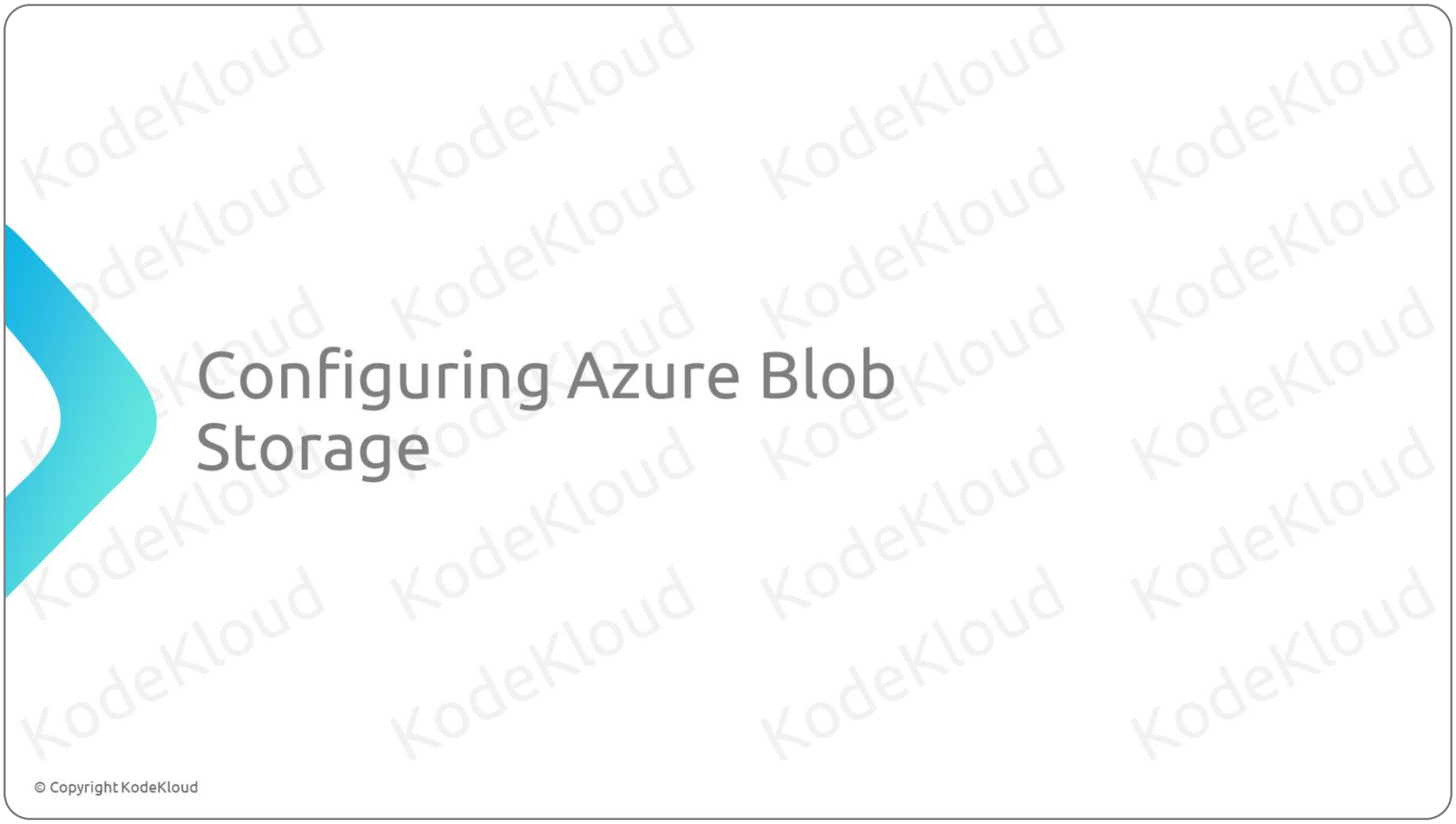
download-and-manage-data-with-azure-storage-explorer/

Use the Azure Import/Export service to export data from Azure Blob storage - https://docs.microsoft.com/azure/storage/common/storage-import-export-data-from-blobs

Export large amounts of data from Azure by using Azure Import/Export - https://docs.microsoft.com/learn/modules/export-data-with-azure-import-export/

Use the Azure Import/Export service to import data to Azure Blob Storage - https://docs.microsoft.com/azure/storage/common/storage-import-export-data-to-blobs

Get started with AzCopy - https://docs.microsoft.com/azure/storage/common/storage-use-azcopy-v10?toc=/azure/storage/files/toc.json



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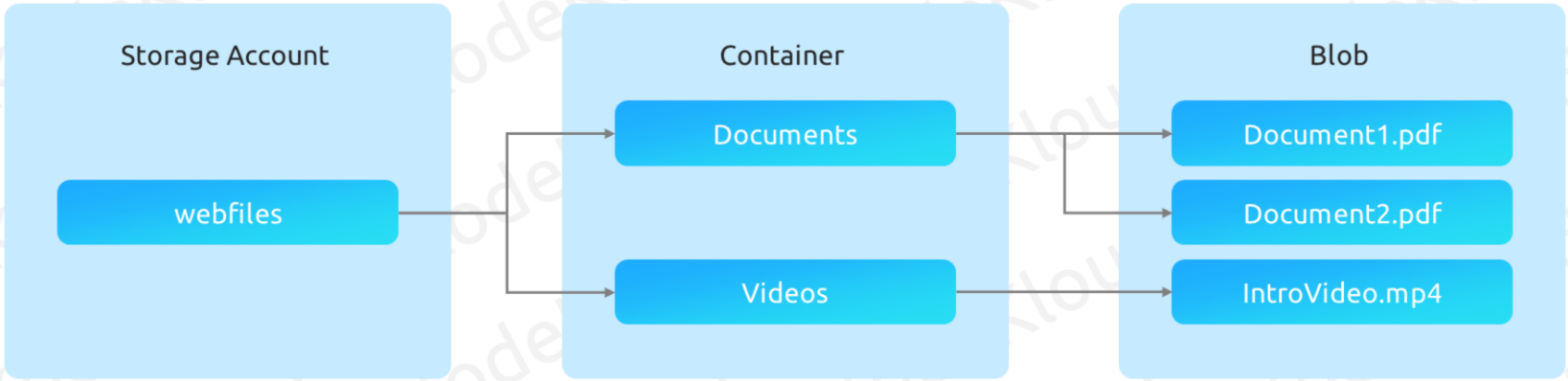
Azure Containers (Blob Storage)



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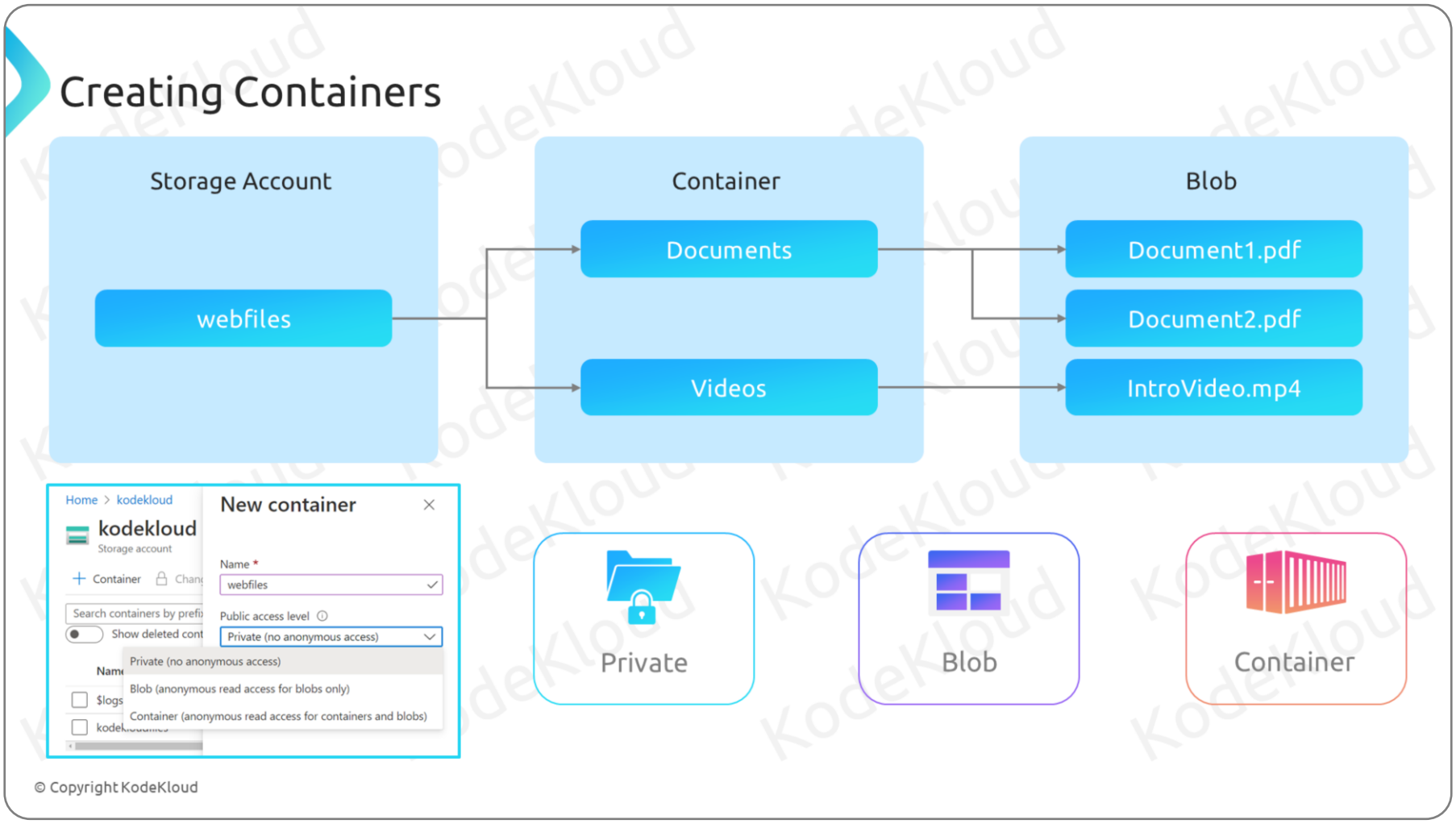
Embed images or documents in webpages
Stream video and audio directly to browser
Strong files for distribution for example installation packages on websites
Act as a disaster recovery site for your on-premises site
Backup, recovery and archiving
Store data for analysis which can be accessed by tools like Power BI



Private
No anonymous access to data stored in the container

Blob
Anonymous read access to blobs only

Container

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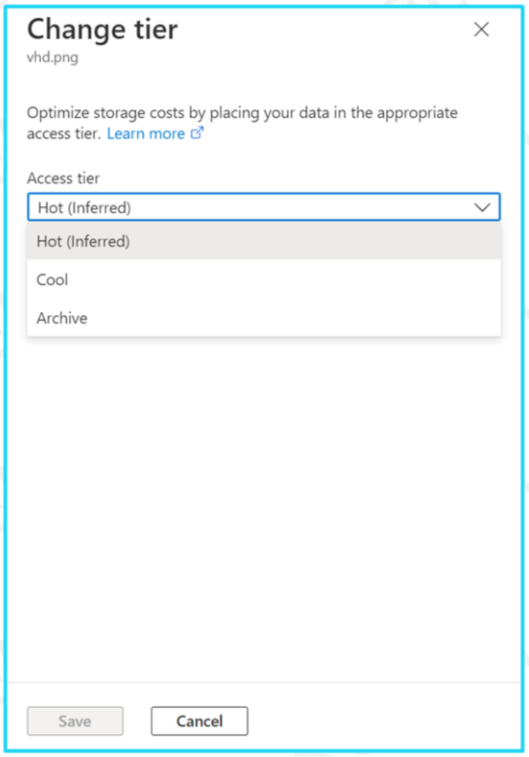
Storage Access Tiers

Tier	Storage Cost	Access Cost
Hot	$$$	$
Cool	$$	$$
Archive	$	$$$



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Hot
Ideal for storing data that is frequently accessed.

Cool
Ideal for storing large amounts data that is not accessed frequently and is stored for at least 30 days.

Archive
Ideal for that can tolerate several hours of retrieval latency and will remain the archive tier for at least 180 days.

Access tiers can be switched any time as required

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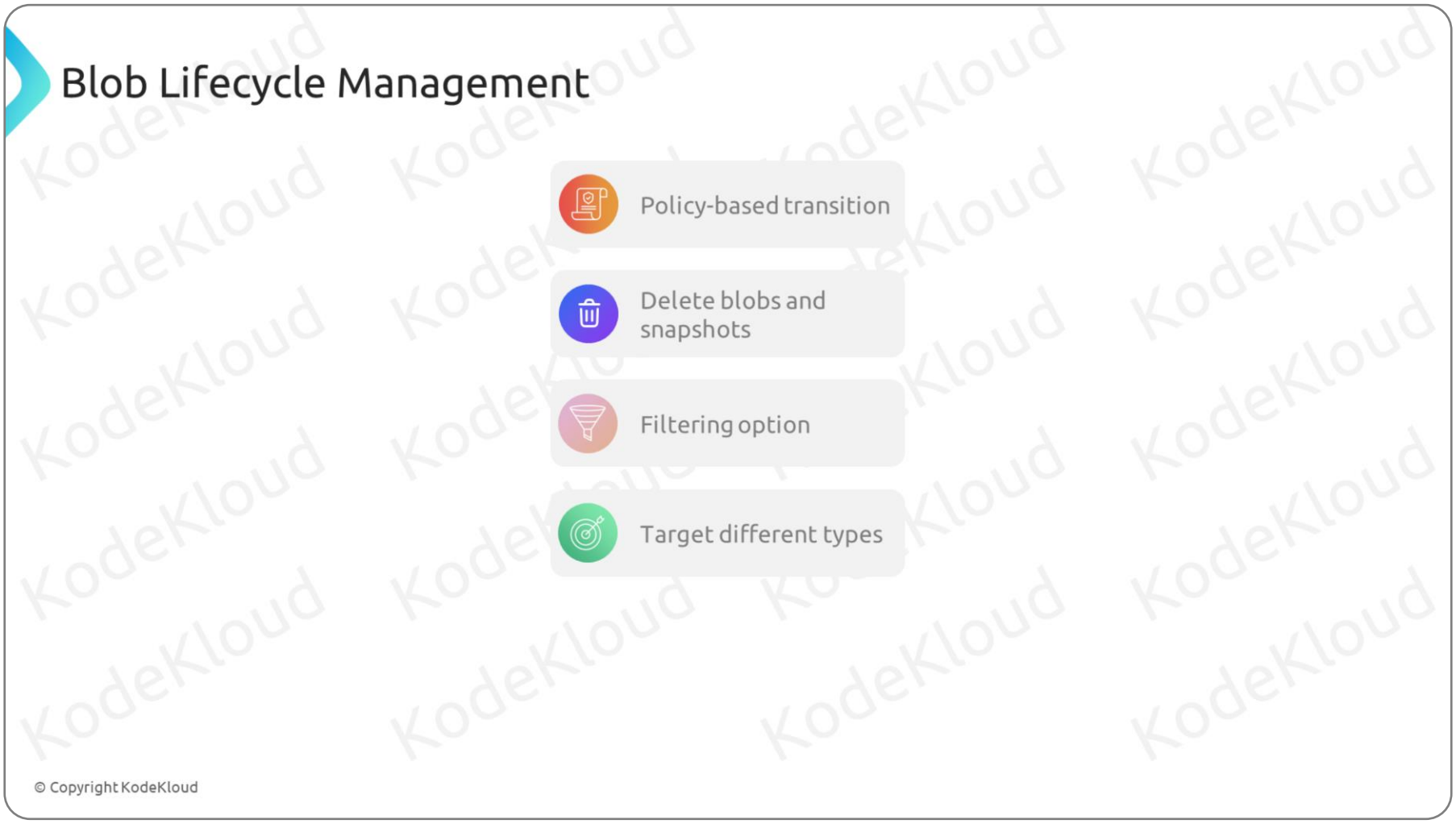

Policy based transition
We can transition blobs to cooler tiers automatically based on the last modified date.

Delete blobs and snapshots
Besides transitioning to cooler tiers, LCM can be used to delete blobs and blob snapshots after X number of days if they are not modified.

Filtering option
We can apply the policy to all the blobs in the storage or limit blobs with filters

Target different types
LCM can target block blobs and append blobs and further apply to sub types such as base blobs, versions and snapshots.

Blob Lifecycle Management

```
{
  "rules": [
    {
      "enabled": true,
      "name": "rule",
      "type": "Lifecycle",
      "definition": {
        "actions": {
          "baseBlob": {
            "tierToCool": {
              "daysAfterModificationGreaterThan": 60
            },
            "tierToArchive": {
              "daysAfterModificationGreaterThan": 180
            },
            "delete": {
              "daysAfterModificationGreaterThan": 365
            }
          }
        },
        "filters": {
          "blobTypes": [
            "blockBlob"
          ]
        }
      }
    }
  ]
}
```

- Policy-based transition
- Delete blobs and snapshots
- Filtering option
- Target different types

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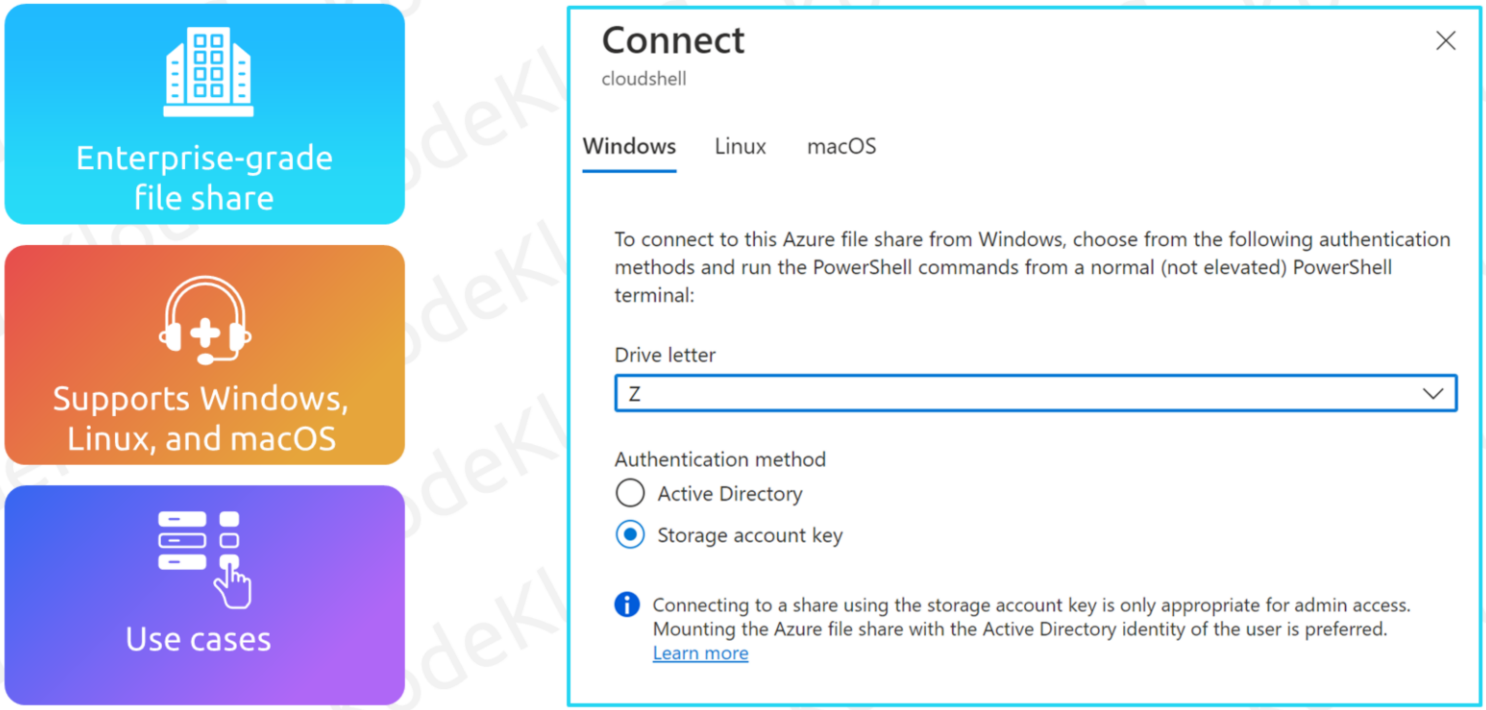
Creating Azure File Share



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Enterprise grade file share
With file shares, we can share files across virtual machines and non-Azure workloads. Any number of Azure or non-Azure virtual machines can mount and work on the file share simultaneously. Also supports backup and snapshot for data recovery.

Supports Windows, Linux and macOS

Azure provides easy to use scripts to mount the file share to Windows, Linux and macOS computers. Computers can interact with Azure file share as they work with on-premises file shares. Port 445 needs to be open for SMB traffic.

Use cases
Firstly, we can decommission on-premises file share and migrate to Azure Files. It can be used for storing diagnostic data, tool and utilities which needs to be shared with teams.

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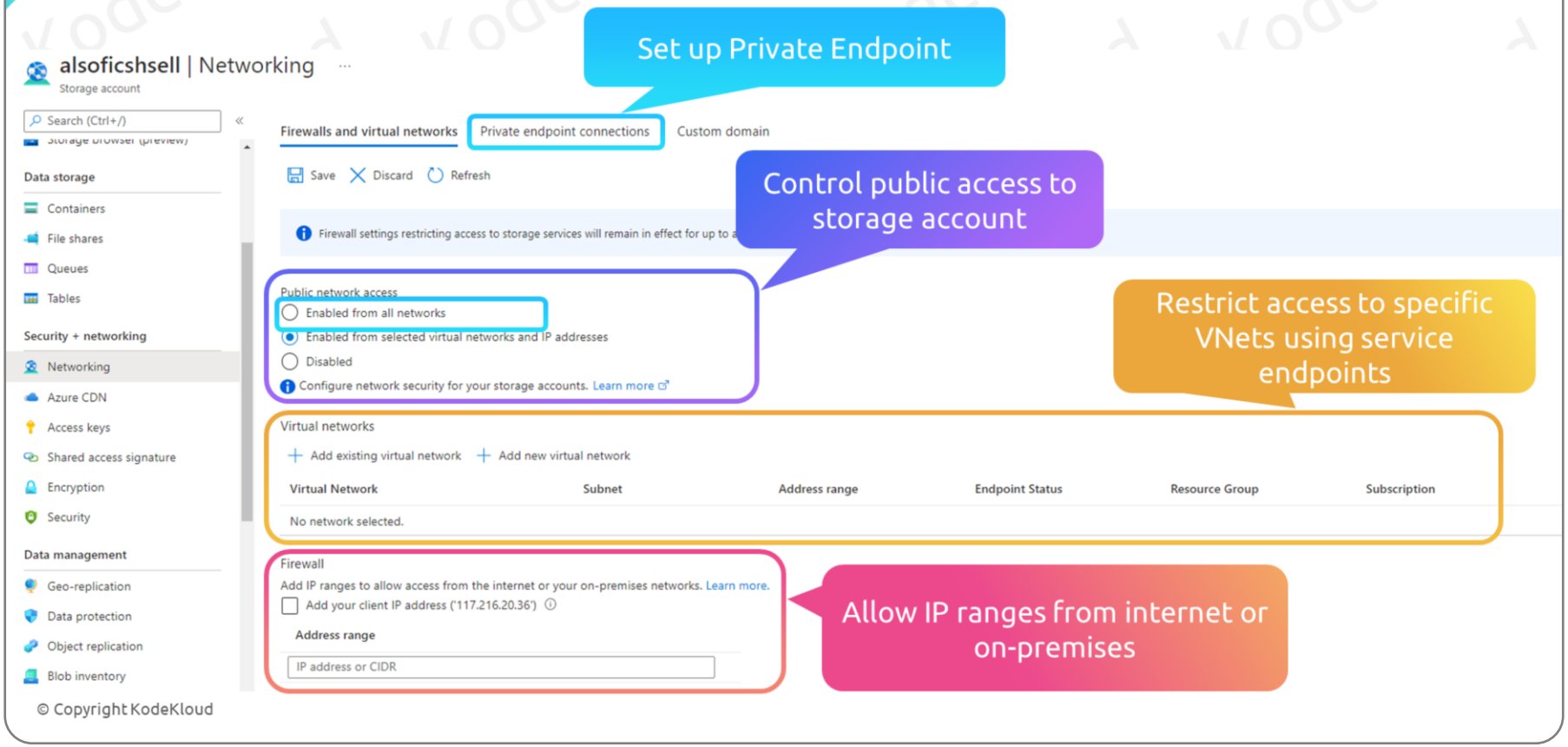
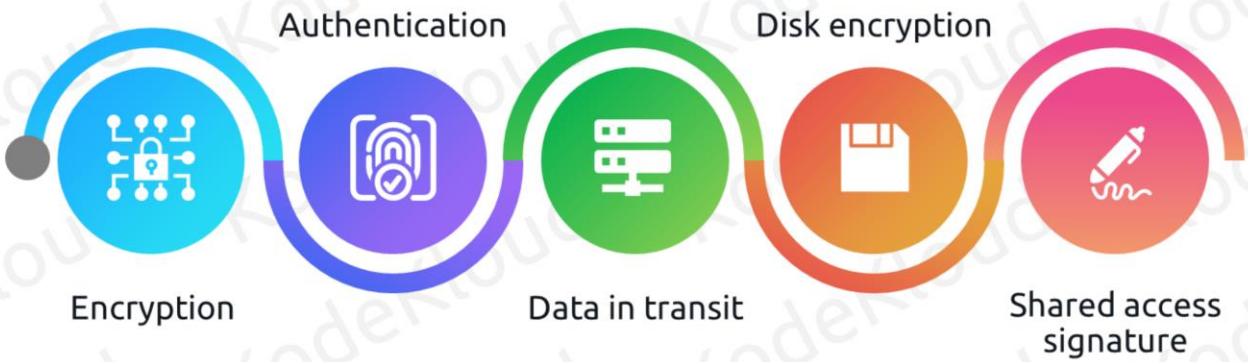
Securing Storage Endpoints



Storage Security Capabilities



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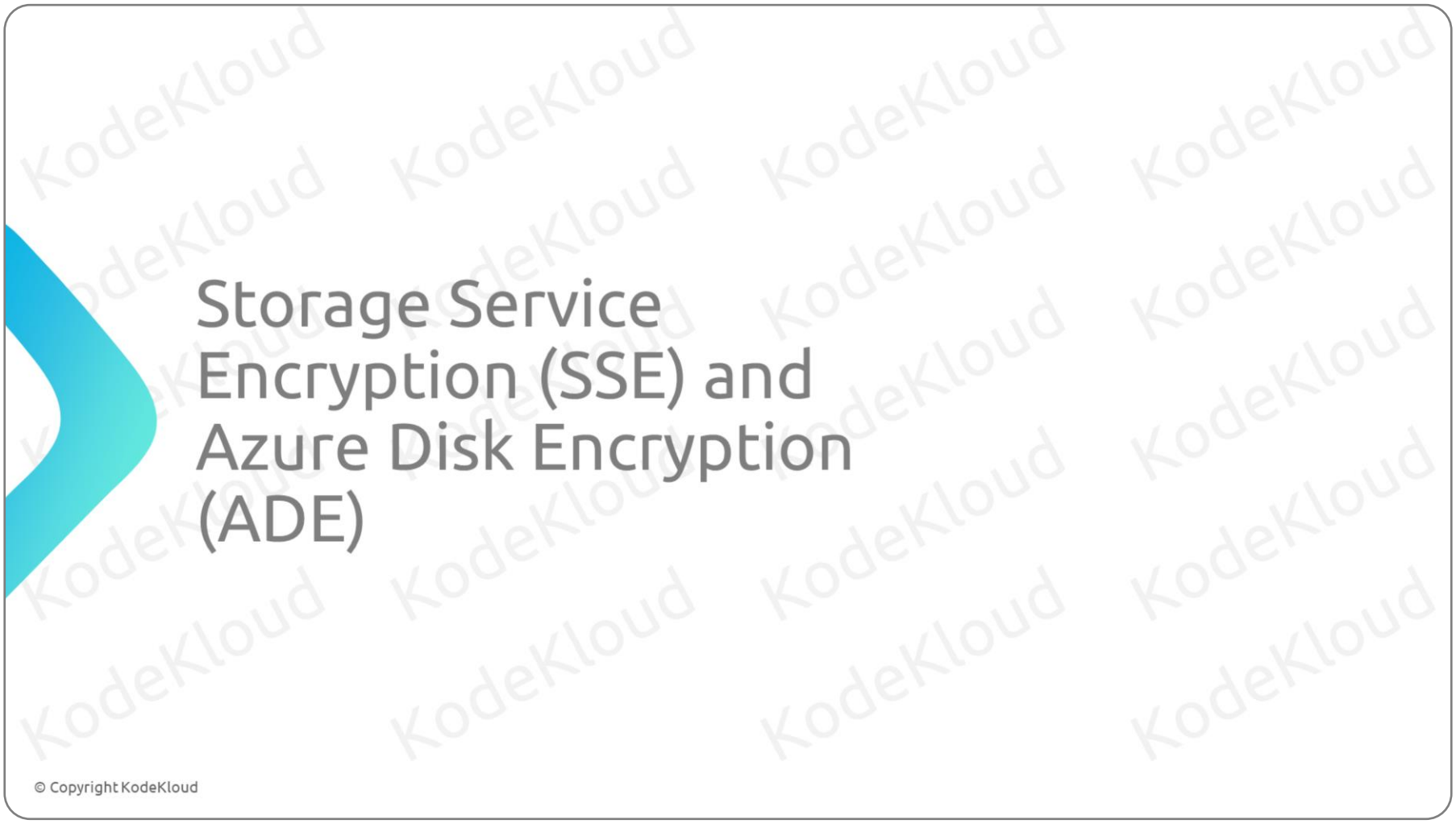
Encryption
By default, without any additional configuration, all data written to the storage account is encrypted by Storage Service Encryption (SSE)

Authentication
With help of Azure AD and RBAC, we can authenticate and requests and provide authorization to storage services.

Data in transit
Client-side encryption, HTTPS, and SMB 3.0 is used to secure data in transit.

Disk encryption
OS and Data disks of Linux and Windows VMs can be encrypted using Azure Disk Encryption (ADE).

Shared access signature
Fine tuned granular access can be given to storage services with the help of SAS.



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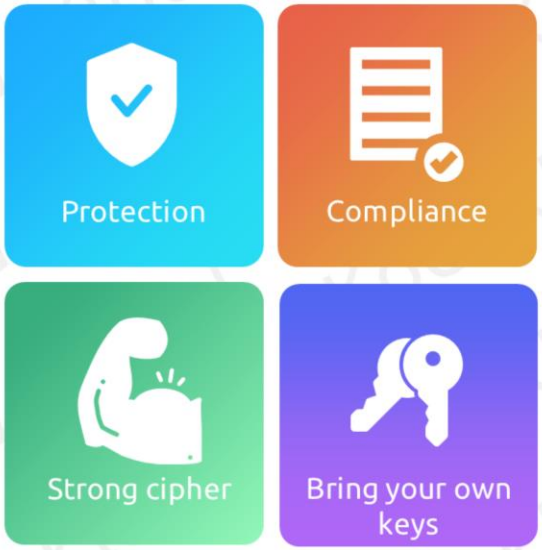
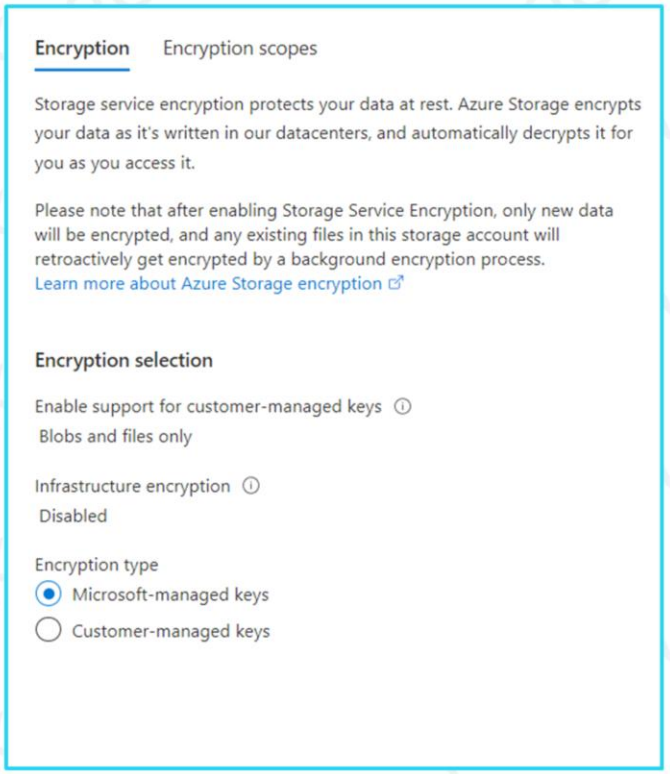
Storage Service Encryption (SSE)





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Protection
Data at rest is protected using SSE. All data written to Azure Disks, Blob, File, Queue, and Table is encrypted using SSE and is decrypted when the data is retrieved.

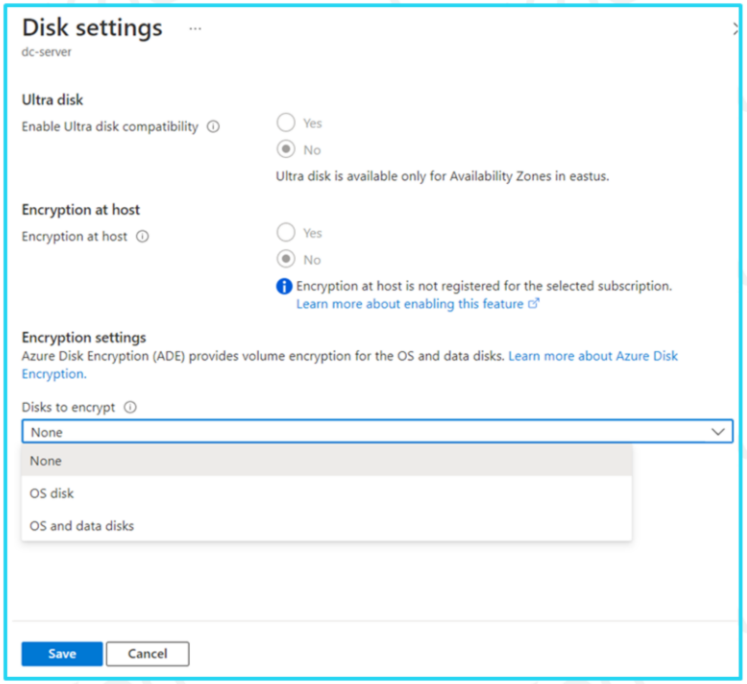
Compliance
Organizations doesn't need develop in-house encryption methods to encrypt data stored in Azure storage. Using SSE

organizations can meet their compliance and security requirements.

Strong cipher
SSE uses 256-bit AES encryption to encrypt the data. The encryption, decryption, data management and key management is done by storage service. SSE cannot be disabled.

Bring your own keys
If you would like to control the encryption keys and their rotation, you replace Microsoft managed keys with Customer Managed Keys. You need to create an Azure Key Vault to store the key and the storage service will retrieve the key from Key Vault for encryption and decryption.

Azure Disk Encryption (ADE)



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Encrypt disks
Using ADE, we can encrypt OS and Data Disks of Windows and Linux virtual machines. ADE uses BitLocker for Windows and DM-Crypt for Linux to encrypting the disks. Encryption keys are stored in Azure Key Vault.

Restrict access
Since the disk is encrypted, only the VM owner will be able to retrieve the data stored in the VM. If anyone downloads

the VHD and attaches to another VM, without the keys, they will not be able to read the data.

Encrypted backup
When you are using Azure Backup, the encryption keys are backed up to the recovery service vault. Also, the backups are encrypted. ASE uses AES 256-bit encryption.

Considerations
If you are encrypting both OS and Data disk, there will be a small performance impact due to the encryption and decryption activity. The impact is very minimal, however, if your application is CPU intensive then you can skip the OS disk and encrypt data disk only to enhance performance.

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Configuring storage access

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Storage Account Keys
Two 512-bit keys will be generated for every storage account, and this can be rotated. Account keys are like root passwords, and we need to secure them to avoid unauthorized access.

Shared access signature
Delegate access to storage at a very granular level. SAS are generated using account keys but with fine tuned access.

Azure AD
Using Azure AD and RBAC we can authenticate and authorize requests from users. Currently Azure AD authentication is supported by Blobs, Queues, and Tables only. For Files, SMB access can be given with the help of AAD Domain Services.

Anonymous
We can enable anonymous access to our blobs and containers. As the request is anonymous, we don’t need pass any authorization header.

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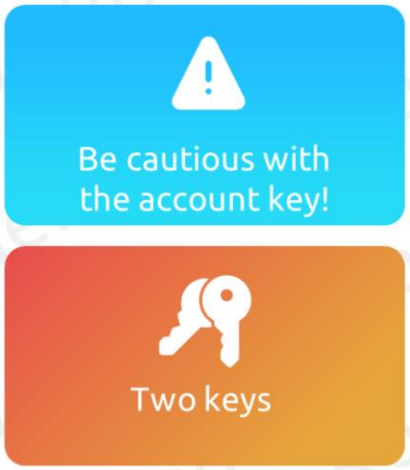
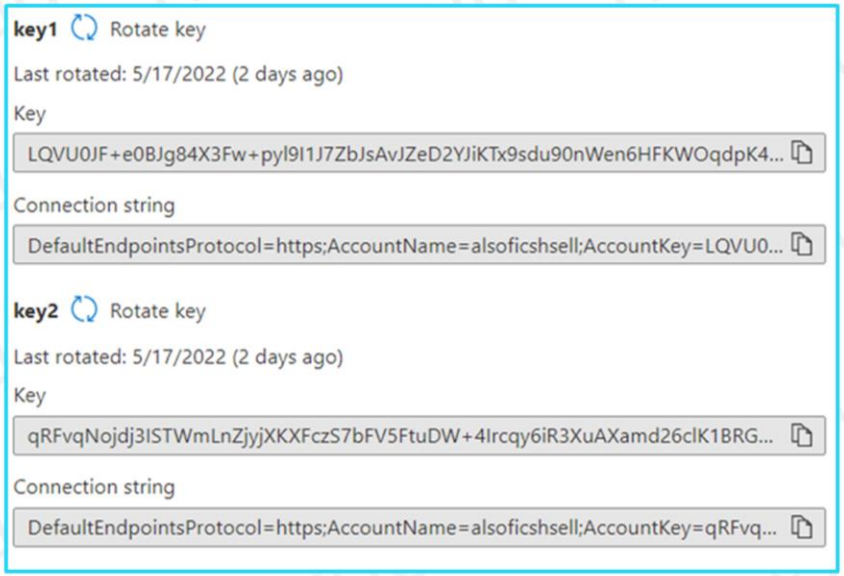
Storage Account Keys





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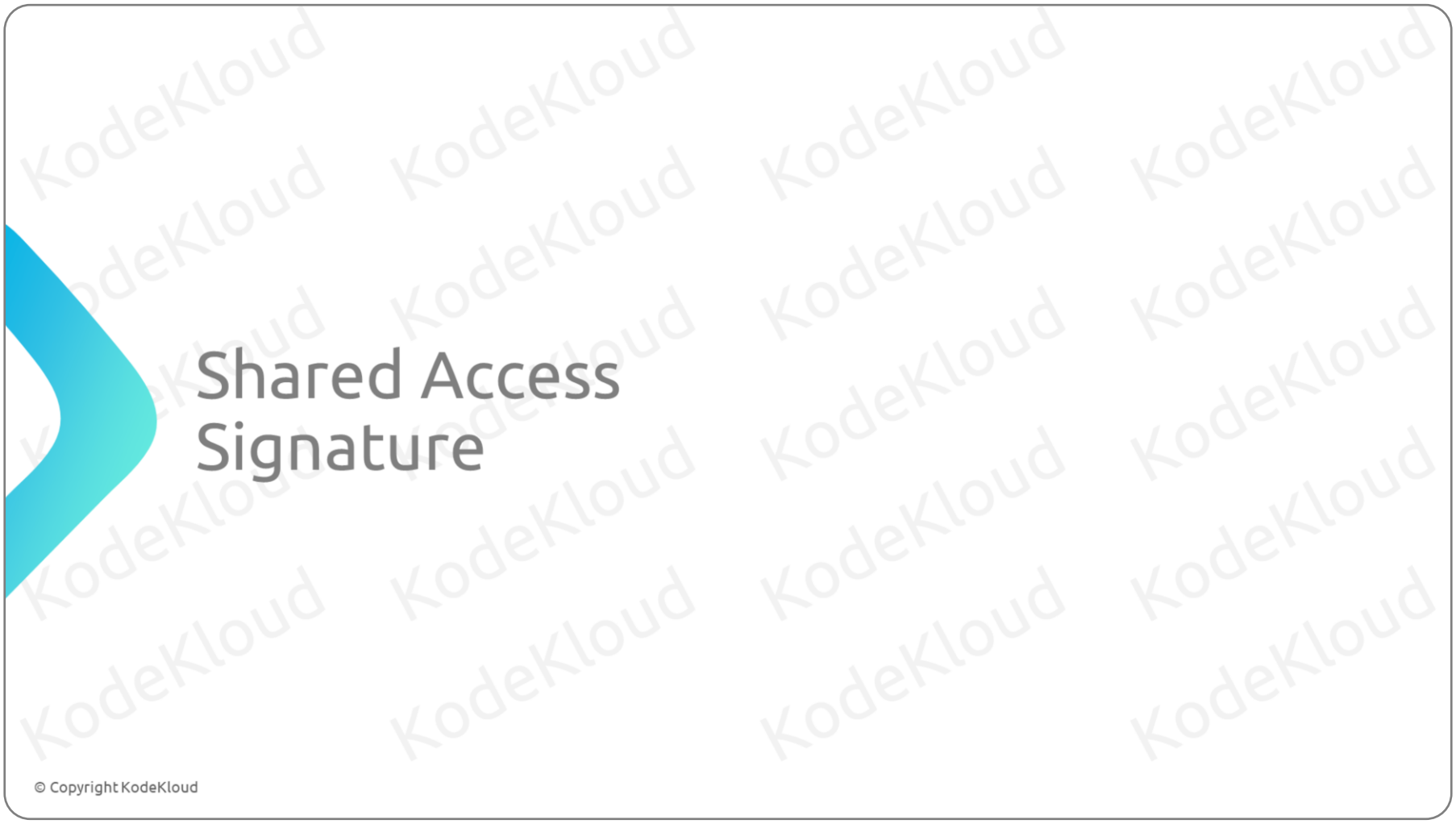
Be cautious with the account key!
Account key is like the root password, the user possessing the account keys can perform any action against the storage account. Microsoft recommends to save the key to Azure Key Vault and regularly rotate them.

Two keys
Azure provides two 512-bit keys for every storage account. You can either one of these in your API calls in your

authorization header. Users with permission to **Microsoft.Storage/storageAccounts/listkeys/action** can view, read or copy the key via Azure Portal, Azure CLI, and Azure PowerShell.



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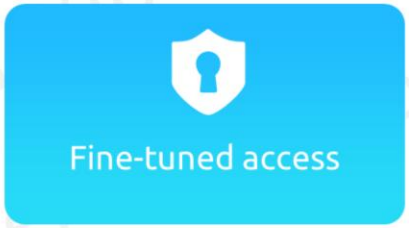
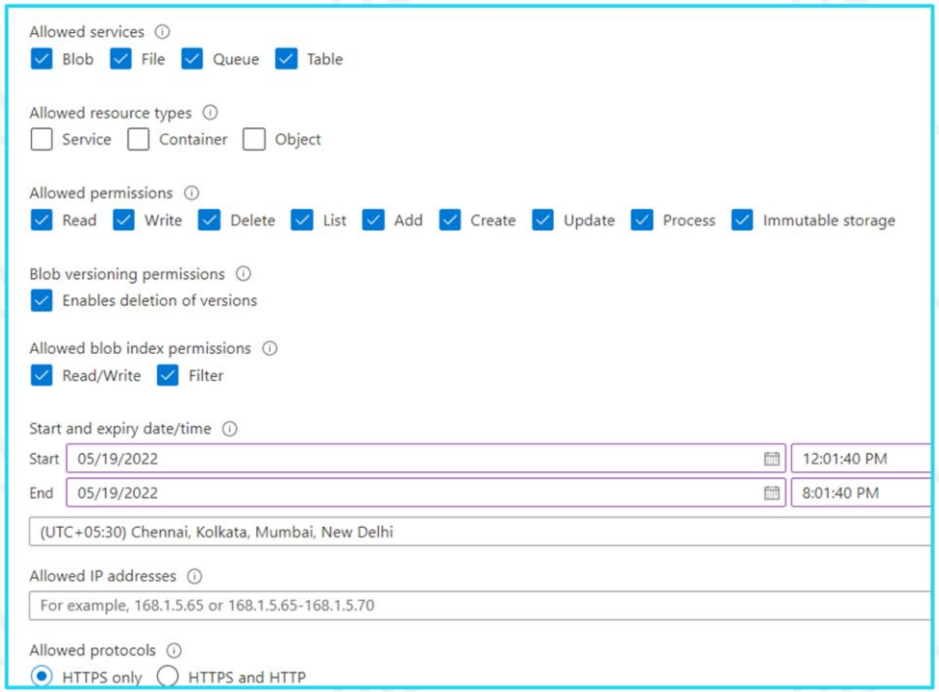
Shared Access Signature





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Fine tuned access
Instead of giving full access via account keys we can fine tune the access via SAS. We can control the allowed services, allowed resource types, permissions, start time, end time, IP address and protocol using SAS

Three types of SAS keys
✓ User delegation SAS

✓ Service SAS
✓ Account SAS

Shared Access Signature

URL

Resource Endpoint
https://kodekloud.blob.core.windows.net

SAS token
?sv=2020-08-04&ss=bfqt&srt=sc&sp=rwdlacup……

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Shared Access Signature

Name	Excerpt	Explanation
Resource URI	https://kodekloud.blob.core.windows.net	Blob endpoint
Storage service version	sv=2020-08-04	Version of the storage service
Services	ss=bftq	SAS applies to blob, file, table and queue
Resource type	srt=sc	SAS applies to service and container level operations
Permissions	sp=rwdlacup	Supports read, write, delete, list, add, create, and update
Start time	st=2022-05-19T06:31:40Z	Start date and time in UTC
End time	se=2022-05-19T14:31:40Z	End date and time in UTC
IP address range	sip=168.11.12.13-168.11.12.19	Allowed IP range
Protocol	spr=https	Only HTTPS requests are allowed
Signature	sig=66iXqzZSakarJO5J210%2ByoPRVXTeT%2FTJcHHSEkUjHr0%3D	Unique signature which is HMAC computed over a string to sign and key using SHA256, then Base64 encoding on top of that.

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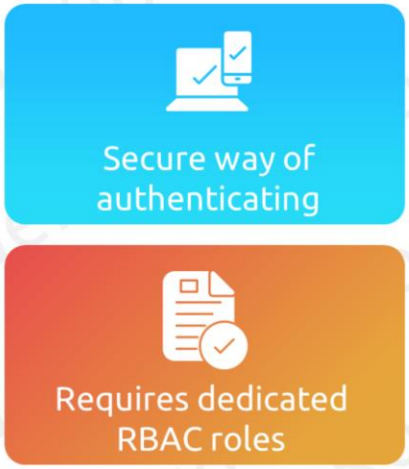
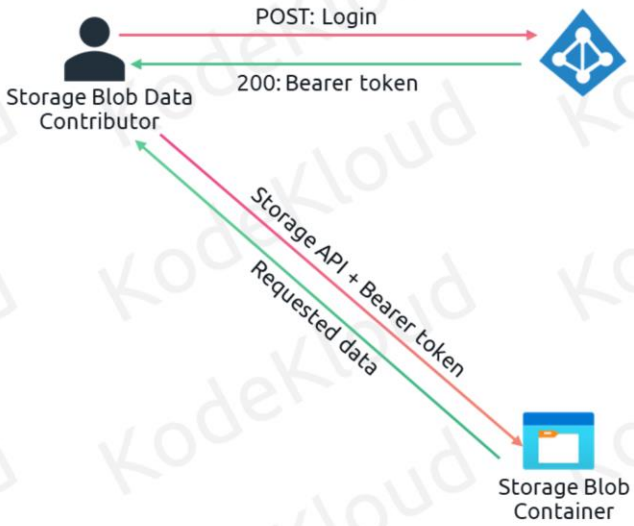
- A repeatable way to deliver software and infrastructure code to its destination
- Build and test code
- Deploy to on-prem or cloud resources
- CICD isn't just for software developers. It's also for infrastructure pros

Microsoft Entra ID Authentication





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Secure way of authenticating
Microsoft recommends using Azure AD authentication for accessing Blobs, Queues and Tables. Azure AD integrates features such as MFA, Conditional Access to enhance the request to access storage.

Requires dedicated RBAC roles
Even if you are the Owner or Contributor of the subscription, you would still require storage specific RBAC to authorize

storage access requests. These RBAC can be assigned to any scope and the access will be inherited. Example: Storage Blob Data Owner, Storage Queue Data Contributor.

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