



AZ-203.1

Module 01:

Implement solutions that use virtual machines (VM)

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Topics

- Provision virtual machines (VMs)
- Configure virtual machines (VMs)
- Create Microsoft Azure Resource Manager templates
- Configure Azure Disk Encryption for VMs

Lesson 01: Provision VMs



Azure virtual machine creation checklist

- Before you create a virtual machine (VM), you should consider the following:

Checklist

- ☒ Network configuration
- ☒ VM name
- ☒ Location
- ☒ Size
- ☒ Pricing model
- ☒ Storage
- ☒ Operating system

VM pricing models

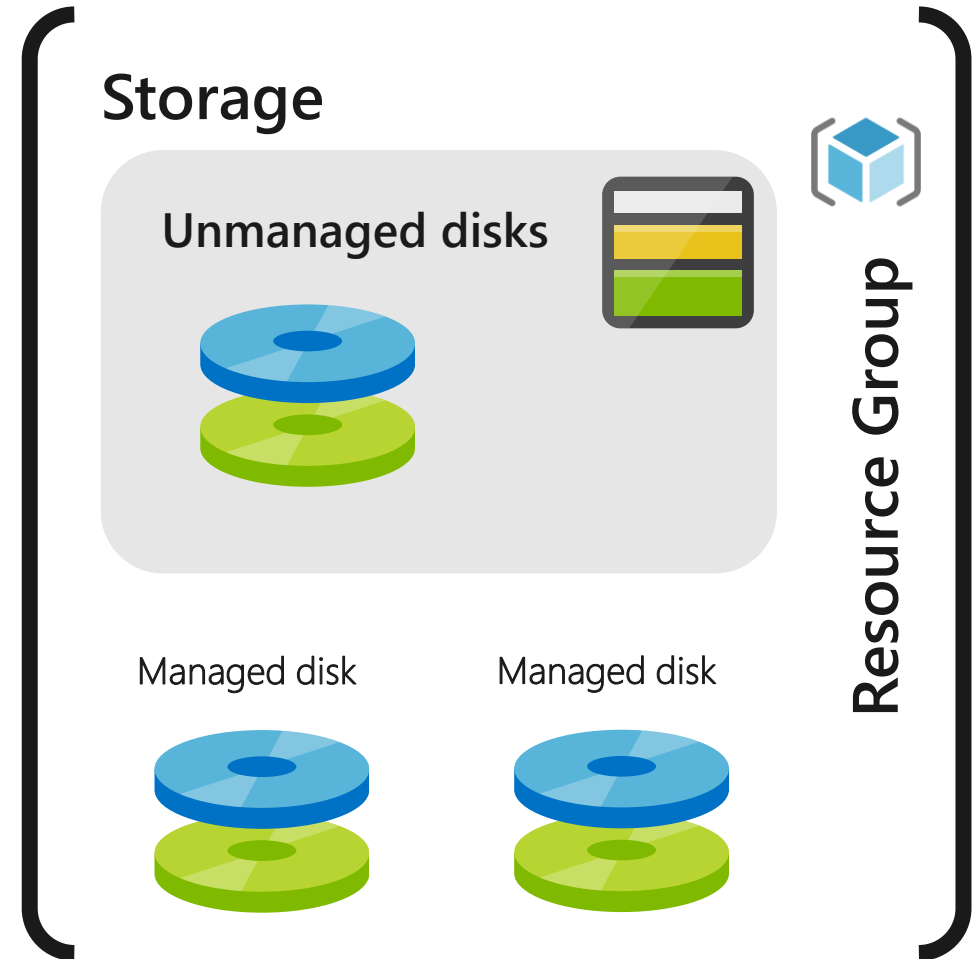
- Two primary costs for every VM:
 - **Storage** – The cost of storing data in every virtual hard disk. This cost is independent of whether the VM is running
 - **Compute** – The usage-based price for compute capacity when the VM is currently allocated
- There are two payment options for compute costs:
 - **Pay as you go** – Compute capacity is billed and paid as it is used without a long-term commitment
 - **Reserved instances** – Compute capacity can be pre-purchased at a reduced rate for anticipated usage

VM storage options

- Virtual disks can be backed by either Standard or Premium Storage accounts
 - Azure Premium Storage leverages solid-state drives (SSDs) to enable high performance and low latency for VMs running I/O-intensive workloads
- You can choose either unmanaged disks or managed disks

Managed and unmanaged disks

- Managed disks
 - The Azure platform manages the disk and the backing storage
 - You don't have to worry about storage account limits and thresholds
- Unmanaged disks
 - You manually create and manage virtual hard disks (VHDs) in your Storage account
 - You will need to consider account throughput and capacity limits when using this model



Azure virtual machine creation and management

- Azure portal
 - Browser-based user interface that allows you to create and manage all your Azure resources
- Azure Resource Manager
 - Allows you to create templates, which can be used to create and deploy specific configurations of multiple Azure resources
- Azure PowerShell
 - Optional package that adds Azure-specific commands to PowerShell
- Azure CLI
 - Cross-platform command-line tool for managing Azure resources
- Programmatic (APIs)

Create an Azure VM by using the Azure portal

[Home](#) > [New](#) > Create a virtual machine

Create a virtual machine

Basics

Disks

Networking

Management

Guest config

Tags

Review + create

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

Looking for classic VMs? [Create VM from Azure Marketplace](#)

PROJECT DETAILS

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

* Subscription ⓘ

Pay-As-You-Go

* Resource group ⓘ

(New) myResourceGroup

[Create new](#)

Create an Azure VM by using PowerShell

Connect-AzAccount

New-AzResourceGroup -Name myResourceGroup -Location EastUS

New-AzVm `

```
-ResourceGroupName "myResourceGroup" `
-Name "myVM" `
-Location "East US" `
-VirtualNetworkName "myVnet" `
-SubnetName "mySubnet" `
-SecurityGroupName "myNetworkSecurityGroup" `
-PublicIpAddressName "myPublicIpAddress" `
-OpenPorts 80,3389
```



Accessing an Azure VM by using PowerShell

```
Get-AzPublicIpAddress -ResourceGroupName "myResourceGroup" | Select  
"IpAddress"
```

```
mstsc /v:publicIpAddress
```

```
Install-WindowsFeature -name Web-Server -IncludeManagementTools
```








Lesson 02: Configure VMs



Sizing a VM

- Each VM size offers a variation of the following characteristics:
 - Processing power
 - Memory
 - Storage capacity
- Based on the workload, you're able to choose from a subset of available VM sizes

VM configuration options

	Computational performance	1 virtual CPU (vCPU) - 128 vCPUs
	Memory	1 gibibyte (GiB) - 4 tebibyte (TiB)
	Disk storage	4GiB - 64TiB Up 160,000 IOPs
	Networking	30 GB Ethernet 100 GB InfiniBand
	Availability	Single VM service-level agreement (SLA) 99.9% Multi AZ SLA 99.99%

VM categories

Virtual machines



Entry level



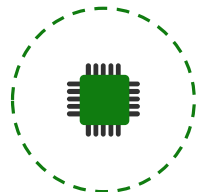
Burstable



General purpose



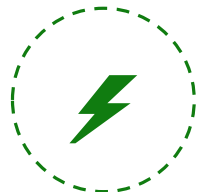
Compute intensive



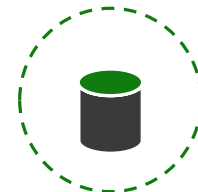
Memory optimized



GPU accelerated



High performance computing



Storage optimized

Purpose built



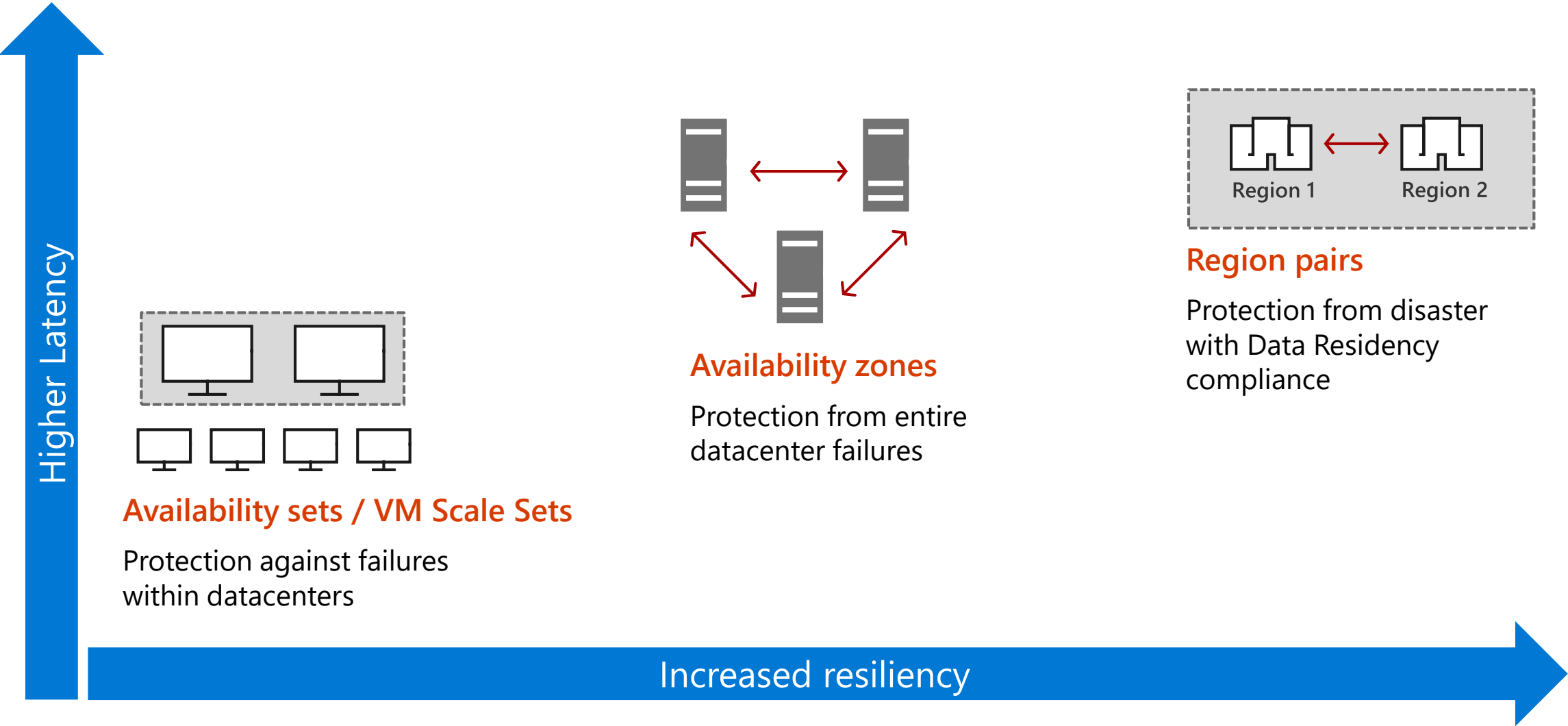
VM categories (cont.)

Option	Description
General purpose	General-purpose VMs are designed to have a balanced CPU-to-memory ratio. Ideal for testing and development, small to medium databases, and low to medium traffic web servers.
Compute optimized	Compute optimized VMs are designed to have a high CPU-to-memory ratio. Suitable for medium traffic web servers, network appliances, batch processes, and application servers.
Memory optimized	Memory optimized VMs are designed to have a high memory-to-CPU ratio. Great for relational database servers, medium to large caches, and in-memory analytics.
Storage optimized	Storage-optimized VMs are designed to have high disk throughput and IO. Ideal for VMs running databases.
GPU	GPU VMs are specialized virtual machines targeted for heavy graphics rendering and video editing. These VMs are ideal options for model training and inferencing with deep learning.
High performance compute	High-performance compute is the fastest and most powerful CPU virtual machine with optional high-throughput network interfaces.

Manage the availability of your Azure VMs

- **Availability** is the percentage of time a service is available for use
- In the event of a physical failure within the Azure datacenter:
 - Azure will move the VM to a healthy host server automatically
 - “Self-healing” migration could take several minutes
 - If your VM is isolated to a single instance, the application(s) hosted on that VM will not be available
- VMs could also be affected by periodic updates initiated by Azure itself

High availability and disaster recovery

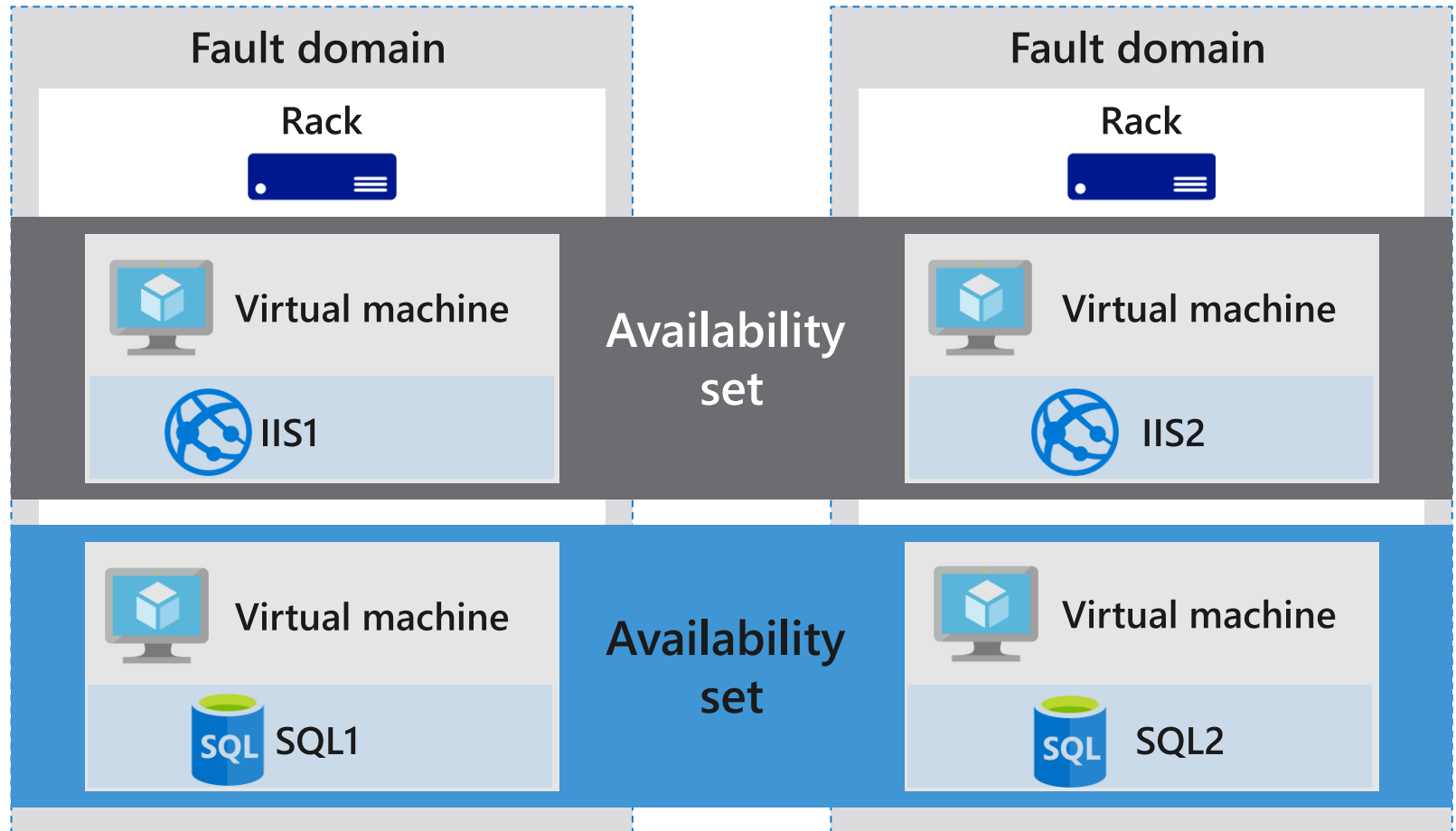


Availability sets

- **Availability set** – logical feature used to ensure that a group of related VMs are deployed so that:
 - They are not all subject to a single physical point of failure
 - They are not all upgraded at the same time
- **Update domain** – logical group of hardware that can undergo a maintenance update at the same time

Fault domains

Fault domain – a logical group of hardware in Azure that shares a common power source and network switch



Demo: Create an Azure VM

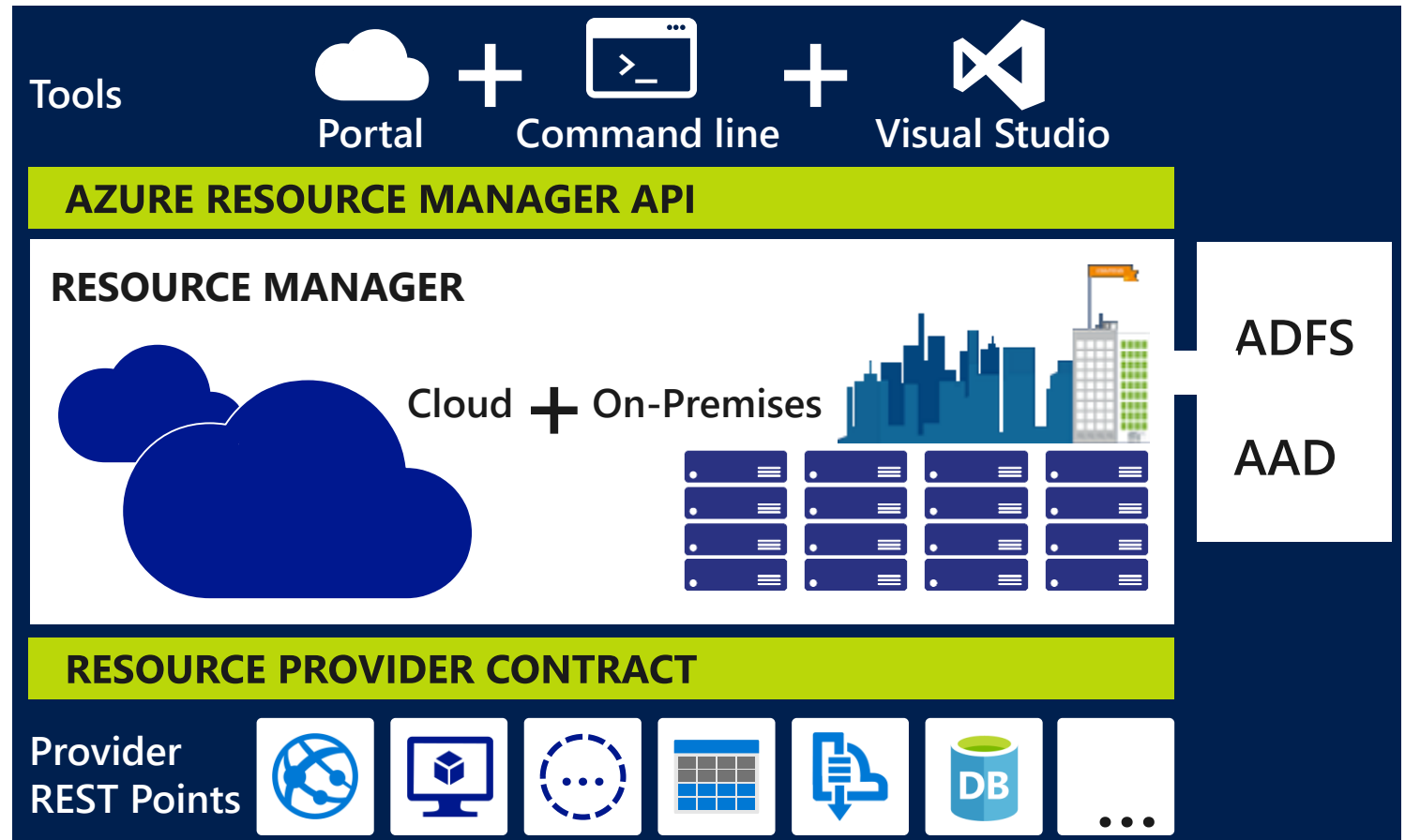


Lesson 03: Create Azure Resource Manager templates



Azure Resource Manager overview

- Resource Manager provides a consistent management layer to perform tasks
 - Azure PowerShell
 - Azure CLI
 - Azure portal
 - REST API
 - Client SDKs

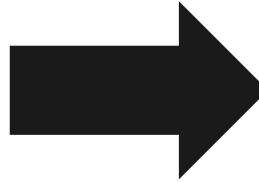


Terminology

- Resource
 - Single manageable item available through Azure
- Resource group
 - Container holding related resources
- Resource provider
 - Service that supplies resource instances in accordance with a predefined contract
- Resource Manager template
 - JSON file that defines one or more resources, specifying their resource providers, to be deployed to a resource group
- Declarative syntax
 - The act of describing your resources by using a template instead of manually creating the resources

Resource Manager template deployment

```
"resources": [  
  {  
    "apiVersion": "2016-01-01",  
    "type":  
"Microsoft.Storage/storageAccounts",  
    "name": "mystorageaccount",  
    "location": "westus",  
    "sku": {  
      "name": "Standard_LRS"  
    },  
    "kind": "Storage",  
    "properties": {}  
  }  
]
```



PUT

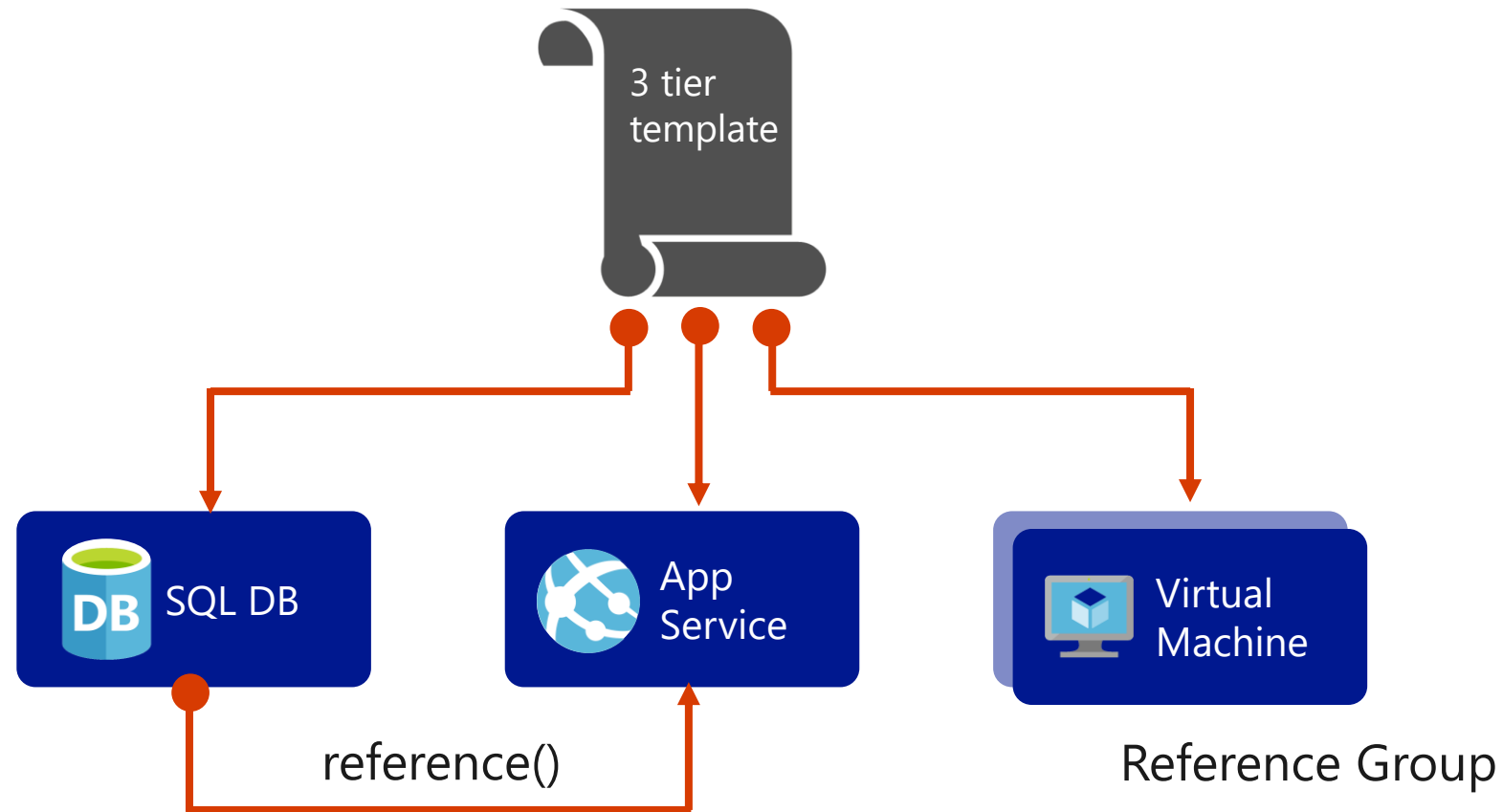
<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Storage/storageAccounts/mystorageaccount?api-version=2016-01-01>

REQUEST BODY

```
{  
  "location": "westus",  
  "properties": {},  
  "sku": {  
    "name": "Standard_LRS"  
  },  
  "kind": "Storage"  
}
```

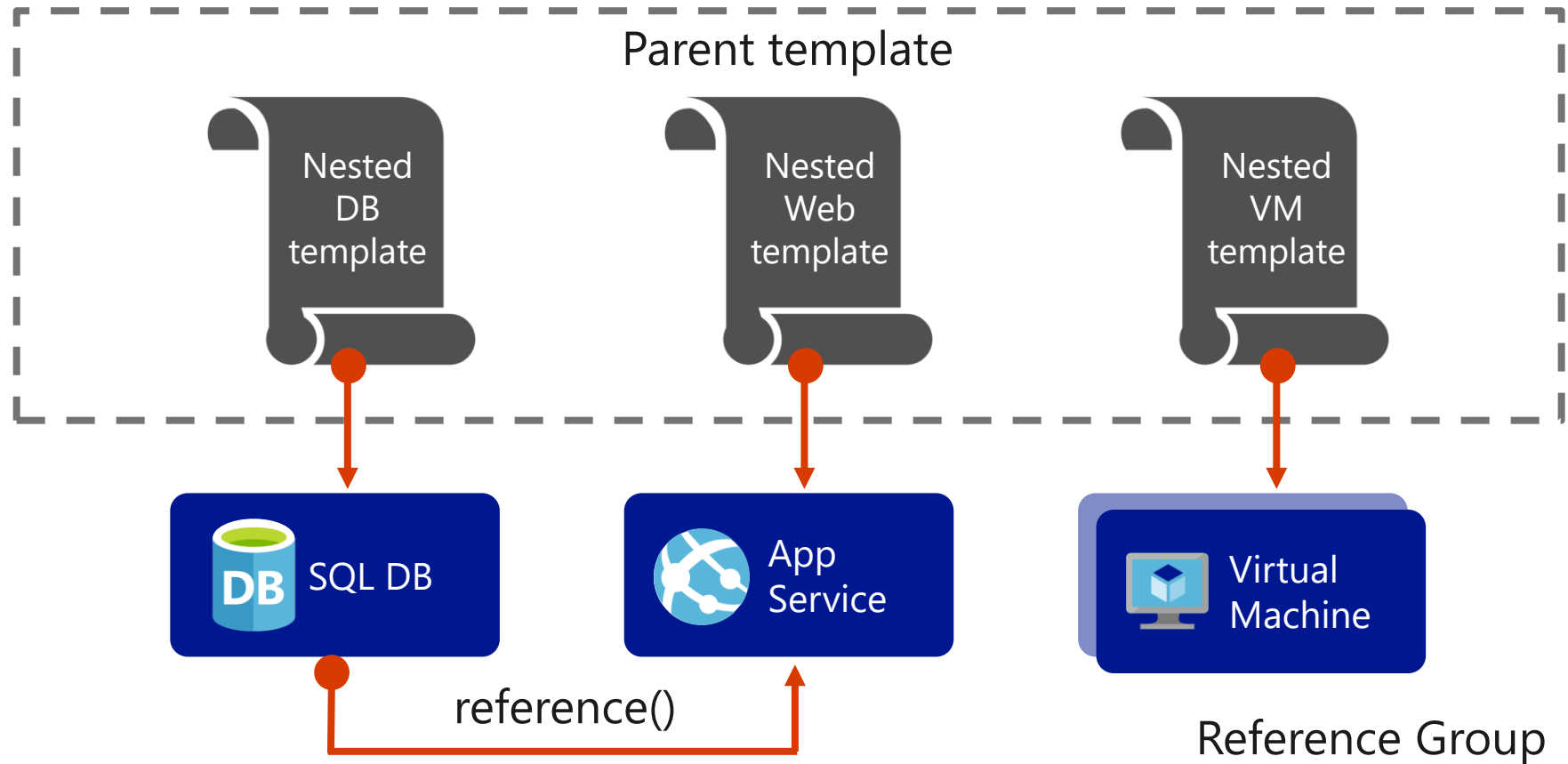
Three-tier Azure Resource Manager template

Three-tier application through a single Resource Manager template

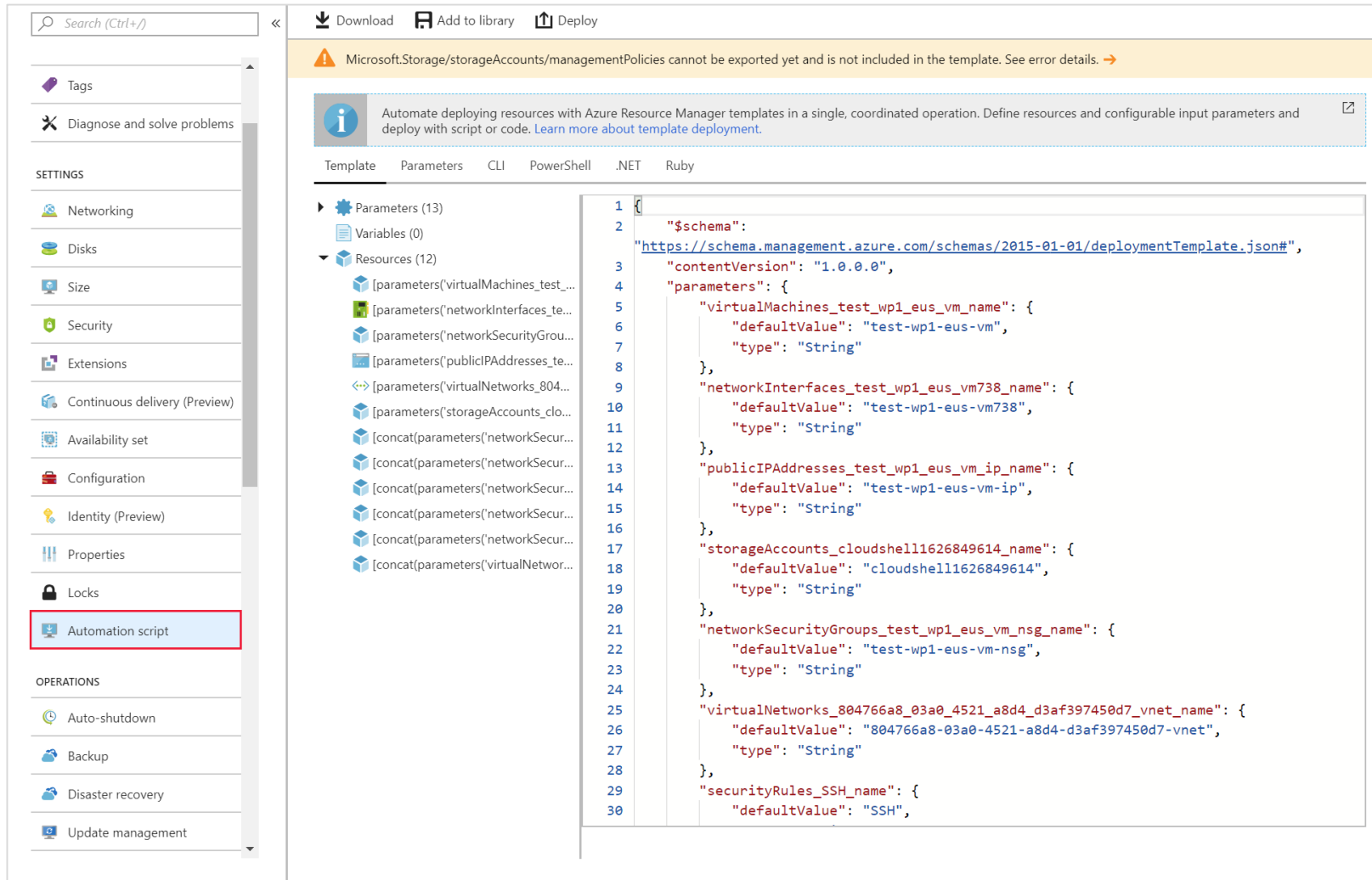


Nested Resource Manager template

Nested templates deploying a similar three-tier application



Create Resource Manager templates by using the Azure portal



The screenshot displays the Azure portal interface for creating a Resource Manager template. The left sidebar contains navigation options: Tags, Diagnose and solve problems, SETTINGS (Networking, Disks, Size, Security, Extensions, Continuous delivery (Preview), Availability set, Configuration, Identity (Preview), Properties, Locks), and OPERATIONS (Auto-shutdown, Backup, Disaster recovery, Update management). The 'Automation script' option is highlighted with a red box. The main content area shows a template editor with tabs for Template, Parameters, CLI, PowerShell, .NET, and Ruby. A warning message at the top states: "Microsoft.Storage/storageAccounts/managementPolicies cannot be exported yet and is not included in the template. See error details. →". Below this, an information box explains that the template automates deploying resources with Azure Resource Manager templates in a single, coordinated operation. The 'Template' tab is active, displaying a JSON schema for a deployment template. The schema includes parameters for virtual machines, network interfaces, network security groups, public IP addresses, virtual networks, storage accounts, and security rules. The parameters are defined with default values and types.

Search (Ctrl+/) << Download Add to library Deploy

Microsoft.Storage/storageAccounts/managementPolicies cannot be exported yet and is not included in the template. See error details. →

Automate deploying resources with Azure Resource Manager templates in a single, coordinated operation. Define resources and configurable input parameters and deploy with script or code. [Learn more about template deployment.](#)

Template Parameters CLI PowerShell .NET Ruby

Parameters (13)
Variables (0)
Resources (12)
[parameters('virtualMachines_test...')]
[parameters('networkInterfaces_te...')]
[parameters('networkSecurityGrou...')]
[parameters('publicIPAddresses_te...')]
[parameters('virtualNetworks_804...')]
[parameters('storageAccounts_clo...')]
[concat(parameters('networkSecur...')]
[concat(parameters('networkSecur...')]
[concat(parameters('networkSecur...')]
[concat(parameters('networkSecur...')]
[concat(parameters('networkSecur...')]
[concat(parameters('virtualNetwor...')]

```
1 {  
2   "$schema":  
3     "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",  
4   "contentVersion": "1.0.0.0",  
5   "parameters": {  
6     "virtualMachines_test_wp1_eus_vm_name": {  
7       "defaultValue": "test-wp1-eus-vm",  
8       "type": "String"  
9     },  
10    "networkInterfaces_test_wp1_eus_vm738_name": {  
11      "defaultValue": "test-wp1-eus-vm738",  
12      "type": "String"  
13    },  
14    "publicIPAddresses_test_wp1_eus_vm_ip_name": {  
15      "defaultValue": "test-wp1-eus-vm-ip",  
16      "type": "String"  
17    },  
18    "storageAccounts_cloudshell11626849614_name": {  
19      "defaultValue": "cloudshell11626849614",  
20      "type": "String"  
21    },  
22    "networkSecurityGroups_test_wp1_eus_vm_nsg_name": {  
23      "defaultValue": "test-wp1-eus-vm-nsg",  
24      "type": "String"  
25    },  
26    "virtualNetworks_804766a8_03a0_4521_a8d4_d3af397450d7_vnet_name": {  
27      "defaultValue": "804766a8-03a0-4521-a8d4-d3af397450d7-vnet",  
28      "type": "String"  
29    },  
30    "securityRules_SSH_name": {  
31      "defaultValue": "SSH",  
32      "type": "String"  
33    }  
34  }
```

Demo: Create Resource Manager templates



Lesson 04: Azure Disk Encryption for VMs



Encryption options for protecting VMs

- Encryption converts meaningful information into something that seems meaningless, as a security measure
 - Typically, a key is used to perform the encryption and subsequent decryption
- There are two forms of key-based encryption:
 - **Symmetric** – A single key is used to encrypt and decrypt the data for best performance
 - **Asymmetric** – A pair of keys is used to encrypt the data. Only one key is made “public” while both parties share a “private” key

Key management

- Key can be managed (by Azure) or managed manually by you
- Managed disk protection technologies for Azure VMs are:
 - **Storage Service Encryption (SSE)** – Protects storage data at rest
 - **Azure Disk Encryption (ADE)** – Uses BitLocker to control the encryption of disks for Windows or Linux

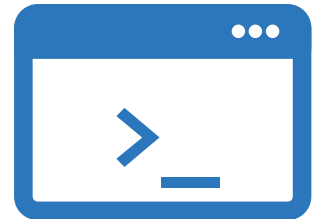
Create Azure Key Vault by using Azure PowerShell

```
New-AzKeyVault -Location "<location>" `
  -ResourceGroupName "<resource-group>" `
  -VaultName "myKeyVault" `
  -EnabledForDiskEncryption
```



Create Azure Key Vault by using Azure CLI

```
az keyvault create \  
  --name "myKeyVault" \  
  --resource-group <resource-group> \  
  --location <location> \  
  --enabled-for-disk-encryption True
```



Encrypt existing VM disks by using the Azure portal

Home > New > Create key vault > Access policies

Create key vault

* Name ⓘ

WebVMEncryptionVault ✓

* Subscription

Concierge Subscription ▼

* Resource Group

040231d4-f905-41ce-b57a-48ebc738bcc7 ▼

Create new

* Location

South Central US ▼

Pricing tier

Standard >

Access policies

1 principal selected >

Virtual Network Access

All networks can access. >

Access policies

Click to hide advanced access policies

☐ Enable access to Azure Virtual Machines for deployment ⓘ

☐ Enable access to Azure Resource Manager for template deployment ⓘ

☒ Enable access to Azure Disk Encryption for volume encryption ⓘ

+ Add new

...

Configuring Azure Key Vault to encrypt VM disks

- You must enable access to keys or secrets to make them available to the VM
- Granting access is done through **policies**
- There are three policies that you can enable:
 - **Disk Encryption** – Required for Azure Disk Encryption
 - **Deployment** – Access secrets during deployment
 - **Template Deployment** – Access secrets in Resource Manager templates

Demo: Encrypt existing VM disks



Review

- Provision VMs
- Configure VMs
- Create Azure Resource Manager templates
- Configure Azure Disk Encryption for VMs

