

AZ203 – Developing Microsoft Azure Solutions

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About me

- Founder & Director – CodeSizzler
- Microsoft Most Valuable Professional – Azure
- Microsoft Certified Trainer
- 8 years of experience as Cloud Consultant
- Azure – AWS – GCP – IoT – Machine Learning – Cognitive Services
 - Bot – Xamarin – Big Data
- Consultant for Accenture, Adobe, Boeing, Deloitte., Infosys, Johnson Controls, Microsoft, Wipro, etc.,



Past Executions:

Delivered Microsoft Open Hack events for Microsoft Clients at India and US region.

Consulted 80+ partners of Microsoft on Open Source integration across the globe

Consulted IT giants on Migration of On-Premise to Microsoft Azure & AWS to Microsoft Azure





Current Executions:

Learning Path for **Microsoft Partners** – Apps & Infra, Data & AI

Azure Migration for Boeing - Seattle, USA.

SQL Server and Windows Server EOS support for Microsoft Partners, KSA.



CodeSizzler Team:



Goals for this session

- Develop Azure Infrastructure as a Service compute solution
- Develop Azure Platform as a Service compute solution
- Develop for Azure storage
- Implement Azure security; monitor, troubleshoot, and optimize solutions
- Connect and consume Azure services and third-party services. Demo!

Github resource to run the demo's -



Modules

- Develop Azure Infrastructure as a Service compute solution (10-15%)
- Develop Azure Platform as a Service compute solution (20-25%)
- Develop for Azure storage (15-20%)
- Implement Azure security (10-15%)
- Monitor, troubleshoot, and optimize solutions (10-15%)
- Connect to and consume Azure and third-party services (20-25%)



Developing Azure IaaS Solutions





Topics

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

Naming a VM

- The VM name is used as the computer name, which is configured as part of the operating system
- Rules:
 - Up to 15 characters for a Windows VM
 - Up to 64 characters for a Linux VM
- Current best practices for VM name choices:

Element	Example	Notes
Environment	dev, prod, QA	Identifies the environment for the resource
Location	uw (US West), ue (US East)	Identifies the region into which the resource is deployed
Instance	01, 02	For resources that have more than one named instance (such as web servers)
Product or Service	service	Identifies the product, application, or service that the resource supports
Role	sql, web, messaging	Identifies the role of the associated resource

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

Sizing a VM (continued)

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.

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 disks** – The disk and the backing storage is managed completely by the Azure platform. Some of the constraints around storage account limits and scale-out are eased in this model.
 - **Unmanaged disks** – You manually create and manage 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)

Manage the availability of your Azure VMs

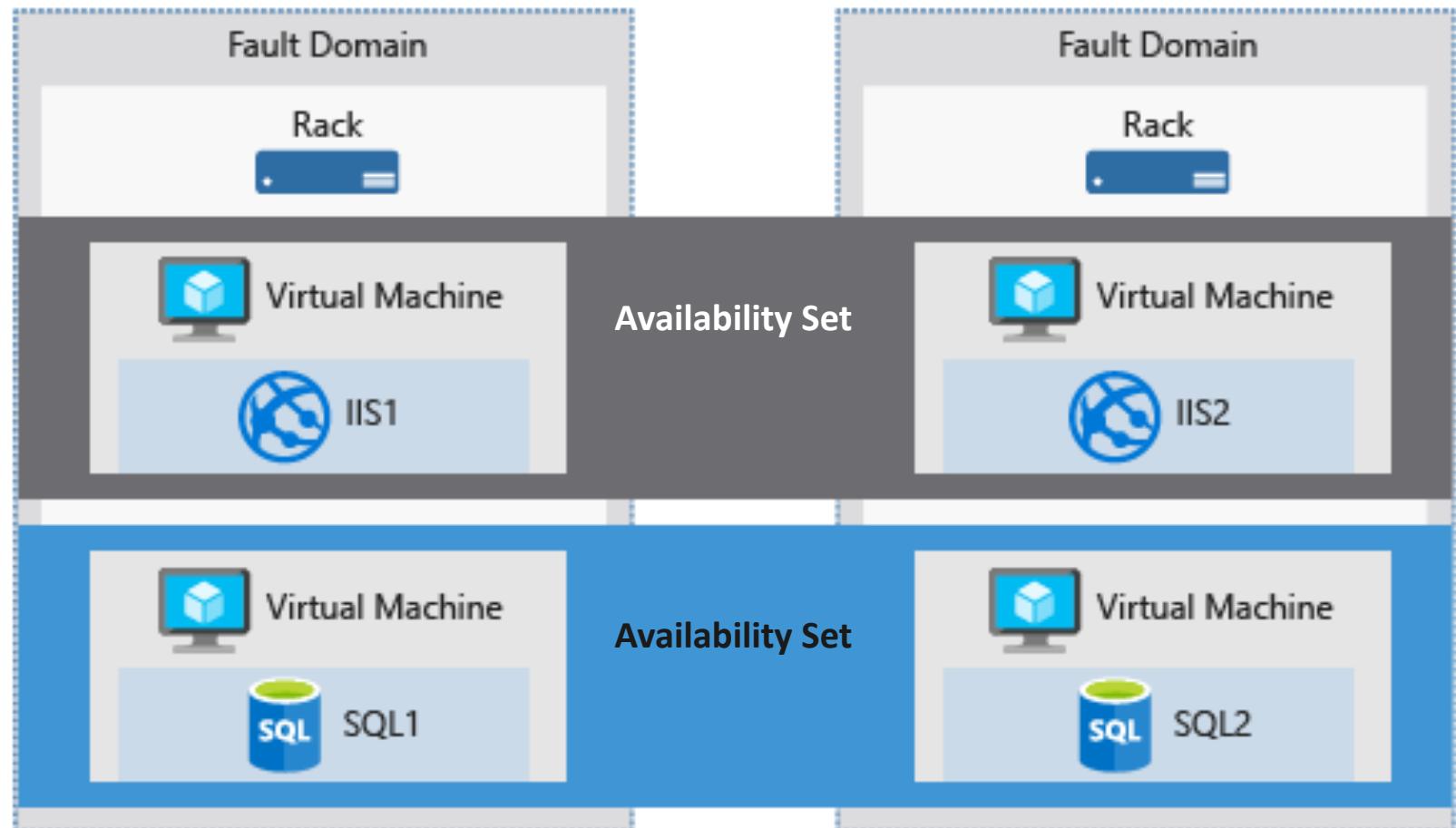
- **Availability** is the percentage of time a service is available for use
- In the event of a physical failure within the Azure datacenter:
 - Azure will move the VM to a healthy host server automatically
 - “Self-healing” migration could take several minutes
 - If your VM is isolated to a single instance,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

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



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 i Pay-As-You-Go ▼

* Resource group i (New) myResourceGroup ▼

[Create new](#)

Demo: Create an Azure VM by using the Azure portal



Create an Azure VM by using PowerShell

```
Connect-AzureRmAccount
```

```
New-AzureRmResourceGroup -Name myResourceGroup -Location EastUS
```

```
New-AzureRmVm  
  -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-AzureRmPublicIpAddress -ResourceGroupName "myResourceGroup" | Select  
"IpAddress"
```

```
mstsc /v:publicIpAddress
```

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

Demo: Create an Azure VM by using PowerShell



Create and manage Azure VMs by using C#

```
using Microsoft.Azure.Management.Compute.Fluent;
using Microsoft.Azure.Management.Compute.Fluent.Models;
using Microsoft.Azure.Management.Fluent;
using Microsoft.Azure.Management.ResourceManager.Fluent;
using Microsoft.Azure.Management.ResourceManager.Fluent.Core;

var credentials = SdkContext.AzureCredentialsFactory
    .FromFile(Environment.GetEnvironmentVariable("AZURE_AUTH_LOCATION"));

var azure = Azure
    .Configure()
    .WithLogLevel(HttpLoggingDelegatingHandler.Level.Basic)
    .Authenticate(credentials)
    .WithDefaultSubscription();
```

Create VM resources by using C#

```
var groupName = "myResourceGroup"; var vmName = "myVM";
var location = Region.USWest;

Console.WriteLine("Creating resource group...");
var resourceGroup = azure.ResourceGroups.Define(groupName)
    .WithRegion(location)
    .Create();

Console.WriteLine("Creating availability set...");
var availabilitySet = azure.AvailabilitySets.Define("myAVSet")
    .WithRegion(location)
    .WithExistingResourceGroup(groupName)
    .WithSku(AvailabilitySetSkuTypes.Managed)
    .Create();
```

Create networking resources by using C#

```
Console.WriteLine("Creating public IP address...");  
var publicIPAddress = azure.PublicIPAddresses.Define("myPublicIP")  
    .WithRegion(location)  
    .WithExistingResourceGroup(groupName)  
    .WithDynamicIP()  
    .Create();
```

```
Console.WriteLine("Creating virtual network...");  
var network = azure.Networks.Define("myVNet")  
    .WithRegion(location)  
    .WithExistingResourceGroup(groupName)  
    .WithAddressSpace("10.0.0.0/16")  
    .WithSubnet("mySubnet", "10.0.0.0/24")  
    .Create();
```

Create network interfaces by using C#

```
Console.WriteLine("Creating network interface...");  
var networkInterface = azure.NetworkInterfaces.Define("myNIC")  
    .WithRegion(location)  
    .WithExistingResourceGroup(groupName)  
    .WithExistingPrimaryNetwork(network)  
    .WithSubnet("mySubnet")  
    .WithPrimaryPrivateIPAddressDynamic()  
    .WithExistingPrimaryPublicIPAddress(publicIPAddress)  
    .Create();
```

Create a VM by using C#

```
Console.WriteLine("Creating virtual machine...");  
azure.VirtualMachines.Define(vmName)  
    .WithRegion(location)  
    .WithExistingResourceGroup(groupName)  
    .WithExistingPrimaryNetworkInterface(networkInterface)  
    .WithLatestWindowsImage("MicrosoftWindowsServer", "WindowsServer", "2012-R2-Datacenter")  
    .WithAdminUsername("azureuser")  
    .WithAdminPassword("Azure12345678")  
    .WithComputerName(vmName)  
    .WithExistingAvailabilitySet(availabilitySet)  
    .WithSize(VirtualMachineSizeTypes.StandardDS1)  
    .Create();
```

Manage a VM by using C#

```
var vm = azure.VirtualMachines.GetByResourceGroup(groupName, vmName);

Console.WriteLine("Starting vm...");
vm.Start();

Console.WriteLine("Resizing vm...");
vm.Update()
    .WithSize(VirtualMachineSizeTypes.StandardDS2)
    .Apply();
```

Modifying and disposing of VMs by using C#

```
Console.WriteLine("Adding data disk to vm...");  
vm.Update()  
    .WithNewDataDisk(2, 0, CachingTypes.ReadWrite)  
    .Apply();
```

```
Console.WriteLine("Stopping vm...");  
vm.PowerOff();
```

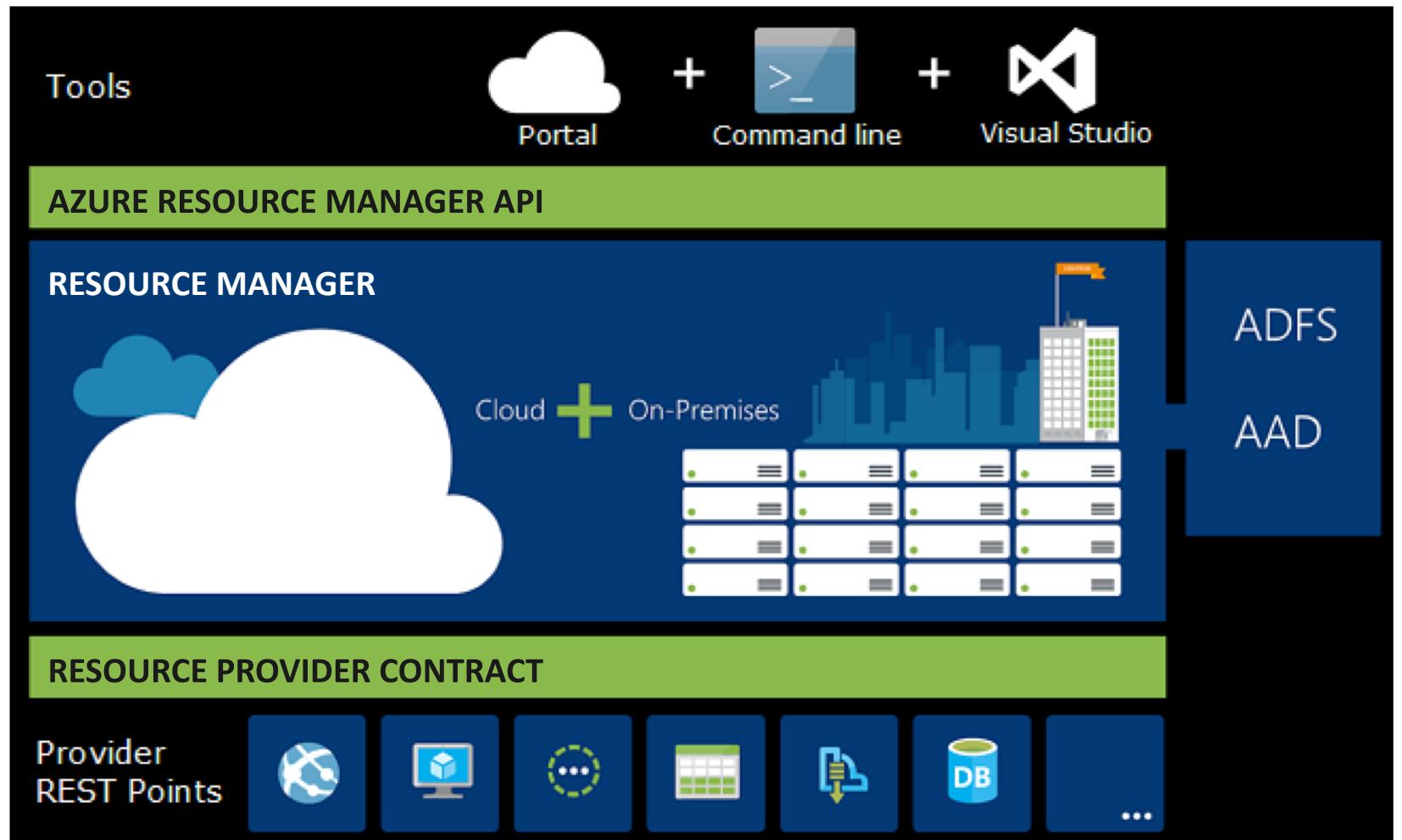
```
vm.Deallocate();
```

Lesson 02: 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

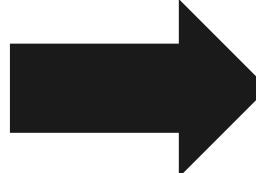


Terminology

- **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

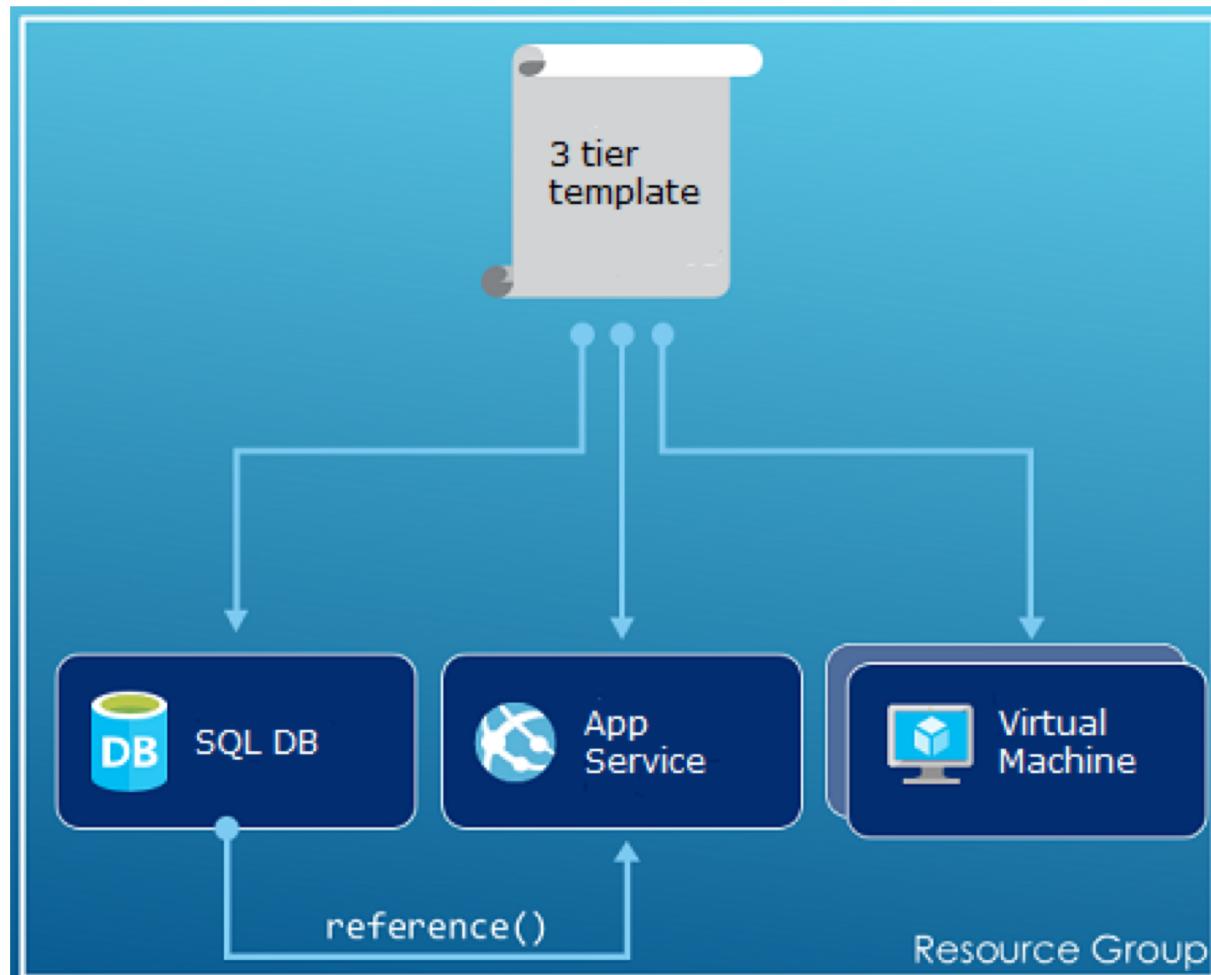
<https://management.azure.com/subscriptions/{subscriptionId}/resourceGroups/{resourceGroupName}/providers/Microsoft.Storage/storageAccounts/mystorageaccount?api-version=2016-01-01>

REQUEST BODY

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

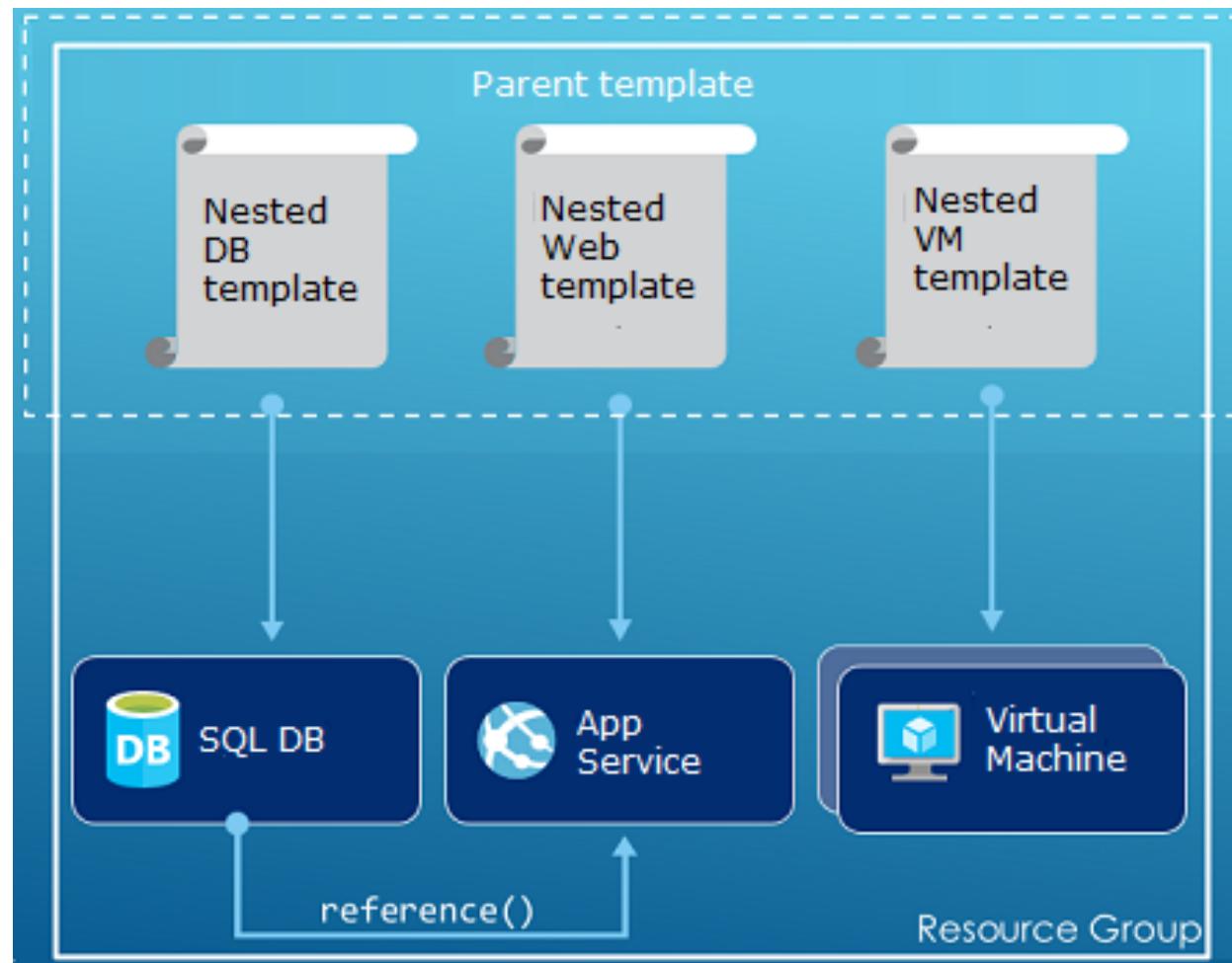
Three-tier Azure Resource Manager template

Three-tier application through a single Resource Manager template

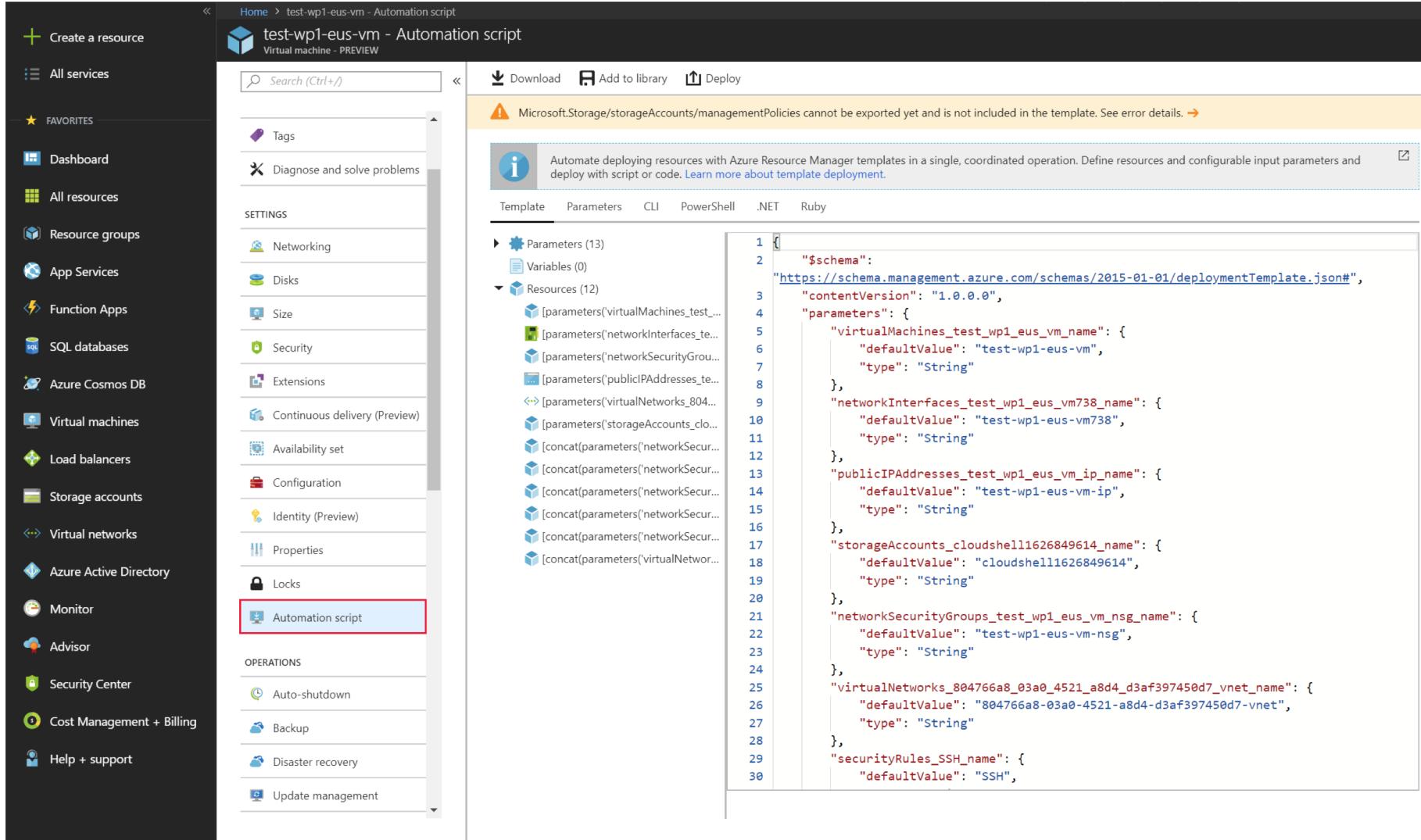


Nested Resource Manager template

Nested templates deploying a similar three-tier application



Create Resource Manager templates by using the Azure portal



Demo:
Create Resource Manager templates by using the
Azure portal



Create Resource Manager templates by using Visual Studio Code

```
az group create --name $resourceGroupName --location  
$location
```

```
az group deployment create --name $deploymentName --  
resource-group $resourceGroupName --template-file  
"azuredeploy.json"
```

```
az storage account show --resource-group  
$resourceGroupName --name $storageAccountName
```

Lesson 03: Configure 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

Encrypt existing VM disks

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

```
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	Access policies
<p>* Name ⓘ WebVMEncryptionVault</p> <p>* Subscription Concierge Subscription</p> <p>* Resource Group 040231d4-f905-41ce-b57a-48ebc738bcc7 Create new</p> <p>* Location South Central US</p> <p>Pricing tier Standard</p> <p>Access policies 1 principal selected</p> <p>Virtual Network Access All networks can access.</p>	<p>Click to hide advanced access policies</p> <p><input type="checkbox"/> Enable access to Azure Virtual Machines for deployment ⓘ</p> <p><input type="checkbox"/> Enable access to Azure Resource Manager for template deployment ⓘ</p> <p><input checked="" type="checkbox"/> Enable access to Azure Disk Encryption for volume encryption ⓘ</p> <p>Add new ...</p>

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



Review

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

