

# Cloud Computing

**Caltech**

**Center for Technology &  
Management Education**

## **Designing Infrastructure Solutions on Azure**



## Design Migrations

# Learning Objectives

By the end of this lesson, you will be able to:

- Implement assessments using Azure Migrate
- Recommend a solution for migrating applications and virtual machines (VM)
- Recommend a solution for migrating databases
- Determine migration scope
- Recommend a solution for migrating data



# A Day in the Life of an Azure Architect

You are working as an architect in an organization which has decided to move to cloud. The company has 500 virtual machines hosted in a VMware environment. The VMs are of varying size and have varied utilization levels.

- You need to recommend the right solution and service to move all the virtual machines to Azure.
- You need to ensure that administrative efforts are minimized and recommend the number and size of Azure VMs needed.
- You need to also consider the .NET and PHP web projects that need to be migrated.

To achieve all the above, along with some additional features, we would be learning a few concepts in this lesson that will help you find a solution for the above scenario.



# Azure Migrate

# Cloud Migration in the Cloud Adoption Framework

The Microsoft Cloud Adoption Framework for Azure is available to assist users in driving Azure adoption across their organizations. The framework supports several methodologies:

Define strategy

Plan

Ready

Migrate

Innovate

Govern

Manage

Organize

# Cloud Migration in the Cloud Adoption Framework

Define strategy

Define the business case for adoption as well as the projected outcomes

Plan

Align actionable adoption plans with organization goals

Ready

Prepare the cloud environment for the changes that will be implemented

Migrate

Migrate and modernize existing workloads

# Cloud Migration in the Cloud Adoption Framework

Innovate

Create innovative hybrid or cloud-native solutions

Govern

Ensure that the environment and workloads are well managed

Manage

Cloud and hybrid solution operations management

Organize

Assemble the teams and responsibilities that will support the cloud adoption activities



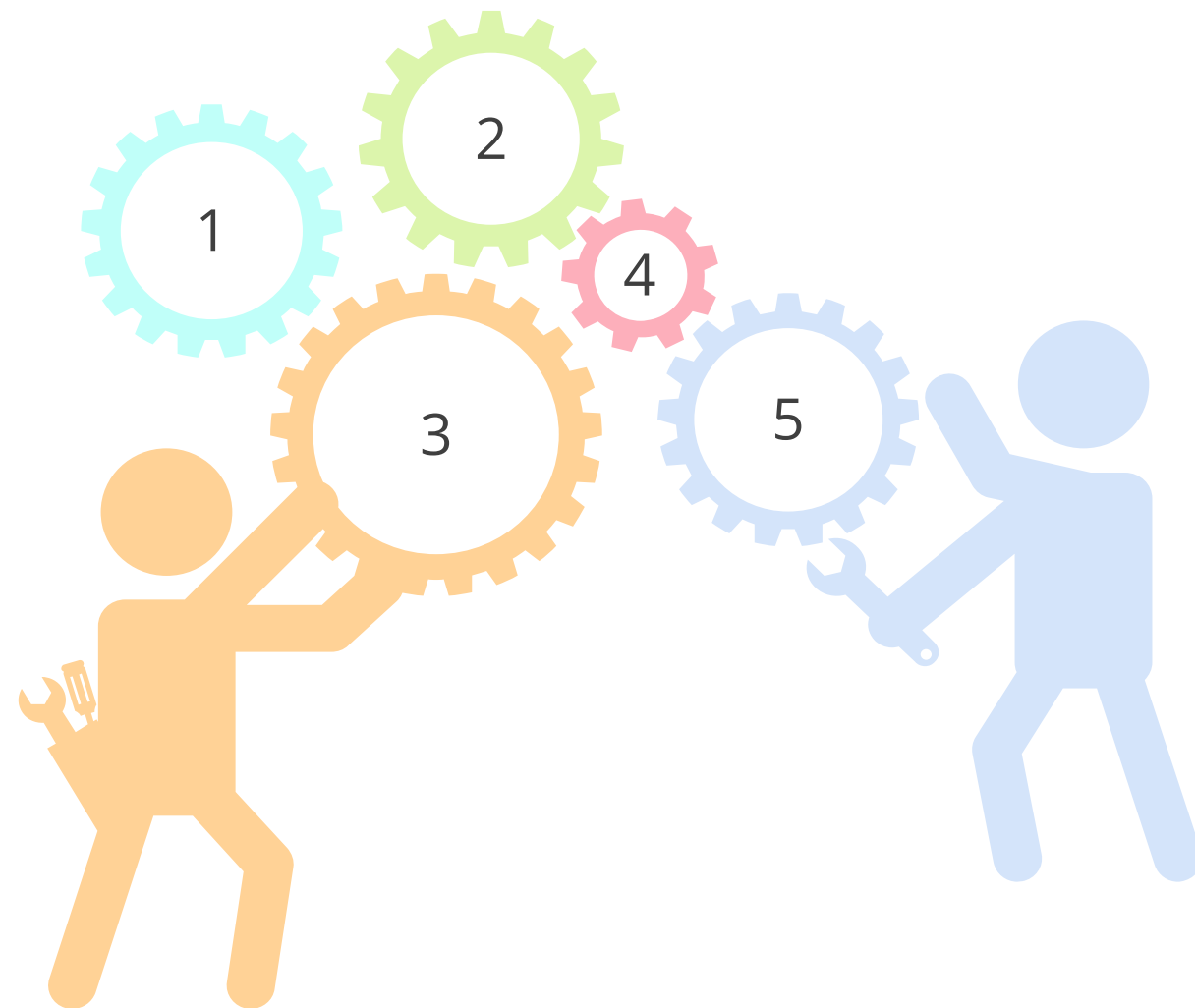
# Azure Migrate

Azure Migrate helps the user to migrate on-premise VMware VMs, Hyper-V VMs, physical servers, other virtualized machines, and private or public cloud instances to Azure.



# Key Features of Azure Migrate

The key features of Azure Migrate are:



Unified migration platform

Azure Migrate server assessment

Azure Migrate server migration

Database assessment or migration

Azure Migrate appliance

# VMware Migration

VMware VMs can be migrated using Azure Migrate Server Migration with the following two options:

## Agentless replication

Migrate VMs without installing an agent on the VMs

## Agent-based replication

Install an agent on the VM for replication

# VMware Migration

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Agentless replication is easy to deploy in VMware, but has the following limitations:



Simultaneous replication: maximum of 300 VMs migrated at a time



VM must have 60 or less disks



VM operating systems may need manual configuration before migration



Issues with Linux or EUFI boot, encrypted disks or volumes, NFS volumes, and target storage

# Deployment Steps Comparison

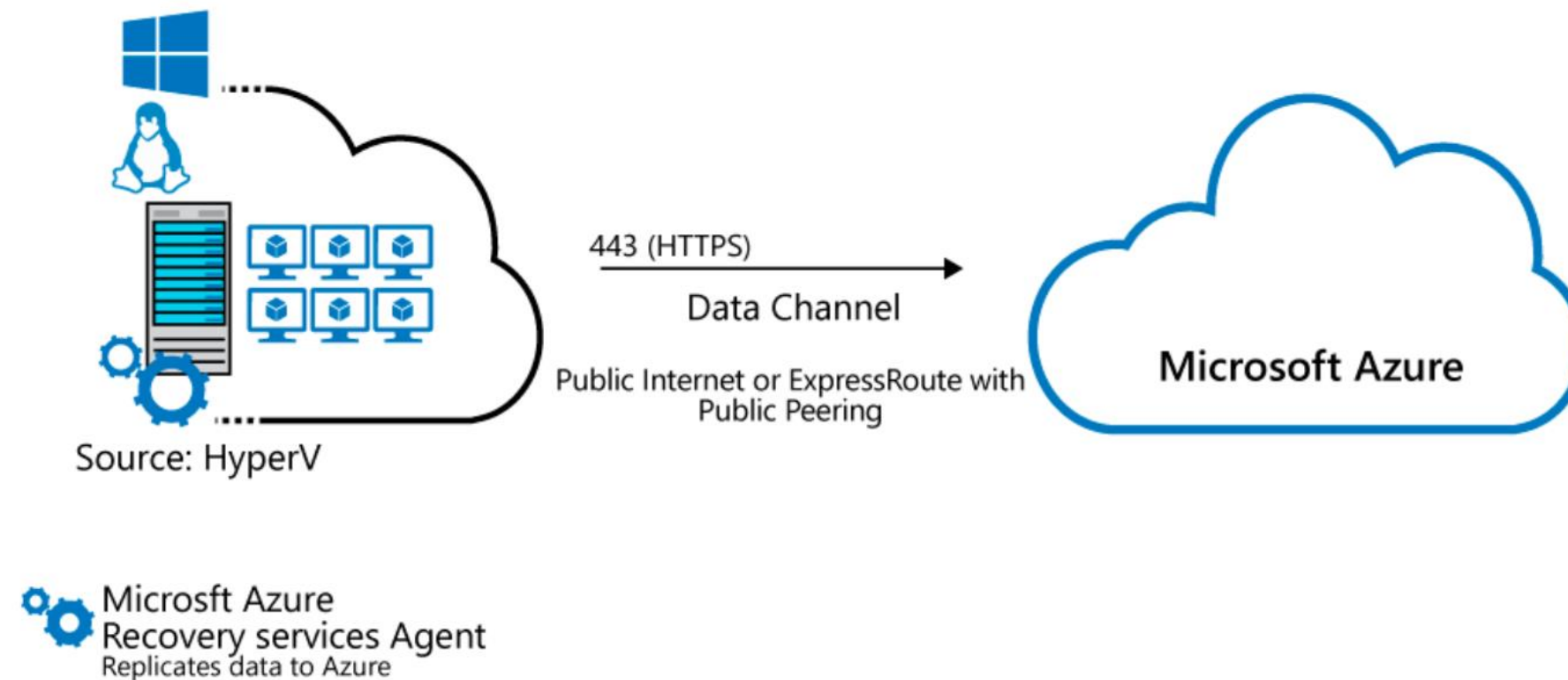
Task	Details	Agentless	Agent-based
<b>Prepare VMware servers and VMs for migration</b>	Configure a number of settings on VMware servers and VMs	Required	Required
<b>Add the server migration tool</b>	Add the Azure Migrate Server Migration tool to the Azure Migrate project	Required	Required
<b>Deploy the Azure Migrate appliance</b>	Set up a lightweight appliance on a VMware VM for VM discovery and assessment	Required	Not required
<b>Install the mobility service on VMs</b>	Install the mobility service on each VM the user wants to replicate	Not required	Required

# Deployment Steps Comparison

Task	Details	Agentless	Agent-based
<b>Deploy the Azure Migrate Server</b>	Set up an appliance on a VMware VM to discover VMs, and bridge between the mobility service running on VMs and Azure Migrate Server Migration	Not required	Required
<b>Enable VM replication</b>	Configure replication settings and select VMs to replicate	Required	Required
<b>Run a test migration</b>	Run a test migration to make sure everything is working as expected	Required	Required
<b>Run a full migration</b>	Migrate the VMs	Required	Required

# Hyper-V Migration

The Azure Migrate Server Migration tool provides agentless replication for on-premise Hyper-V VMs, using a migration workflow that's optimized for Hyper-V.



# Hyper-V Migration

Hyper-V VM installs services such as, Microsoft Azure Site Recovery provider and Microsoft Azure Recovery Service agent on Hyper-V Hosts or cluster nodes for migration.

## Replication provider

It is installed on Hyper-V hosts and registered with Azure Migration Server Migration. The provider orchestrates replication for Hyper-V VMs.

## Recovery Services agent

It handles data replication. It works with the provider to replicate data from Hyper-V VMs to Azure.

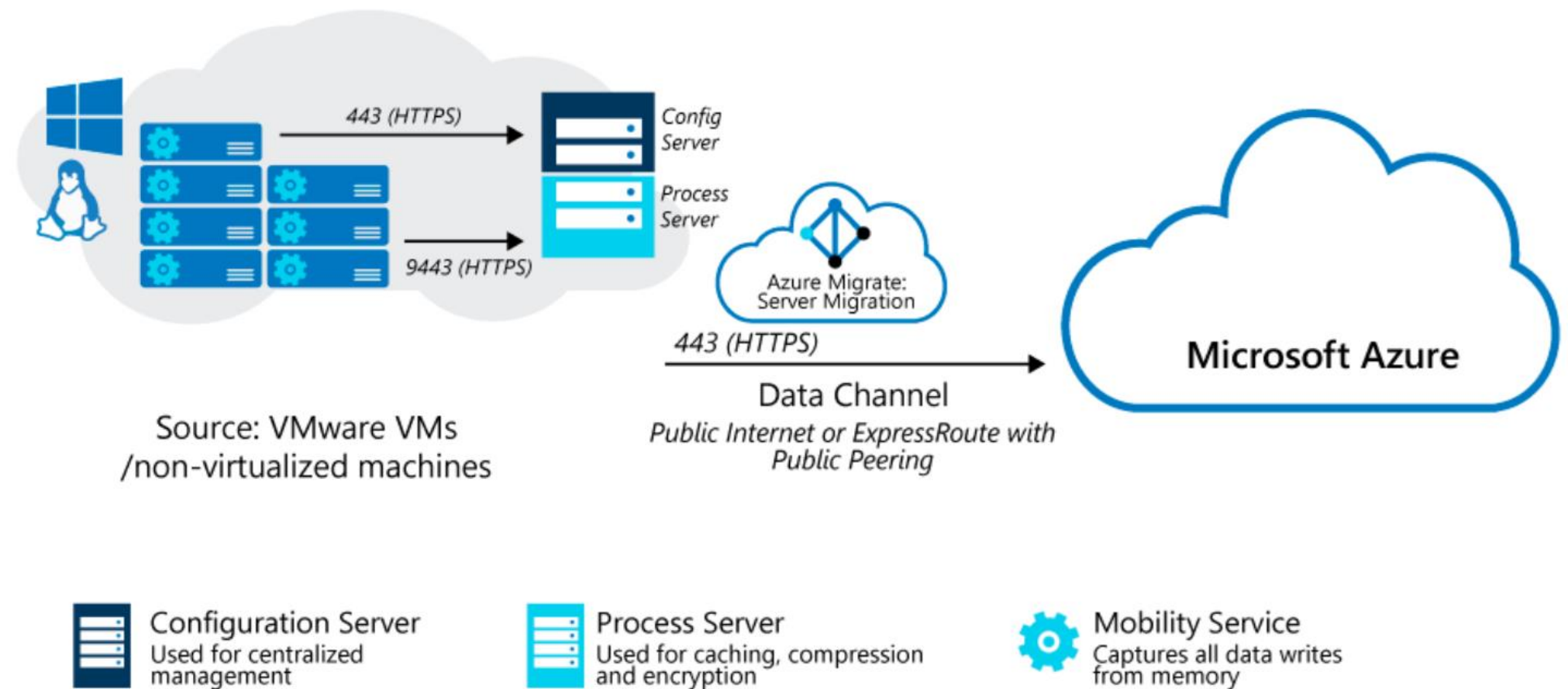


# Agent-Based Migration Architecture

The following diagram shows the architecture of agent-based migration:

## Core requirements

- Configuration VM
- ESXi hosts > v5.5
- Permissions
- VM Requirements
- Mobility Service
- Azure Storage



# Assessments Using Azure Migrate

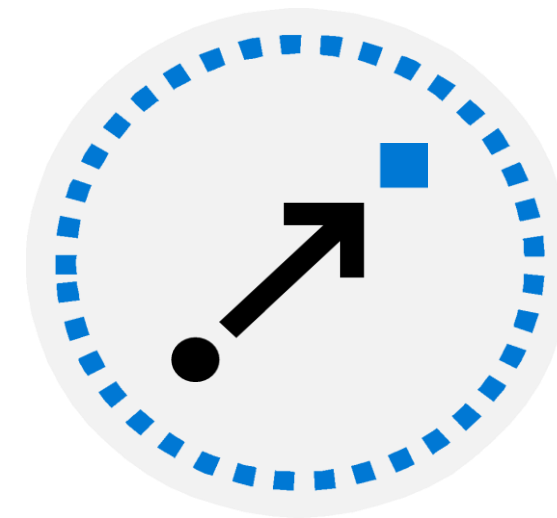
# Planning Azure Migration

A user can follow the migration path by using the Cloud Adoption Framework of assess, migrate, optimize, and monitor.



## Assess

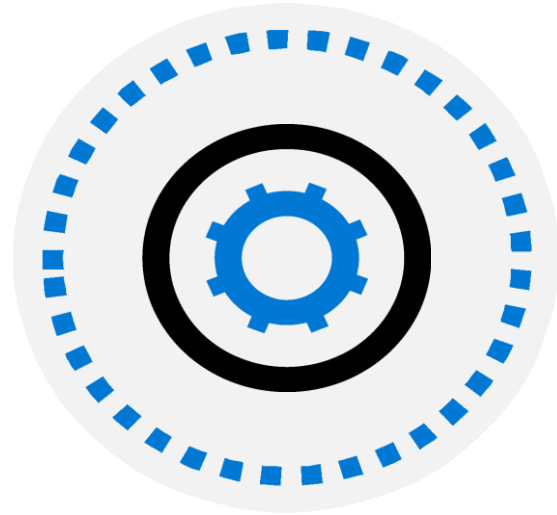
Start with a full assessment of the current environment



## Migrate

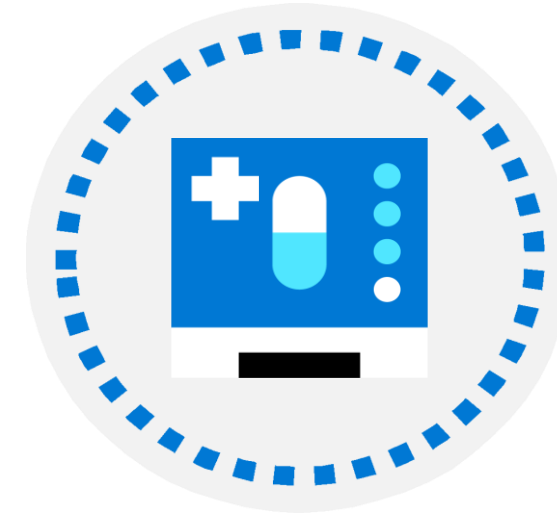
To migrate to Azure, users will need destination systems and services

# Planning Azure Migration



## Optimize

Once the services are migrated, it is important to optimize them to ensure their efficiency.



## Monitor

Log Analytics agent captures health and performance information from Azure VMs.

# Assess

The servers, applications, and services that are in scope for migration start with a full assessment of the current environment.



# Assess

For each application, there are multiple migration options:

Rehost

Recreate existing infrastructure by moving virtual machines from the data center to VMs on Azure

Refactor

Move services running on VMs to PaaS services

Rearchitect

Rearchitect some systems so that they can be migrated

Rebuild

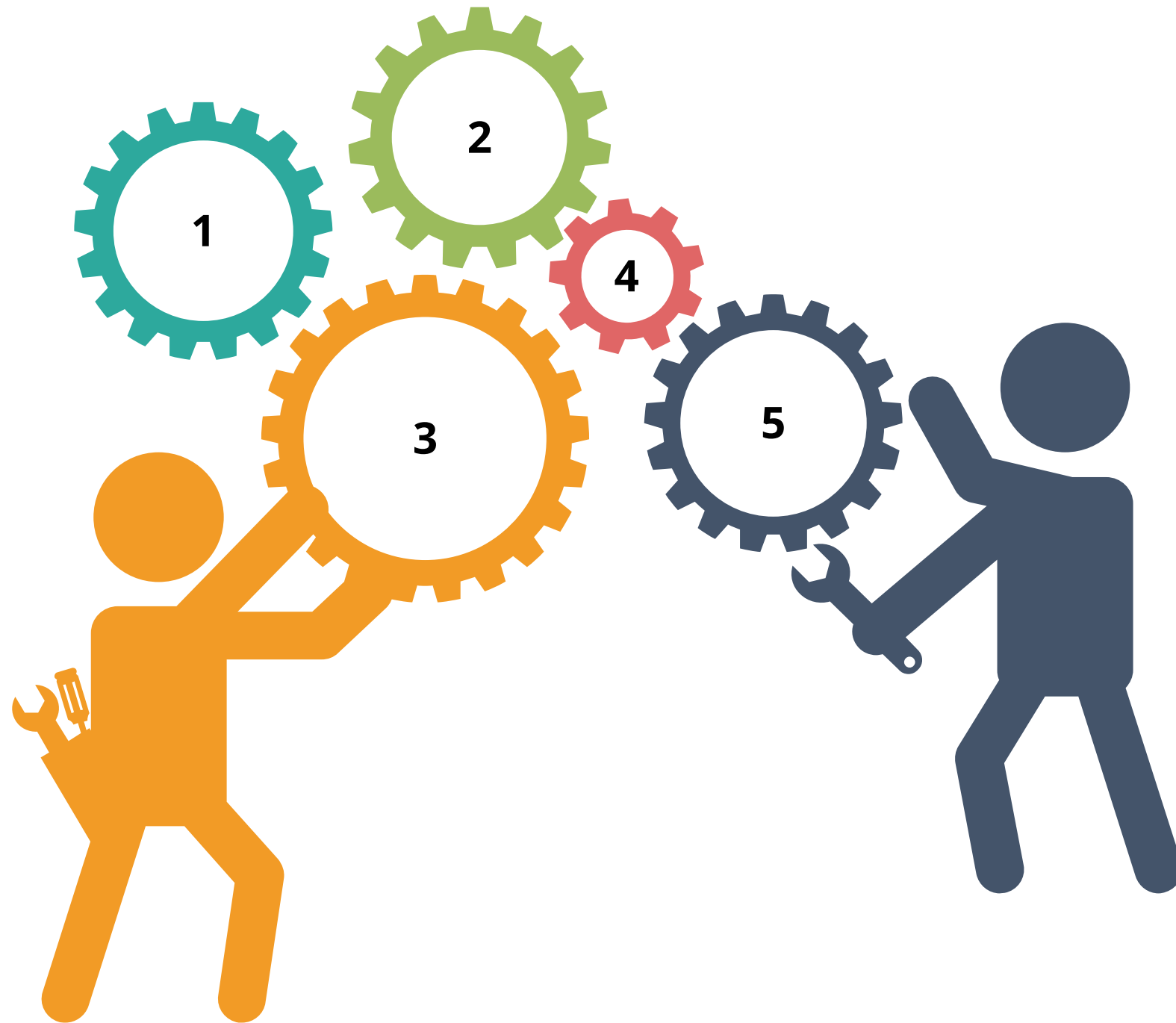
Rebuild software if the cost to rearchitect is more than that of starting from scratch

Replace

Third-party applications could replace custom applications. Evaluate SaaS options to replace existing applications

# Assess

Migration planning includes the following steps:



**Create a cloud migration plan  
(Requirements, environment, and tools)**

**Involve stakeholders  
(Business and IT)**

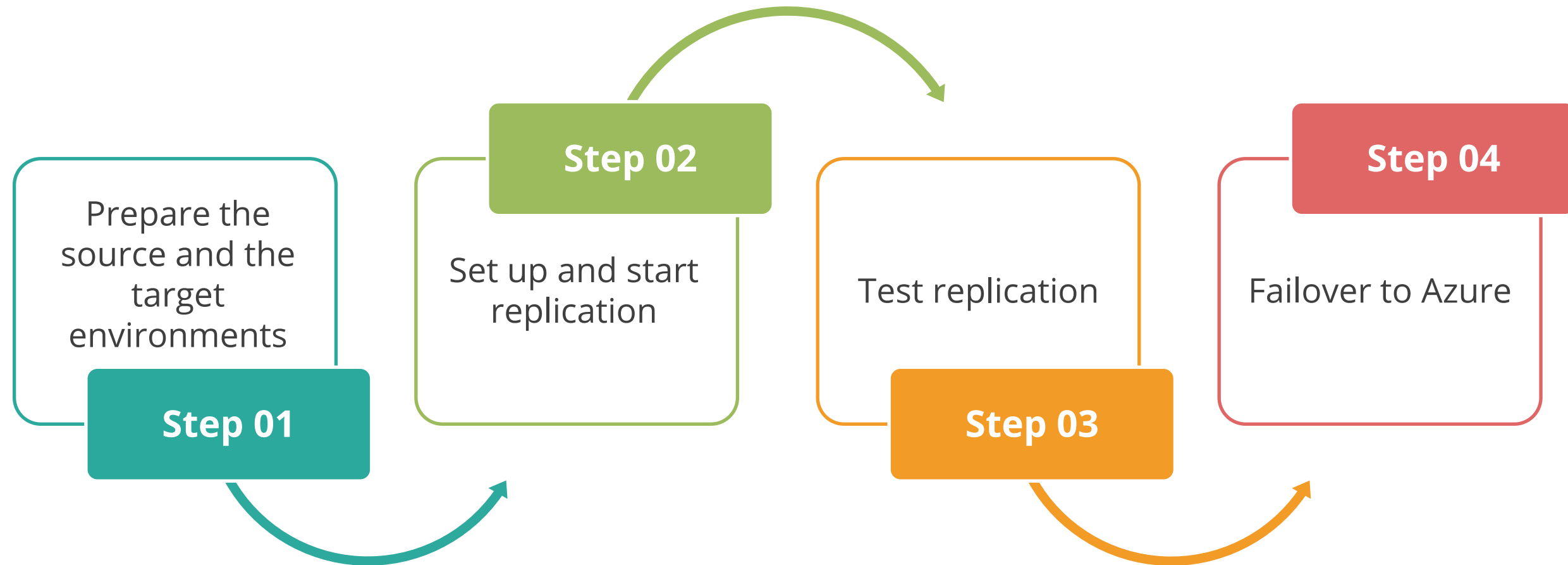
**Estimate cost savings using tools like  
TCO**

**Discover, evaluate, and document  
applications**

**Discover tools that help in migration  
journey**

# Migrate

Migration includes the following steps:





# Migrate

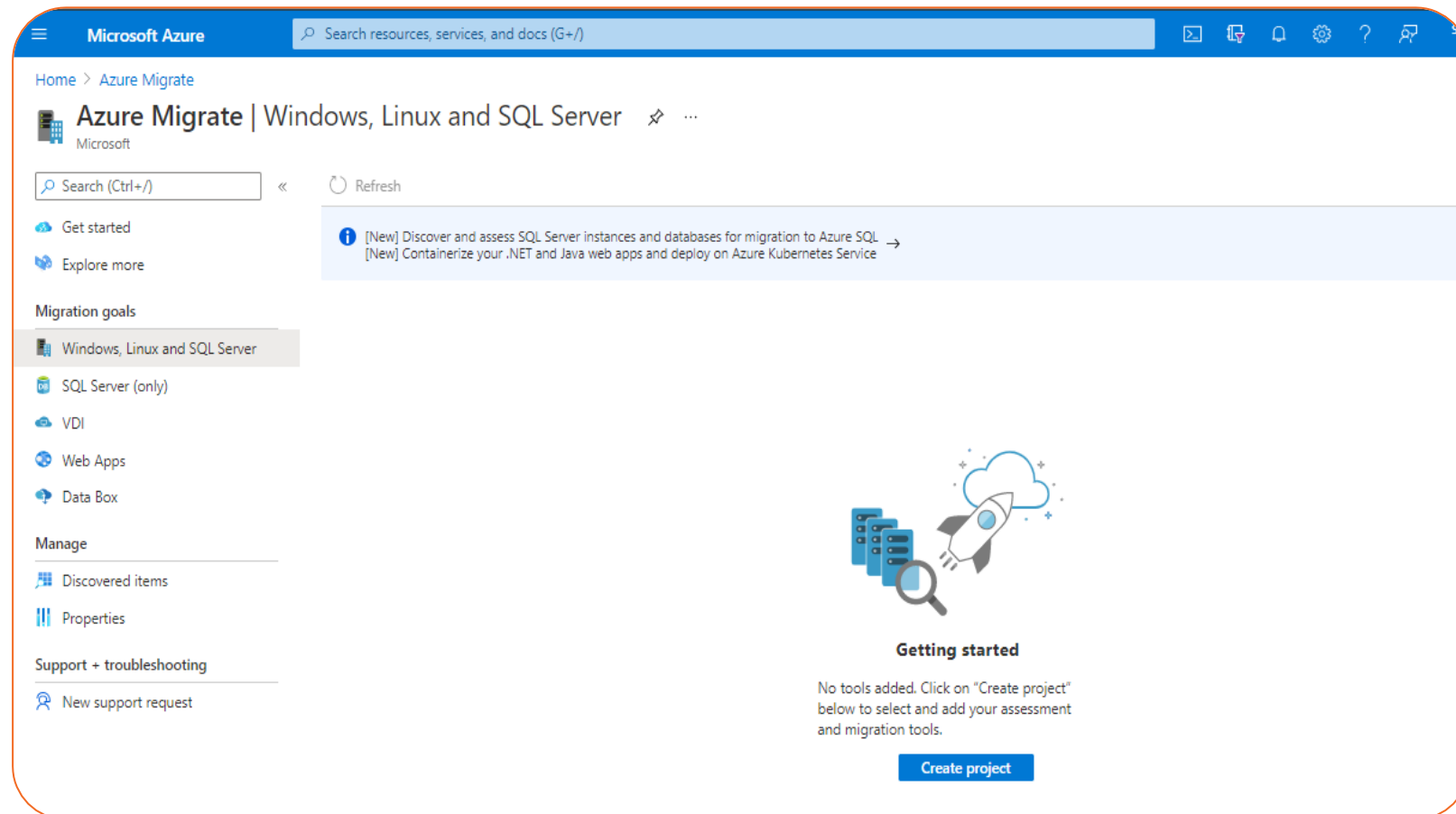
Database migration includes the following steps:



- Assess the on-premises databases
- Migrate the schemas
- Create and run an Azure Database Migration Service
- Monitor migration

# Using Azure Migrate to Assess Environment

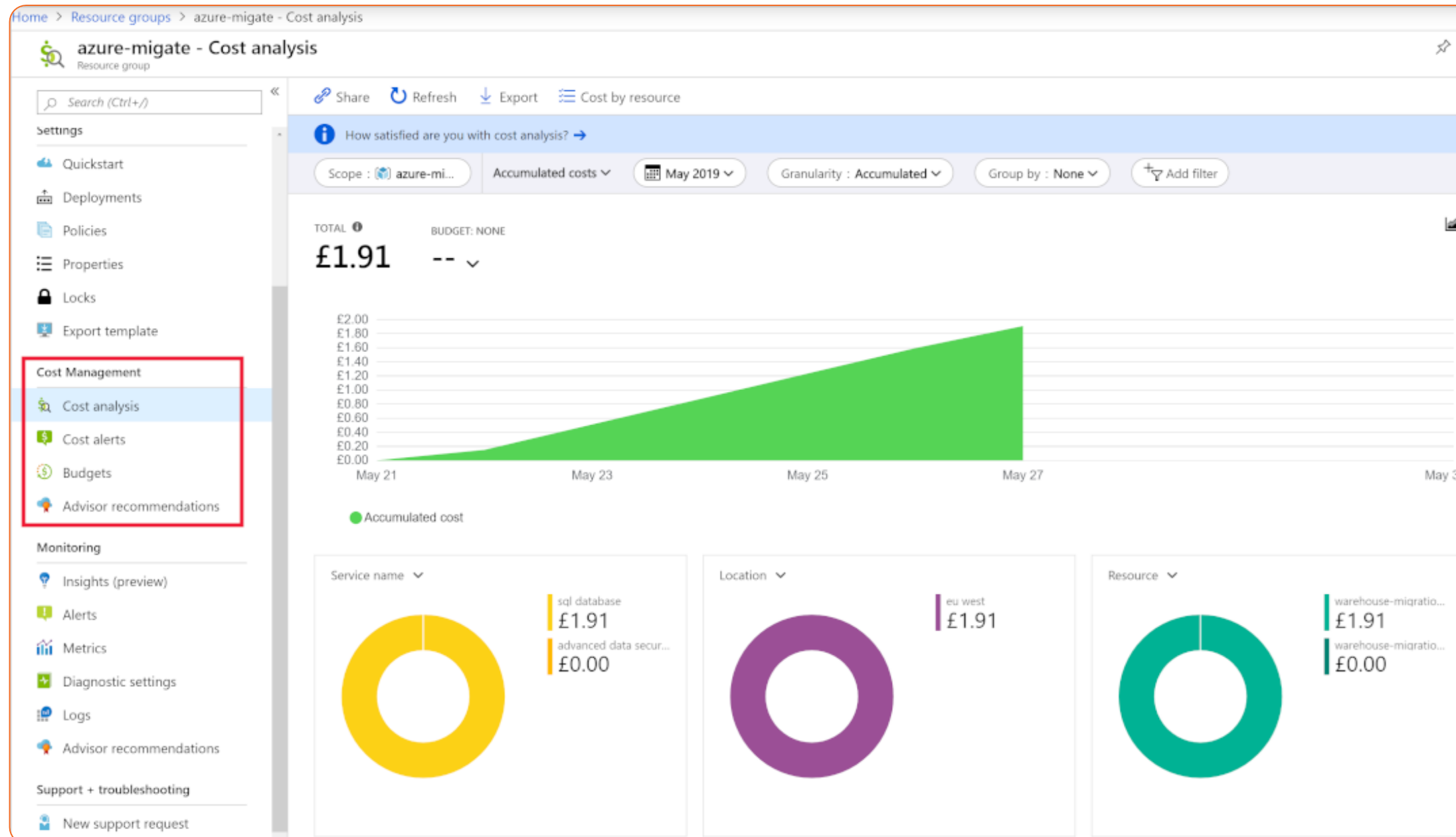
The Azure Migrate assessments are created within a project.



- Group VMs according to the types of VM workloads
- Assessment steps:
  - Discover virtual machines
  - Create assessments

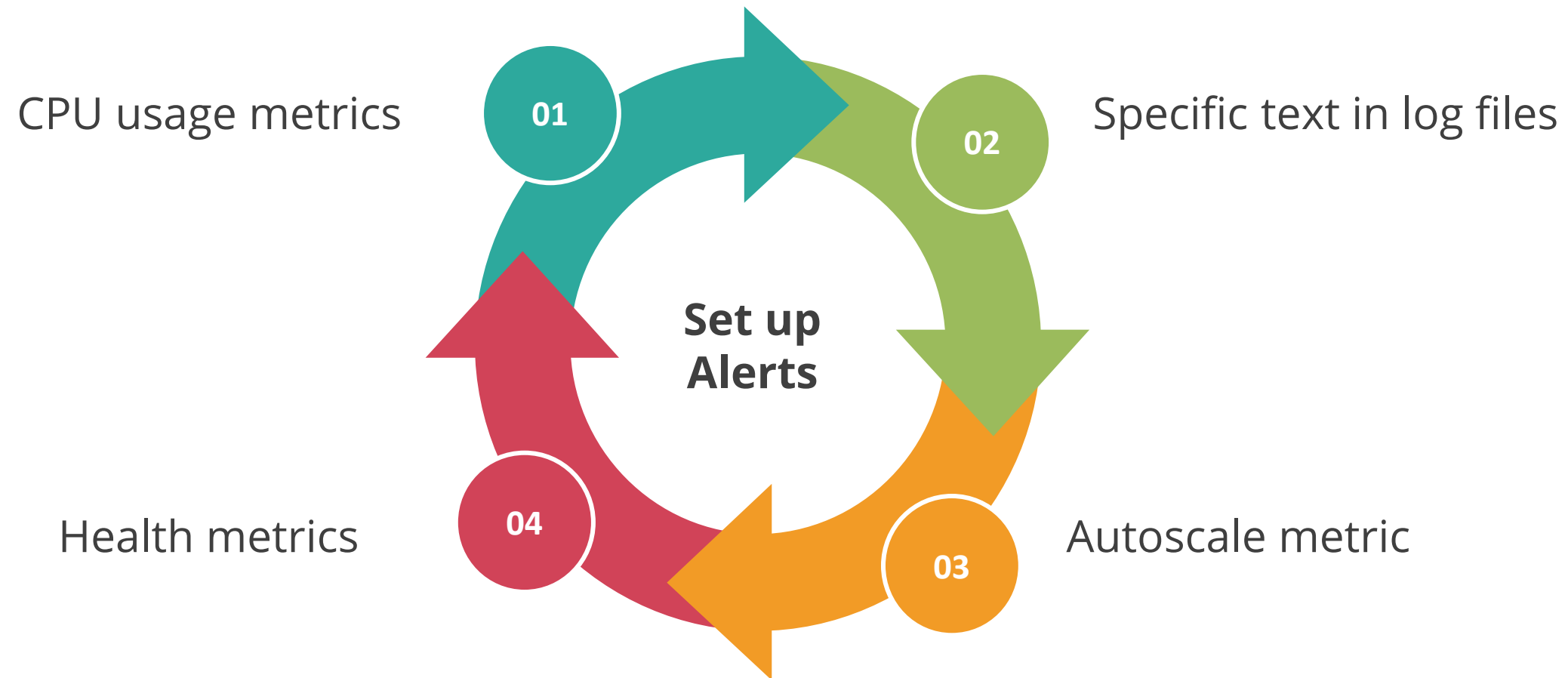
# Optimize

Use Azure Cost Management to analyze Azure costs for various management scopes.



# Monitor

The Azure Monitor captures health and performance information from Azure VMs (Log Analytics agent).



# Azure Migrate

The Azure Migrate service assesses readiness and assists with migration to Azure from an on-premises environment.



It helps with performance-based sizing calculations for the machines that will be migrated and estimate the ongoing cost of running these machines on Azure.

# Discover Machines

Import and spin up the collector appliance on a Hyper-V or VMware host.

- Collector gathers data on VM cores, memory, disk sizes, and network adapters.
- Performance data like CPU and memory usage, disk IOPS, disk throughput, and network output is gathered.
- The output of data collection is pushed to Azure Migrate project.

The user can view discovered systems on the Azure portal.

# Create an Assessment

Azure Migrate assesses an environment's readiness to be migrated to Azure on the portal.

The screenshot displays the Azure Migrate portal interface. The top navigation bar includes 'Home > Azure Migrate' and the title 'Azure Migrate | Windows, Linux and SQL Server' with a Microsoft logo. Below the title is a search bar and a 'Refresh' button. The left sidebar lists various migration goals: 'Overview', 'Migration goals' (selected), 'Windows, Linux and SQL Server', 'SQL Server (only)', 'VDI', 'Web Apps', 'Data Box', 'Manage', 'Discovered items', and 'Support + troubleshooting'. The main content area is titled 'Assessment tools (Add more tools)' and features a card for 'Azure Migrate: Discovery and assessment'. This card has tabs for 'Discover', 'Dependency analysis (Preview)', 'Assess' (selected), and 'Overview'. Under the 'Assess' tab, there are several metrics: 'Discovered servers' (3), 'Servers running SQL Server' (0), 'OS distribution' (a dropdown menu with 'Azure VM' selected), 'Dependency enabled machines' (0 out of 3 total), 'Notifications' (0), 'Groups' (3), and 'Appliances' (2). A 'Next step' section at the bottom suggests starting migration or refining application grouping.

Home > Azure Migrate

**Azure Migrate** | Windows, Linux and SQL Server

Microsoft

Search (Ctrl+/) Refresh

Overview

Last refreshed at: 2/8/2021, 7:57:21 PM (Click on "Refresh" to update the page)

**Migration goals**

- Windows, Linux and SQL Server
- SQL Server (only)
- VDI
- Web Apps
- Data Box

**Manage**

- Discovered items
- Support + troubleshooting
- New support request

**Assessment tools (Add more tools)**

**Azure Migrate: Discovery and assessment**

Discover Dependency analysis (Preview) **Assess** Overview

Discovered servers: 3

Servers running SQL Server: 0

OS distribution: **Azure VM**

Dependency enabled machines: 0 Machines / 3 total

Notifications: 0

Groups: 3

Appliances: 2

**Next step:** Start migrating your servers or optionally you can refine your application grouping with dependency analysis

## **Recommend a Solution for Migrating Applications and VMs**



# Migrate Azure App Service with Azure Migration Assistant

Enter a public URL and access the web app for migration.

## Get a free compatibility report for your external app

Run a scan on your web app's public URL for a report of the technologies it uses and whether App Service fully supports them. If compatible, you'll be guided to download the migration assistant to simplify your migration.

Assess your web app for migration now.

Enter a public URL (https://)

Assess

## Assess and migrate your on-premises .NET, Java, and Linux web apps to Azure

Download the App Service migration assistant—a fast, free, and automated way to migrate web apps with minimal or no code changes. Run readiness checks and get potential remediation steps for common issues. Receive step-by-step guidance for moving your web app to App Service.

- Simplify the migration of your web apps to the cloud with minimal or no code changes
- Run readiness checks and get potential remediation steps for common issues

# Migrate Servers with Azure Migrate

The Azure Migrate assessment identifies candidates for server migration to Azure.



## Azure Migrate: Server Assessment



Discover



Assess



Overview

### Quick start

#### 1: Discover

Discover your on-premises machines by using an appliance or importing in a CSV format. Click 'Discover' to get started.

#### 2: Assess

Click 'Assess' to assess the discovered machines.

Azure Migrate runs an agentless migration of virtual and physical servers into Azure.

# Migrating the Virtual Machines to Production

**Azure Migrate: Server Migration - Replicating machines**  
ContosoMigration

Search (Ctrl+/) Refresh Migrate Columns

To view the machines replicating via the Azure Migrate appliance, click on the 'Azure Migrate appliance' tab. For all other machines, click 'Other'.

Azure Migrate appliance Other

Last refreshed at: 2/10/2020, 10:42:35 AM

Filter items...

Name	Status	Health	Migration phase	Last sync	Test migration status
PayrollWeb04	Migrated	Not applicable	Not applicable	11/3/2019, 7:38:46 AM	Never performed
PayrollWeb01	Delta sync	Healthy	Test clean up pending	2/10/2020, 9:42:35 AM	1/30/2020, 9:20:09 PM
PayrollWeb02	Delta sync	Healthy	Ready to migrate	2/10/2020, 10:42:35 AM	
PayrollWeb03	Delta sync	Healthy	Test migration pending	2/10/2020, 10:42:35 AM	

Test migration  
Clean up test migration  
**Migrate**  
Repair replication  
Error Details  
Stop replication

Once you are ready for the production migration, then:

- Select Migrate from the replicating machines
- Shut down the VMs for final replication
- Migrate during off-peak hours

# Post-Migration Steps

After the migration:



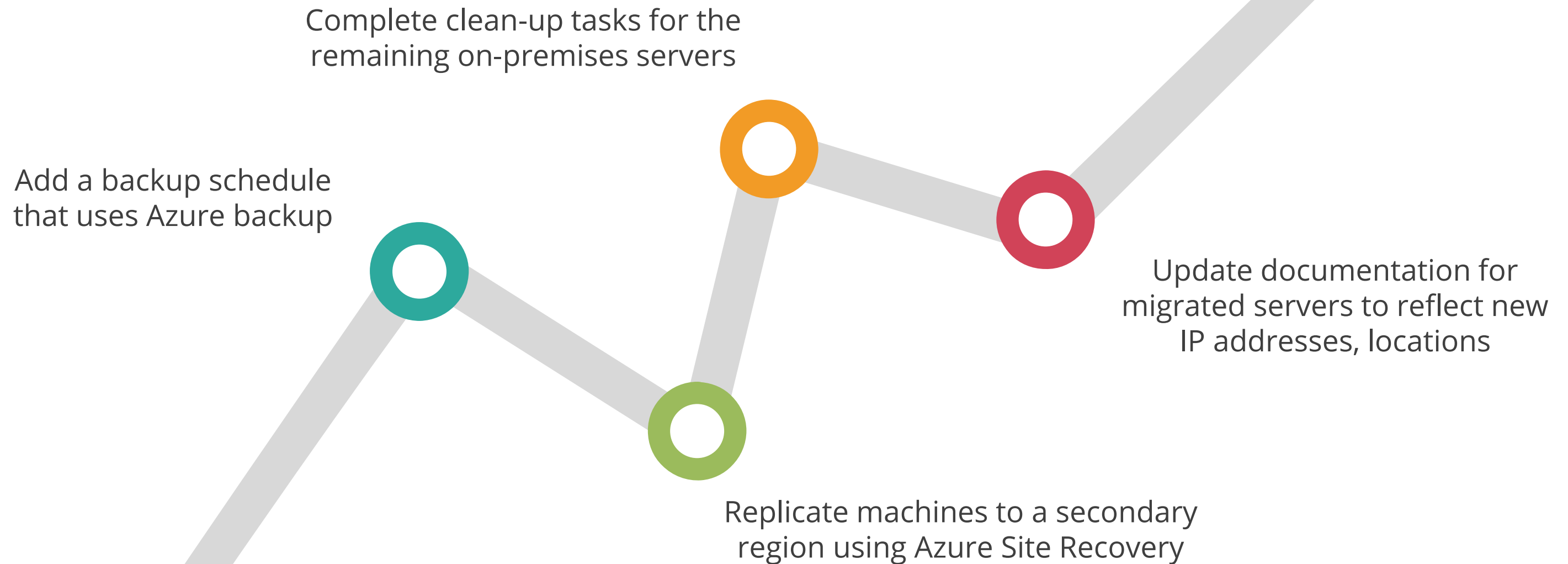
Review security settings of virtual machines

Restrict network access for unused services (NSG)

Deploy Azure Disk Encryption

# Post-Migration Steps

Follow the steps given below to increase resilience:



# Assisted Practice

## Migrate Azure App Service with Azure Migration Assistant

**Duration: 10 Min.**

### Problem Statement:

As an Azure Architect, you've been asked to assist your company with an Azure migration solution for .NET and PHP web projects.

# Assisted Practice: Guidelines

Steps to migrate an azure app service with an azure migration assistant are:

1. Login to your Azure portal
2. Navigate to <https://azure.microsoft.com/en-in/services/app-service/migration-assistant/>
3. Enter the URL of the web app that needs to be migrated
4. Get a report on an external web app
5. Do a greenfield deployment of your application to App Services

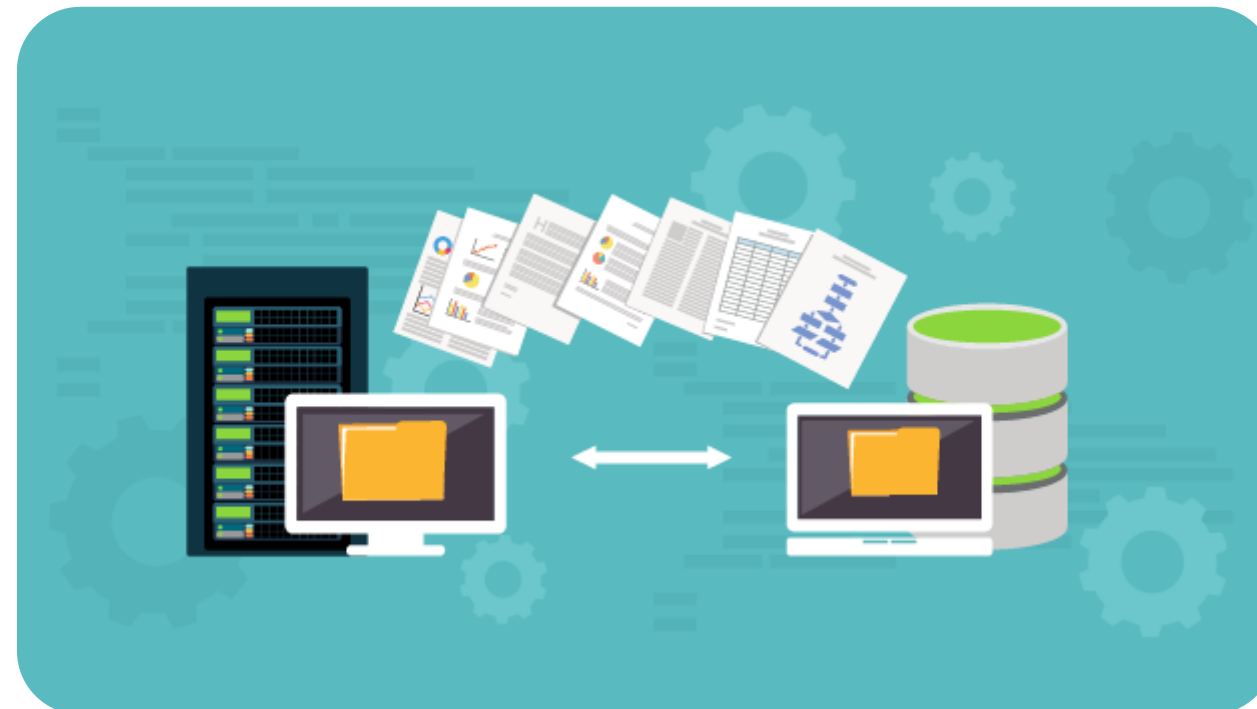


## Recommend a Solution for Migrating of Databases



# Azure Database Migration Service

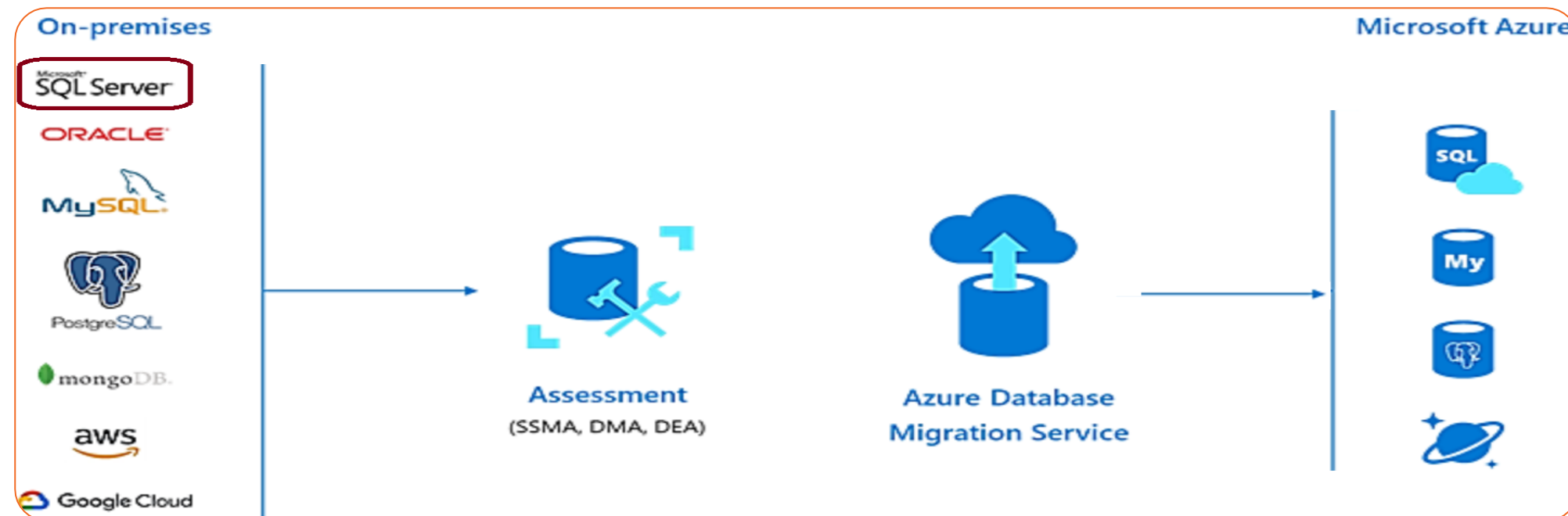
Azure database migration service enables online and offline migrations from multiple database sources to Azure data platforms, all with minimal downtime.



# Migrate Databases with Azure Database Migration Service

Two different ways to migrate SQL Server databases:

Offline migration requires shutting down the server at the start of the migration for service



Online migration uses a continuous synchronization of live data, allowing a cutover to the Azure replica database at any time

# Migrate Databases with Azure Database Migration Service

User relational database can be migrated to several destinations in Azure:

Single Azure SQL Database instance:

A fully managed, single SQL database

Azure SQL Database managed instance:

Database Engine but missing some minor SQL Server features

SQL Server on Azure Virtual Machines:

An infrastructure-as-a-service (IaaS) offering that runs a full version of SQL Server and supports all the features of SQL Server

# Migrate Databases with Azure Database Migration Service

User relational database can be migrated to several destinations in Azure:

Azure Database for MySQL:

An Azure database service based on the MySQL Community Edition, versions 5.6 and 5.7

Azure Database for PostgreSQL:

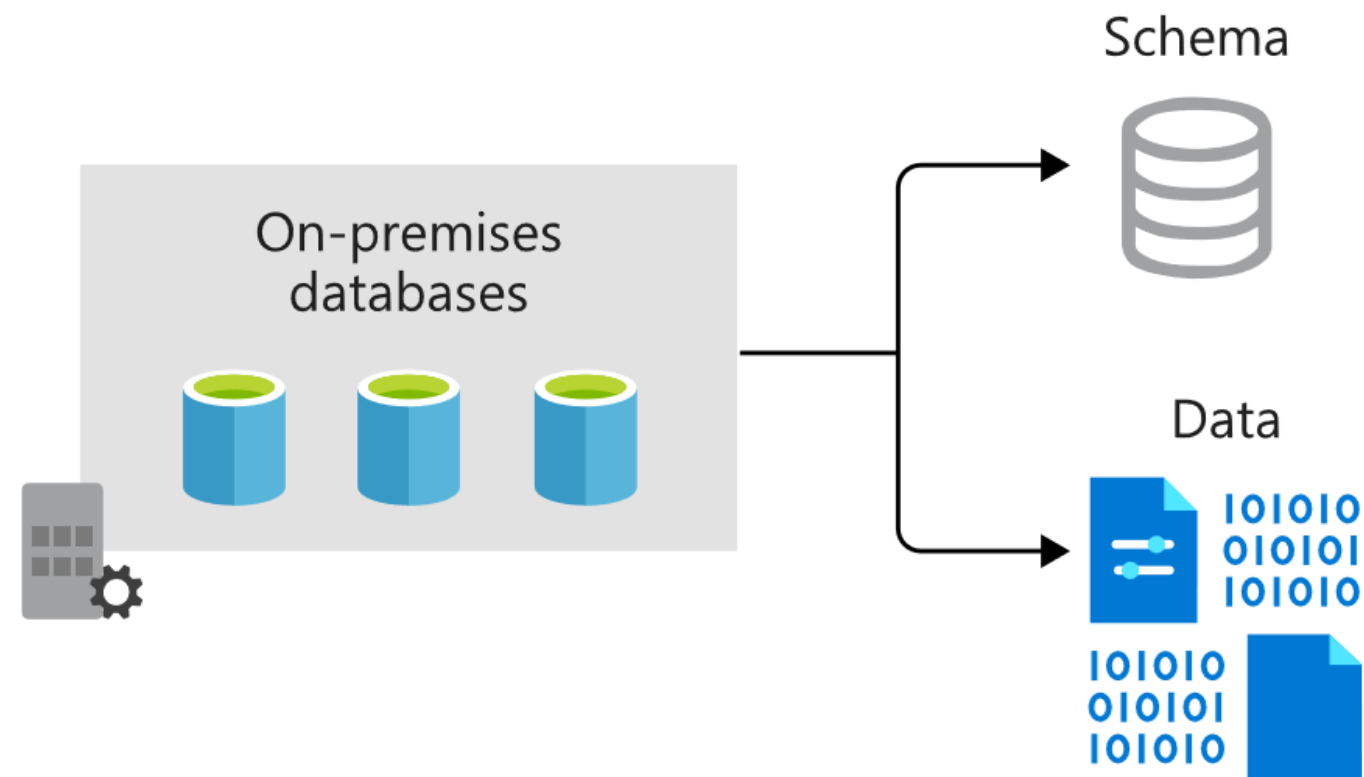
An Azure database service based on the community version of the PostgreSQL database engine

Azure Cosmos DB:

A globally distributed, multi-model, fully managed database service

# Overview of Database Migration

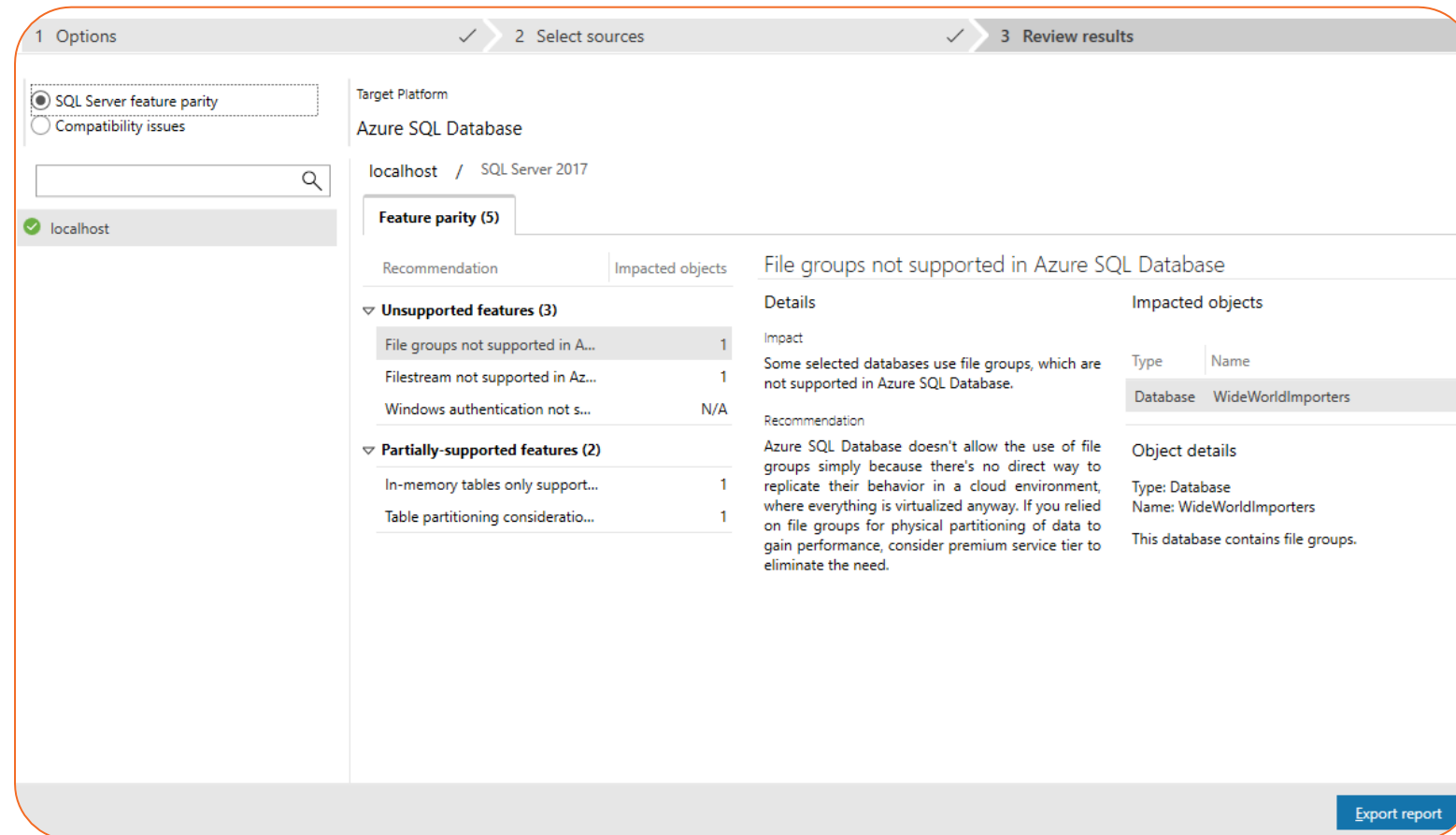
Offline and online migrations prerequisites:



- Download the Data Migration Assistant
- Create an Azure Virtual Network instance
- Configure the network security group
- Configure the Windows Firewall
- Configure credentials

# Assess the On-Premises Databases

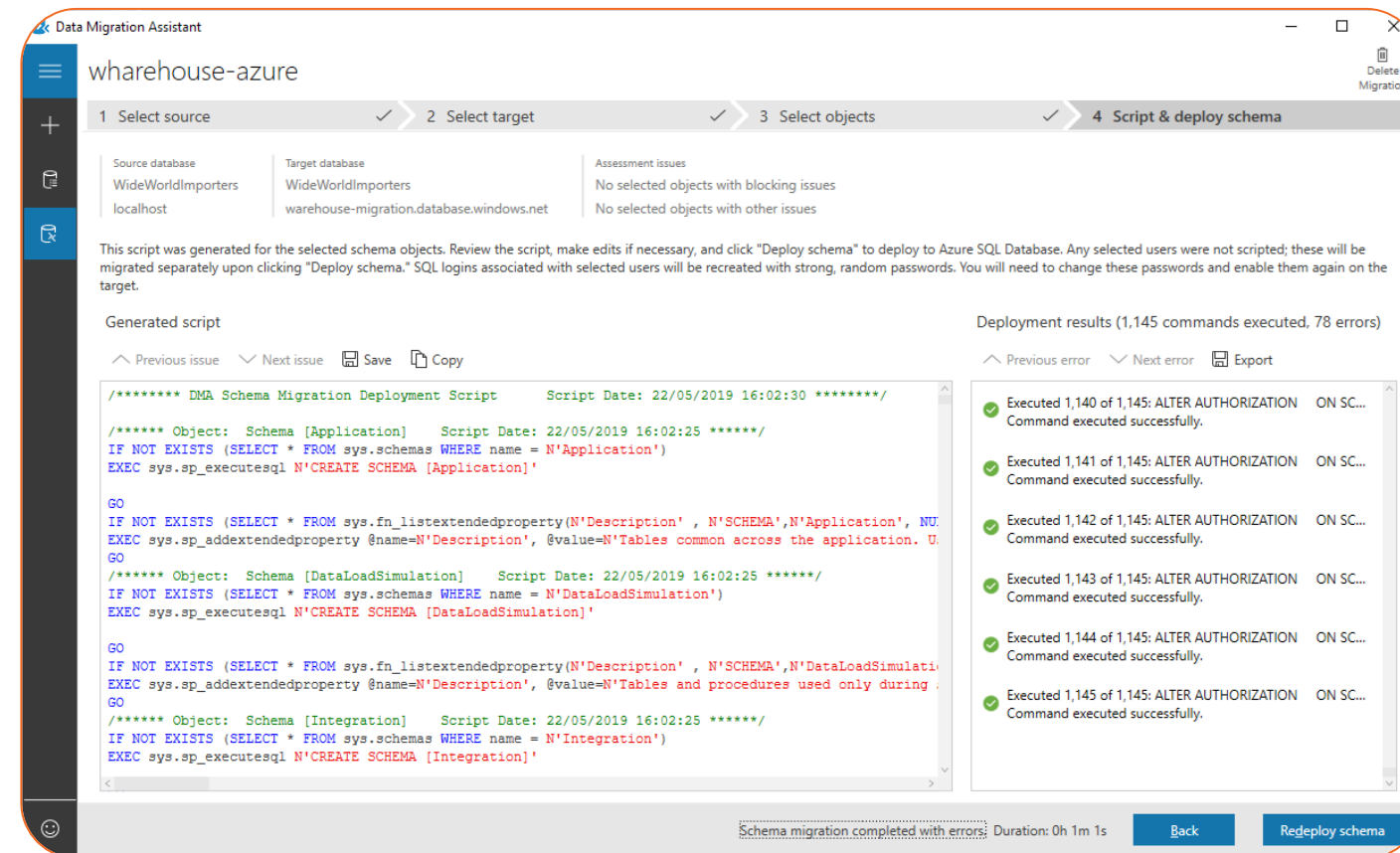
These are the steps to assess the on-premises databases:



- Use Data Migration Assistant to create an Assessment project
- Select the source and target servers
- Provide the connection details and permissions
- Choose the database to migrate

# Data Migration Assistant

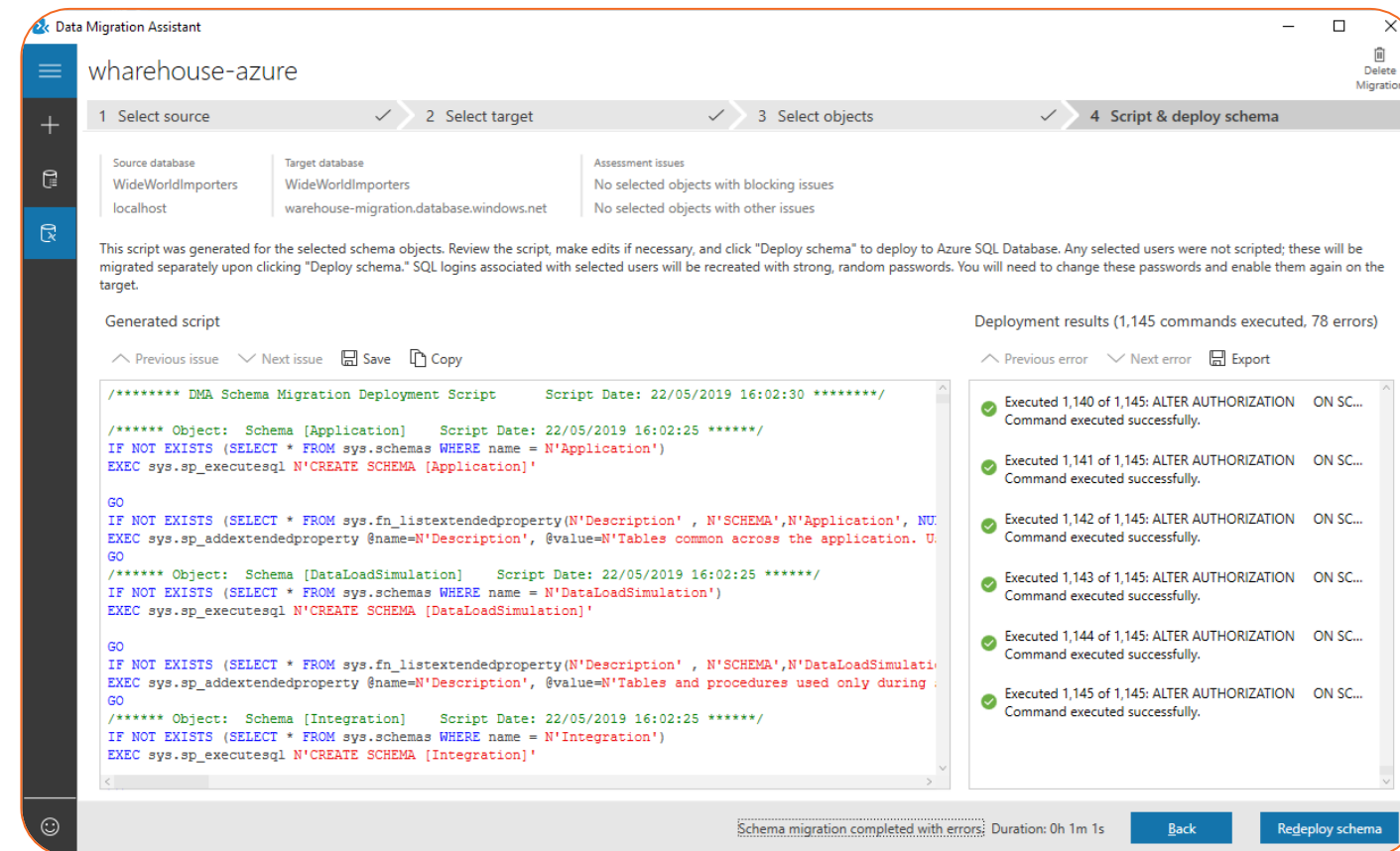
These are the steps to migrate the schema using the data migration assistant:



- Select an on-premises SQL Server instance as the source server
- Set the Azure SQL Database instance as the target server
- Set the scope of the migration to Schema Only
- Once connected to the source database, choose the schema objects to deploy to the new SQL database

# Data Migration Assistant

These are the steps to migrate the schema using the data migration assistant:

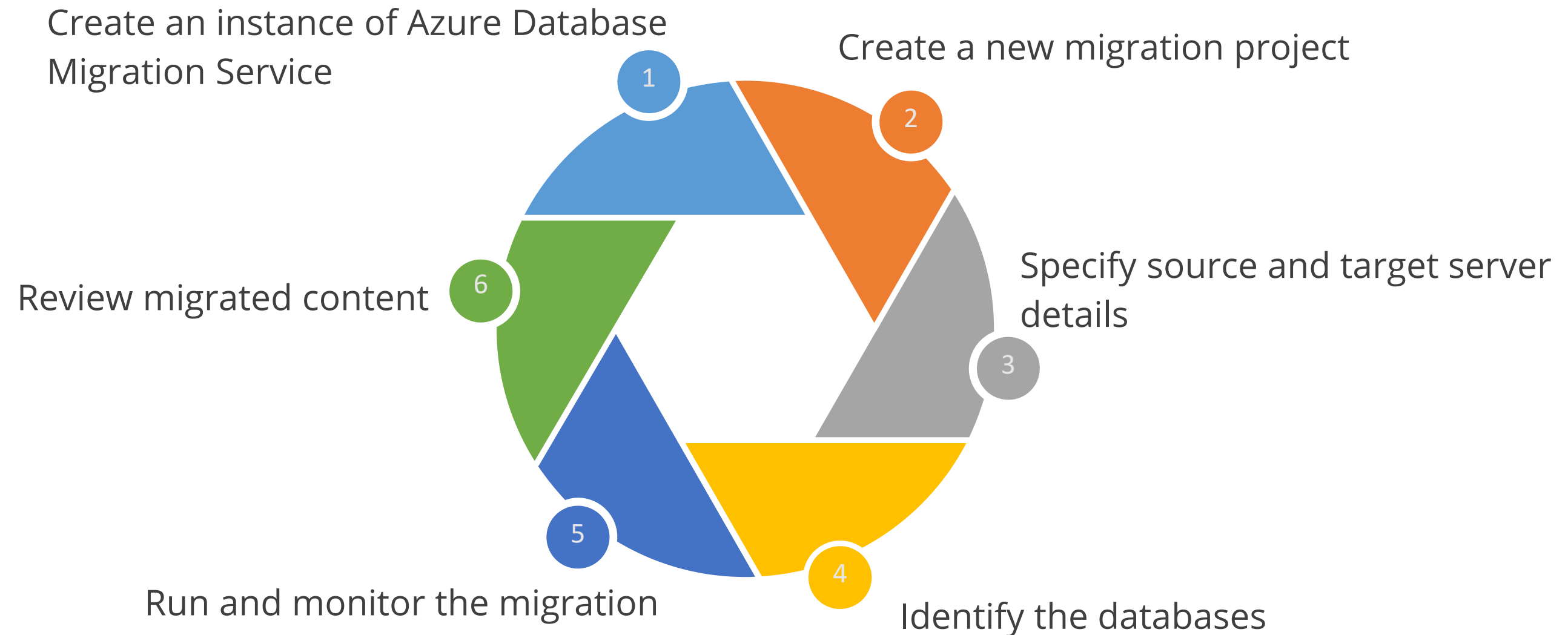


- Data Migration Assistant will create a script of actions
- Select Deploy Schema to run the script
- Once the script has run, check the target server to make sure it has been configured correctly



# Migrate Data with Database Migration Service

These are the steps to migrate data with database migration service:



## Determine Migration Scope

# Supported Scopes of Migration

There are four ways to complete the migration of compute, network, and storage resources:

Migration of virtual machines  
(Not in a virtual network)

Migration of virtual machines (In  
a virtual network)



Migration of unattached resources

Migration of storage accounts

# Migration of Virtual Machines (Not in a Virtual Network)

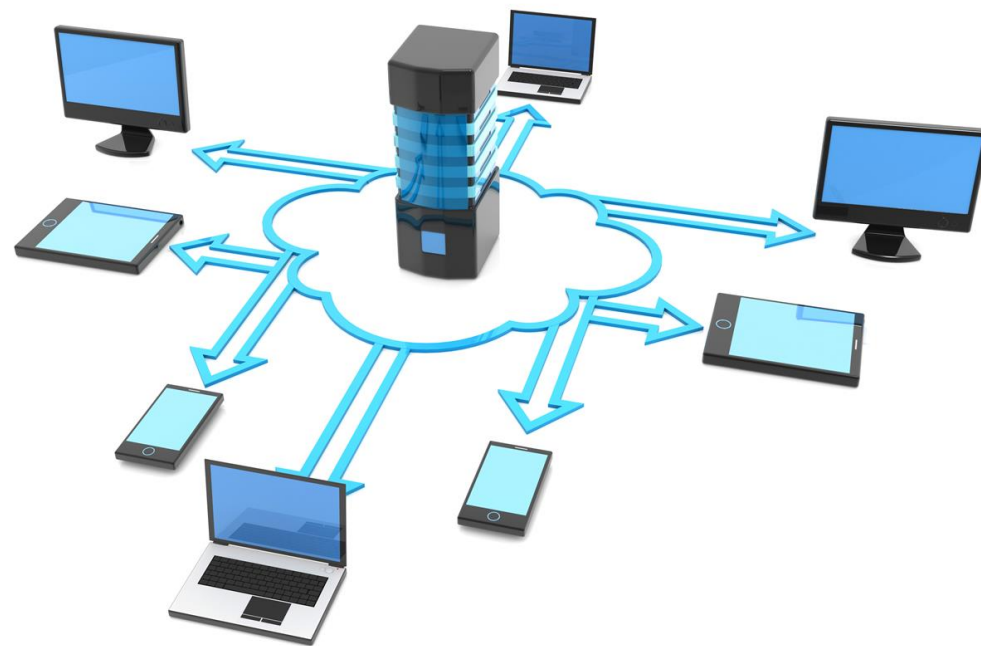
There are two options for the virtual networks that the Virtual Machines will be migrated to:



- Request the platform to create a new virtual network and migrate the virtual machine into the new virtual network.
- Migrate the virtual machine into an existing virtual network in Resource Manager.

# Migration of Virtual Machines (In a Virtual Network)

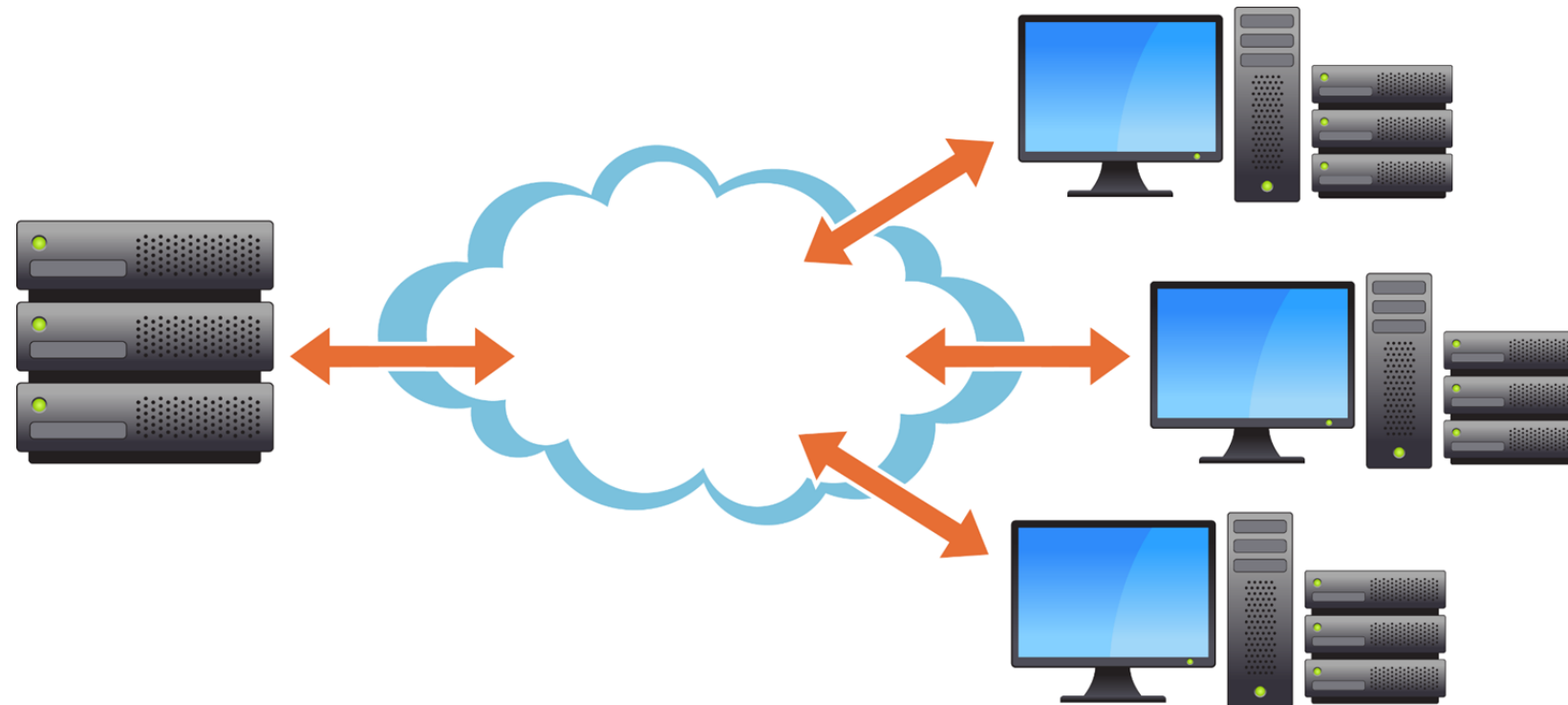
There are two options for the virtual networks that the Virtual Machines will be migrated to:



- For most VM configurations, only the metadata migrates between the Classic and Resource Manager deployment models.
- The underlying VMs run on the same hardware, in the same network, and with the same storage.

# Migration of Storage Accounts

If users are using a VM with a classic storage account, then compute and network resources should be migrated independently of storage accounts.



To complete the migration procedure, users' storage accounts must be migrated once the virtual machines and virtual network have been migrated.

# Migration of Storage Accounts

If a storage account does not have any associated disks or virtual machines data and only has blobs, files, tables, and queues, then, the migration to Azure Resource Manager can be done as a standalone migration without dependencies.



# Migration of Unattached Resources

Storage Accounts with no associated disks or Virtual Machines data can be migrated independently.



Network security groups, route tables and reserved IPs are not attached to any Virtual Machines.

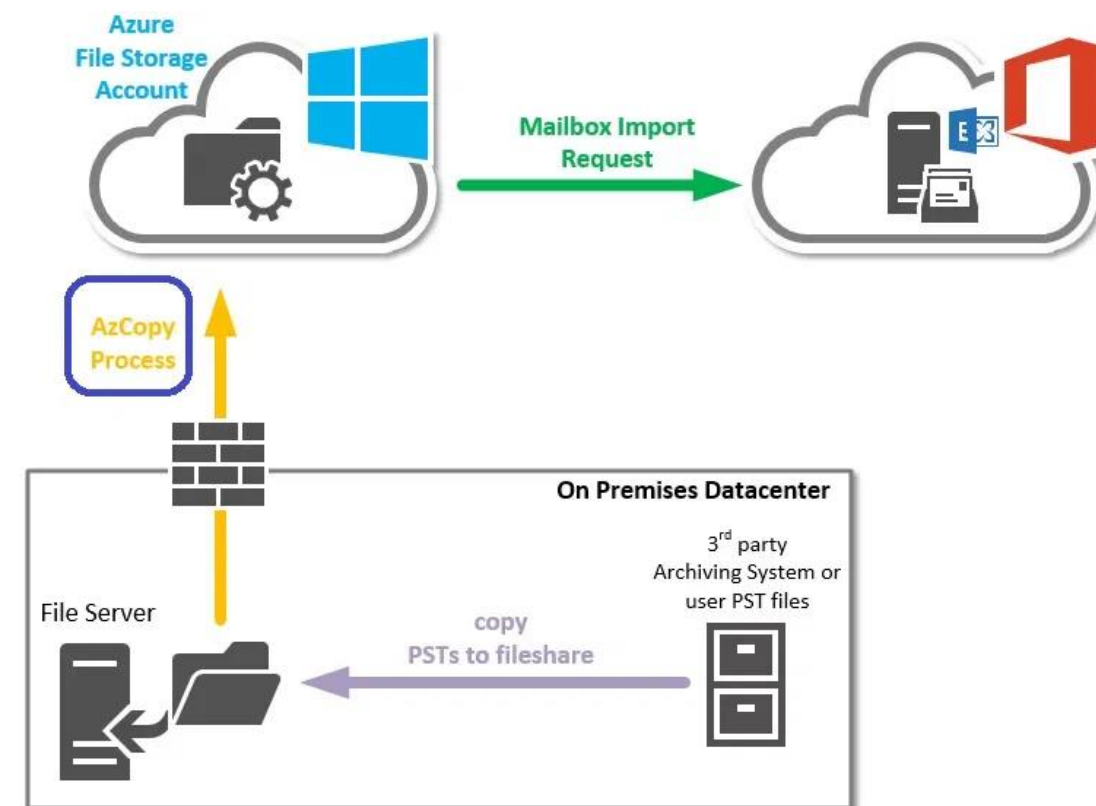


## Recommend a Solution for Migrating Data

# AzCopy

AzCopy is a command-line tool for copying data to, or from, Azure Blob storage, Azure Files, and Azure Table storage.

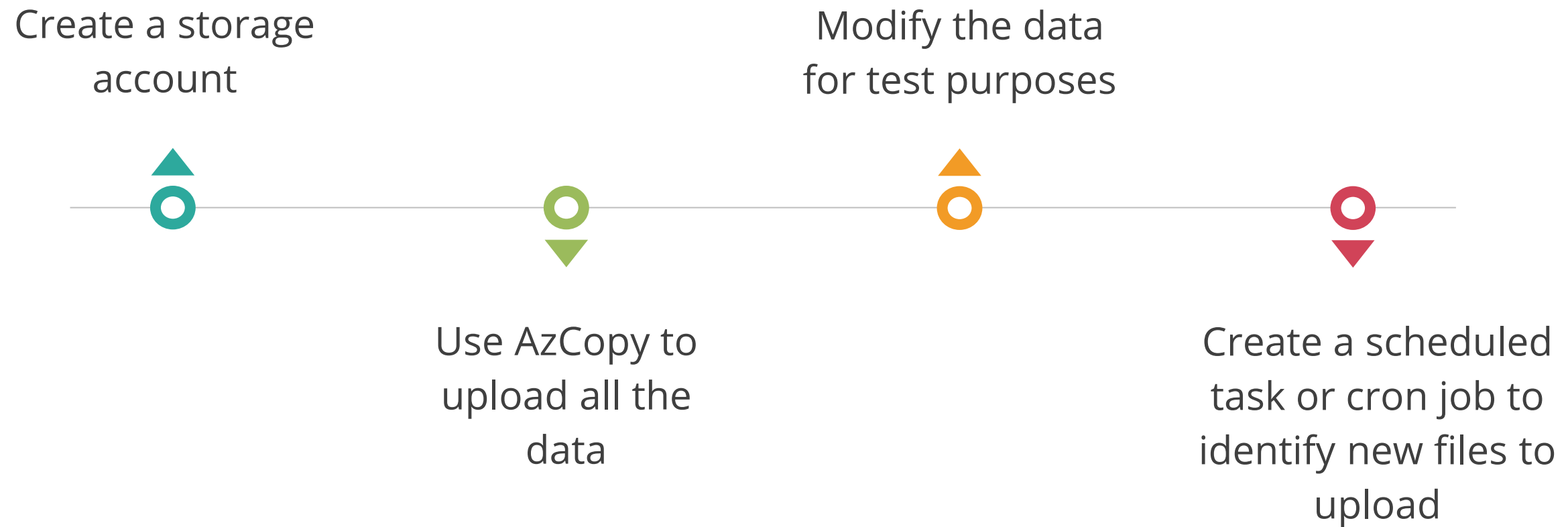
The commands are designed for optimal performance.



Users can either copy data between a file system and a storage account or between storage accounts using AzCopy.

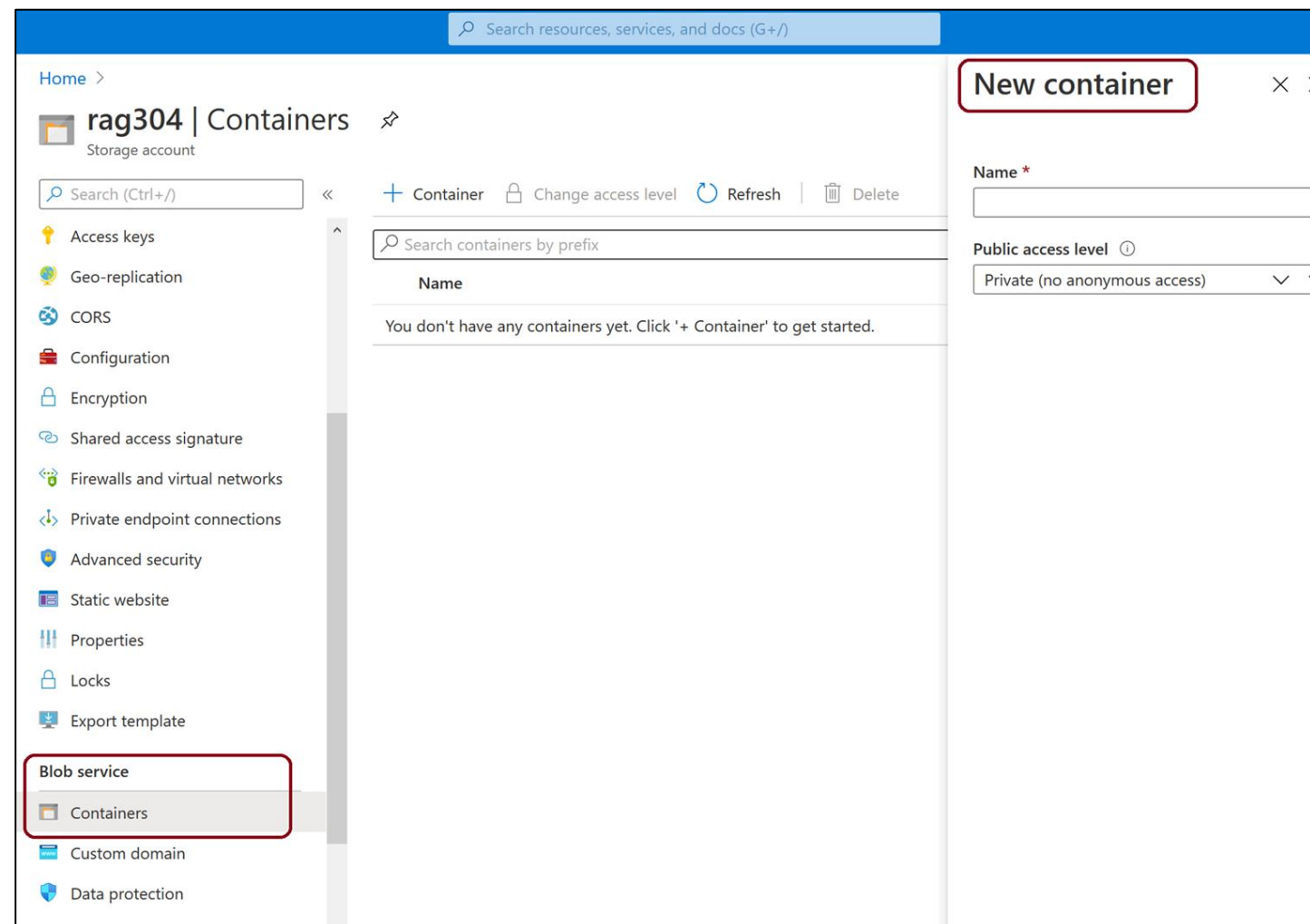
# Workflow of AzCopy

Workflow for using AzCopy to migrate on-premises data to cloud storage with AzCopy:



# Create a Container

Blobs must be uploaded into a container.



Steps to upload Blobs on a container:

- Select the Storage Account
- Select Containers under Blob Services

# Authenticate with Azure AD

Provide the access using RBAC to perform the required operation:

- 1 Storage Blob Data Contributor
- 2 AzCopy <enter>
- 3 Authentication URL (code provided)
- 4 Sign into your Azure account
- 5 Begin using AzCopy



# Upload Contents of a Folder to Blob Storage

Syntax for uploading a file content to Blob Storage using the azcopy copy command is:

## Upload Blob:

```
azcopy copy "<local-folder-path>" "https://<storage-account-name>.<blob or dfs>.core.windows.net/<container-name>" --recursive=true
```

To upload the contents of the specified directory to Blob storage recursively, specify the recursive option.

# Upload Modified Files to Blob Storage

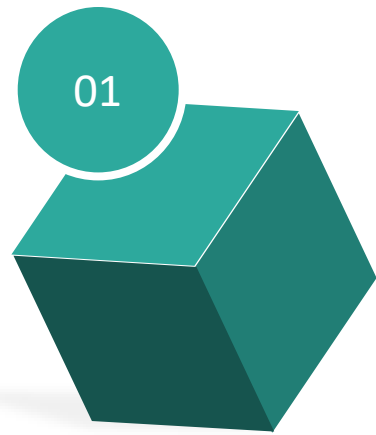
The AzCopy used to upload files based on their last-modified time by entering the following AzCopy command:

## Syntax

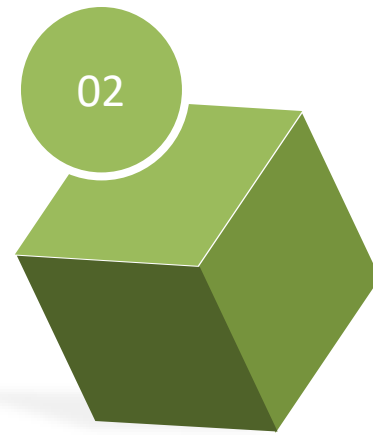
```
azcopy sync "<local-folder-path>" "https://<storage-  
account-name>.blob.core.windows.net/<container-name>"  
--recursive=true
```

# Create a Scheduled Task

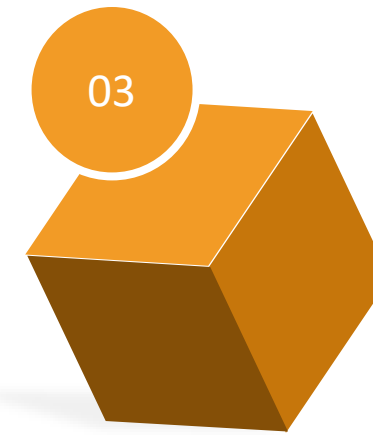
Steps to be followed for creating a scheduled task using AzCopy command script:



Copy the AzCopy command to a text editor (Windows or Linux)



Update the parameter values



Save the file as script.sh (Linux) or script.bat (Windows)



# Create a Scheduled Task

To create a cron job using the AzCopy command script:

- Cron allows Linux and Unix users to schedule the execution of commands or scripts at a specified date and time.
- On a local or remote computer, Schtasks allows an administrator to create, delete, query, update, run, and end scheduled tasks.

For Linux, using Terminal:

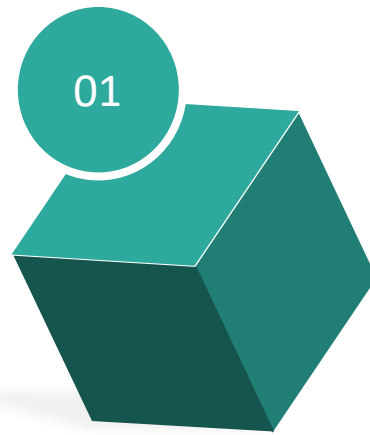
```
crontab -e */5 * * * * sh  
/path/to/script.sh
```

For Windows, using PowerShell:

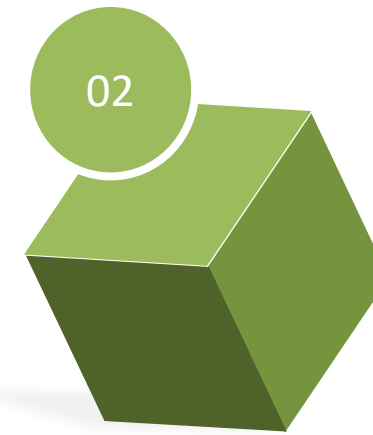
```
schtasks /CREATE /SC minute /MO 5 /TN  
"AzCopy Script" /TR C:\script.bat
```

# Migrate Offline Data

These are the two ways of migrating offline data to Azure:



Azure Import or Export



Azure Data Box

# Azure Import or Export

Azure Import or Export is an Azure service that allows users to move huge amounts of data between on-premises and Azure Storage accounts.



# When to Use Azure Import or Export

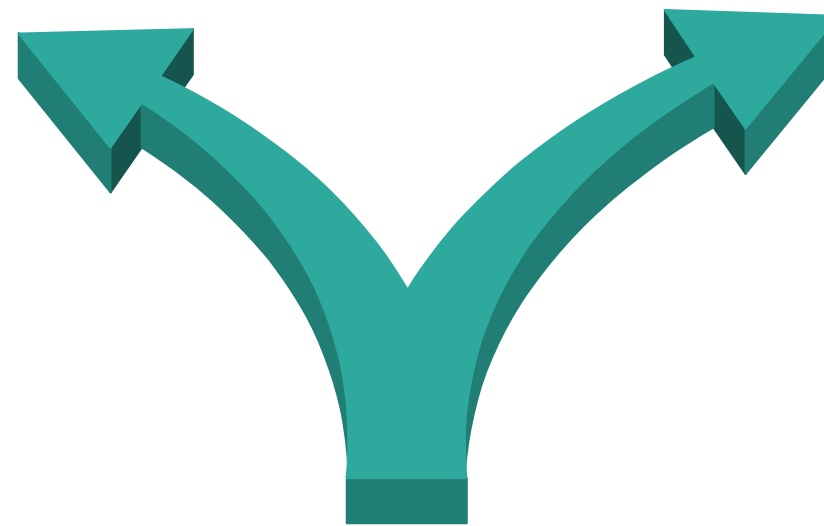


- Migrate significant amounts of data from on-premises to Azure as a one-time job
- Back up the data on-premises in Azure storage
- Distribute data from Azure storage to customer sites

# Azure Data Box

The Microsoft Azure Data Box cloud solution lets users send terabytes of data into and out of Azure in a quick, inexpensive, and reliable way.

Offline data  
transfer

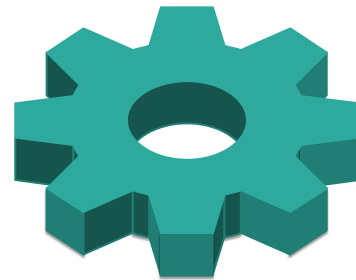


Online data  
transfer

The Azure Data Box family  
can be divided into two  
groups:

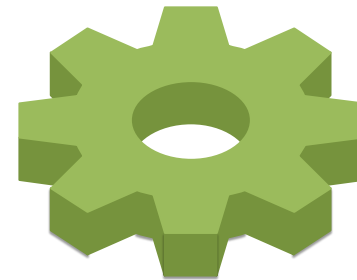
# Offline Data Transfer

The devices in the offline grouping include:



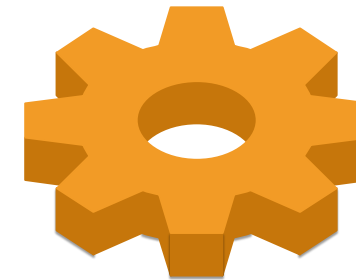
## **Data Box Disk:**

Provides one  
~35-TB transfer  
to Azure



## **Data Box:**

Provides one  
~80-TB transfer  
to Azure per  
order



## **Data Box Heavy:**

Provides one  
~800-TB transfer  
to Azure

# Online Data Transfer

Online data transfer enables a link between a user's on-premises assets and Azure.

- Transferring huge amounts of data to Azure is like copying data to a networking share.
- Online data transfer is ideal when a user needs a continuous link to transfer a massive amount of data.

## Data Box Gateway:

- This device is an entirely virtual appliance.
- It is based on a virtual machine that one can provision in their on-premises environment.

# Azure File Sync

Azure file sync enables centralizing the organization's file shares in Azure Files while keeping the flexibility, performance, and compatibility of a Windows file server.



Source: <https://docs.microsoft.com/>

Powered by **simplilearn**



# Benefits of Azure File Sync

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## **Cloud tiering:**

The most frequently accessed files are cached on the local server, and the least frequently accessed files are tiered to the cloud.



## **Multi-site access and sync:**

It is good for distributed access scenarios.



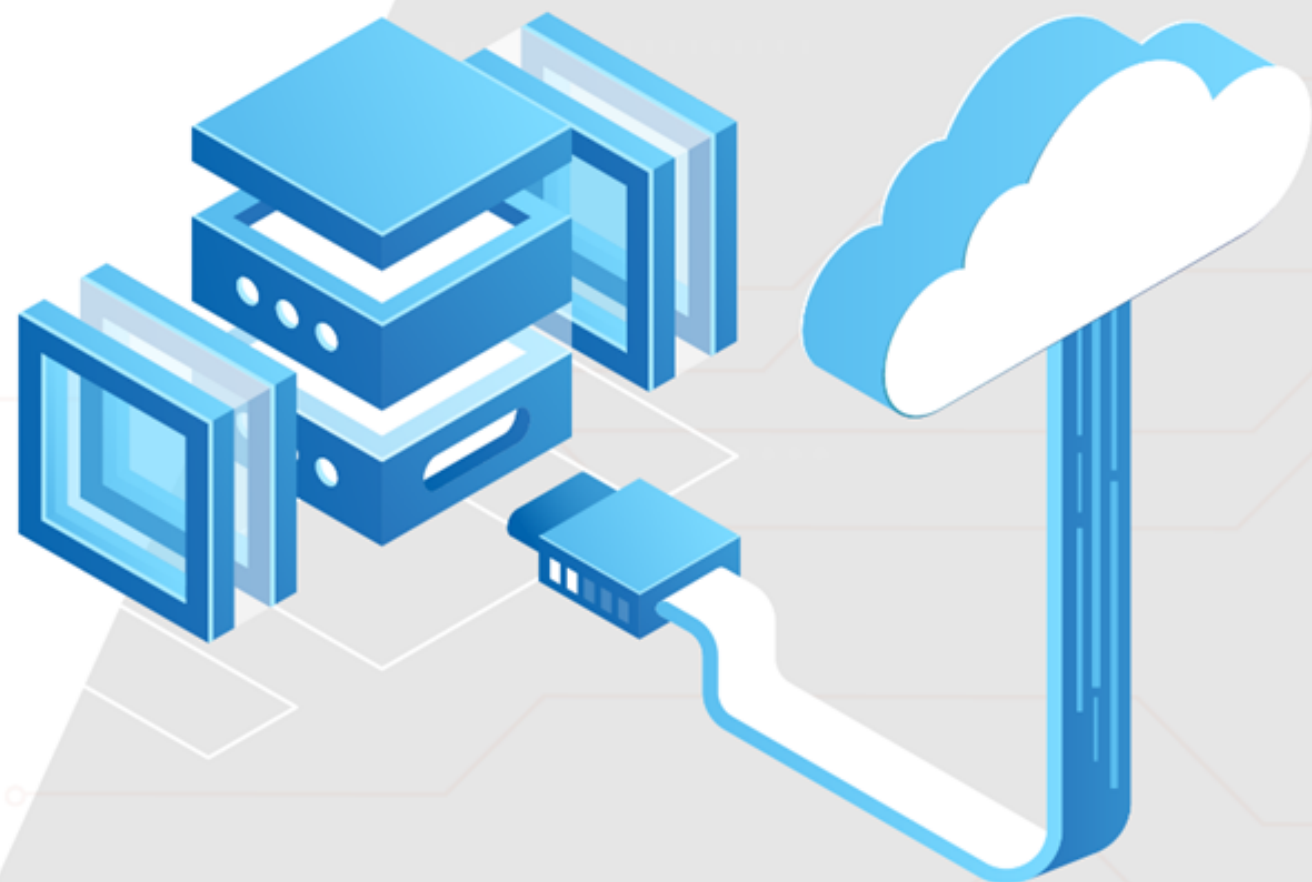
## **Business continuity and disaster recovery:**

Azure Files backs the Azure file sync, which offers several redundancy options for highly available storage.

## Key Takeaways

- Azure Migrate service assesses readiness and assists with migration to Azure from an on-premises environment.
- Azure Migrate runs an agentless migration of virtual and physical servers into Azure.
- Azure DB migration service enables online and offline migrations from multiple database sources to Azure data platforms.
- Users can either copy data between a file system and a storage account or between storage accounts using AzCopy.





**Thank you**