



Azure Administration: Compute Management

Aligned with Microsoft Certification Exam AZ-104

ine.com

Course Topics

Virtual Machine Management
Azure App Service Management
Container Management

AZ-104 Objective Domains

- Manage Azure Identities and Governance (15-20%)
- Implement and Manage Storage (10-15%)
- **Deploy and Manage Azure Compute Resources (25-30%)**
- Configure and Manage Virtual Networking (30-35%)
- Monitor and back up Azure resources (10-15%)

Exam AZ-104: Microsoft Certified Azure Administrator Associate

- Configure VMs for high availability and scalability
 - + configure high availability
 - + deploy and configure scale sets
- Automate deployment and configuration of VMs
 - + modify Azure Resource Manager (ARM) template
 - + configure VHD template
 - + deploy from template
 - + save a deployment as an ARM template
 - + automate configuration management by using custom script extensions
- Create and configure VMs
 - + configure Azure Disk Encryption
 - + move VMs from one resource group to another
 - + manage VM sizes
 - + add data discs
 - + configure networking
 - + redeploy VMs
- Create and configure containers
 - + create and configure Azure Kubernetes Service (AKS)
 - + create and configure Azure Container Instances (ACI)
- Create and configure Web Apps
 - + create and configure App Service
 - + create and configure App Service Plans

Pre-requisites

- **Azure Fundamentals**



Virtual Machine Fundamentals

Virtual Machine Fundamentals

- Virtual Machine Architecture
- Virtual Machine Elements
- Virtual Machine Sizing

Virtual Machine Architecture

Virtual Machine Elements

- Image
- OS disk
- Data disk(s)
- OS profile (server name, admin, etc.)
- NIC(s)
- Availability set/availability zone
- Extensions
- Diagnostics

Virtual Machine Sizing

- Size defines
 - + processor type and number of vCores
 - + disk type and number
 - + memory
 - + NIC capacity
 - + temp disk size
- Categories
 - + general purpose
 - + compute optimizes
 - + memory optimized
 - + storage optimized
 - + GPU
 - + high performance compute



Deploy Virtual Machines

Deploy Virtual Machines

- Provisioning Virtual Machines
- Updating Virtual Machines
- Demo: Deploy Virtual Machines

Provisioning Virtual Machines

- Platforms
 - + Portal
 - + PowerShell
 - + CLI
 - + API
- Resource dependencies
 - + virtual network
 - + subnet
 - + NIC
 - + OS disk
- Additional resources
 - + public IP address(es)
 - + data disk(s)
 - + extensions

Updating Virtual Machines

- Online updates
 - + Disk
 - + add a disk
 - + change disk cache setting
 - + NIC
 - + change public or private IP settings*
- Offline updates
 - + Resize a VM
 - + Disk
 - + resize disk
 - + remove disk
 - + NIC
 - + add or remove a NIC*

*sometimes

Demo: Deploy Virtual Machines



Advanced Virtual Machine Deployment

Advanced Virtual Machine Deployment

- Deploy Multiple NICs
- Deploy Multiple Disks
- Demo: Deploy Virtual Machines

Advanced Virtual Machine Deployment

- + Deploy Multiple NICs
- + Deploy Multiple Disks

```
$vm0Config = New-AZVMConfig -VMName $vm0Name`
               -VMSize Standard_D2_V3 |`
Set-AZVMOperatingSystem -Windows -ComputerName`
$vm0Name`
               -Credential $cred |`
Set-AZVMSourceImage -PublisherName`
MicrosoftWindowsServer -Offer windowsServer`
               -Skus 2016-Datacenter -Version latest |`
Add-AZVMNetworkInterface -Id $nic0.Id -Primary |`

Add-AZVMNetworkInterface -Id $nic1.Id |`
Add-AZVMDaDataDisk -Name "vm0-datadisk0" -`
DiskSizeInGB 10`
               -Caching None -Lun 0 -CreateOption Empty |`
Add-AZVMDaDataDisk -Name "vm0-datadisk1" -`
DiskSizeInGB 10`
               -Caching None -Lun 1 -CreateOption Empty
```

Demo: Deploy Virtual Machines



ARM Template Deployment

ARM Template Deployment

- Repeatable Deployments with ARM Templates
- ARM Template Elements
- ARM Template for Virtual Machines
- Generate an ARM Template from the Azure Portal
- Demo: ARM Template Deployment

Repeatable Deployments with ARM Templates

Create a virtual machine

[Basics](#) [Disks](#) [Networking](#) [Management](#) [Advanced](#) [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 * ⓘ

INE Demonstrations

Resource group * ⓘ

[Create new](#)

Instance details

Virtual machine name * ⓘ

Region * ⓘ

(US) East US

Availability options ⓘ

No infrastructure redundancy required

Image * ⓘ

Windows Server 2016 Datacenter

[Browse all public and private images](#)

Repeatable Deployments with ARM Templates

```
# Variables for common values
$rg = "VOD-AZ300-VM"
$location = "EastUS"
$vmName = "ps-long-vm"

# Create user object
$cred = Get-Credential -Message "Enter a username and password for the virtual machine."

# Create a resource group

# Create a subnet configuration
$subnetConfig = New-AzVirtualNetworkSubnetConfig -Name default -AddressPrefix 10.0.0.0/24

# Create a virtual network
$vnnet = New-AzVirtualNetwork -ResourceGroupName $rg -Location $location `
    -Name az-300-dmo-vm-vnet -AddressPrefix 10.0.0.0/16 -Subnet $subnetConfig

# Create a public IP address and specify a DNS name
$pip = New-AzPublicIpAddress -ResourceGroupName $rg -Location $location `
    -Name $vmName -AllocationMethod Static -IdleTimeoutInMinutes 4

# Create an inbound network security group rule for port 3389
$nsgRuleRDP = New-AzNetworkSecurityRuleConfig -Name myNetworkSecurityGroupRuleRDP -Protocol Tcp `
    -Direction Inbound -Priority 1000 -SourceAddressPrefix * -SourcePortRange * -DestinationAddressPrefix * `
    -DestinationPortRange 3389 -Access Allow

# Create a network security group
$nsg = New-AzNetworkSecurityGroup -ResourceGroupName $rg -Location $location `
    -Name myNetworkSecurityGroup -SecurityRules $nsgRuleRDP

# Create a virtual network card and associate with public IP address and NSG
```



Repeatable Deployments with ARM Templates

```
New-AzResourceGroupDeployment -Name vm -ResourceGroupName 02tasks `
  -TemplateFile .\AZ104.3-ARM-Template.json -Verbose
```

ARM Template Elements

```
{  
  "$schema": "",  
  "contentVersion": "",  
  "parameters": { },  
  "variables": { },  
  "resources": [ ],  
  "outputs": { },  
  "functions": [ ],  
  "apiProfile": ""  
}
```

ARM Template for Virtual Machines

```
{  
  "type": "Microsoft.Compute/virtualMachines",  
  "apiVersion": "2018-10-01",  
  "name": "",  
  "location": "",  
  "dependsOn": [],  
  "properties": {  
    "hardwareProfile": {"vmSize": ""},  
    "osProfile": {"computerName": "", ...},  
    "storageProfile": {"imageReference": {}, "osDisk": {}, "dataDisks": []},  
    "networkProfile": {"networkInterfaces": []},  
    "diagnosticsProfile": {"bootDiagnostics": {}  
  }  
}
```

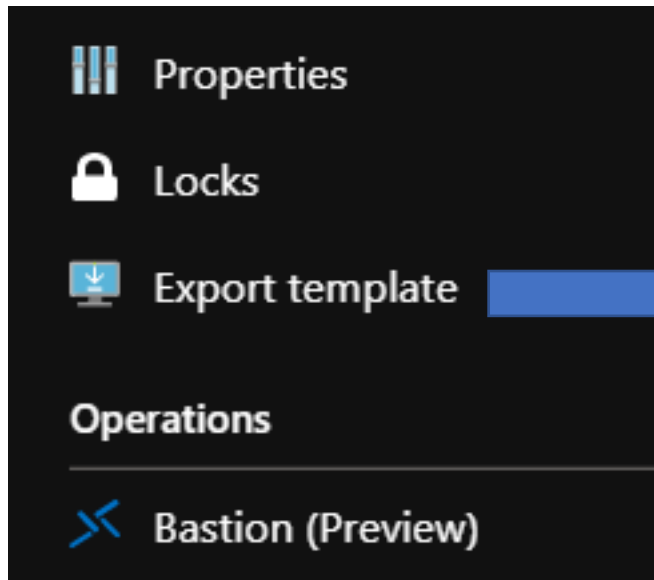
VHD Template Elements

```
"osDisk": {  
  "osType": "string",  
  "encryptionSettings": {"diskEncryptionKey": {}, "keyEncryptionKey": {}, "enabled": ""},  
  "name": "",  
  "vhd": {"uri": ""},  
  "image": {"uri": ""},  
  "caching": "string",  
  "writeAcceleratorEnabled": "boolean",  
  "diffDiskSettings": {},  
  "createOption": "string",  
  "diskSizeGB": "integer",  
  "managedDisk": {"id": "", "storageAccountType": "", "diskEncryptionSet": {}}  
}
```

VHD Template Elements

```
"dataDisks": [  
  {  
    "lun": "",  
    "name": "",  
    "vhd": {"uri": ""},  
    "image": {"uri": ""},  
    "caching": "",  
    "writeAcceleratorEnabled": "",  
    "createOption": "",  
    "diskSizeGB": "",  
    "managedDisk": {},  
    "toBeDetached": ""  
  }  
]
```


Generate an ARM Template from the Azure Portal



Template Parameters Scripts

Parameters (0)
Variables (0)
Resources (2)
workload-win (Microsoft.Comp...
workload-win/Microsoft.Insight...

```
1 {  
2   "$schema": "https://schema.management.azure.com/schemas/2015-08-01/  
3   "contentVersion": "1.0.0.0",  
4   "parameters": {},  
5   "variables": {},  
6   "resources": [  
7     {  
8       "type": "Microsoft.Compute/virtualMachines",  
9       "apiVersion": "2019-03-01",  
10      "name": "workload-win",  
11      "location": "eastus",  
12      "tags": {  
13        "keepRunning": "keepRunning"  
14      },  
15      "properties": {  
16        "hardwareProfile": {  
17          "vmSize": "Standard_D2s_v3"  
18        },  
19        "storageProfile": {  
20          "imageReference": {  
21            "publisher": "MicrosoftWindowsServer",  
22            "offer": "WindowsServer",  
23            "sku": "2019-Datacenter",  
24            "version": "latest"  
25          },  
26          "osDisk": {
```

Demo: ARM Template Deployment



Advanced ARM Template Deployment

Advanced ARM Template Deployment

- Deploy NICs and Disks
- Template Functions
- Multiple Instances
- Update Via Template
- Demo: Complex Deployments

Deploy NICs and Disks

- + NICs
- + Data Disks

```
"dataDisks": [
  "networkProfile": {
    "networkInterfaces": [
      {
        "name": "datadisk0",
        "caching": "None",
        "writeAcceleratorEnabled": "false",
        "createOption": "Empty",
        "diskSizeGB": "10",
        "properties": {
          "primary": "true"
        },
        "lun": "1",
        "name": "datadisk1",
        "caching": "None",
        "writeAcceleratorEnabled": "false",
        "id": "",
        "createOption": "Empty",
        "diskSizeGB": "10",
        "managedDisk": {
          "storageAccountType": "Premium_LRS"
        }
      }
    ]
  }
]
```

Template Functions

- Add dynamic and responsive capabilities
- Format: "property": "[function(parameters)]"
- Examples:
 - + "location": "[resourceGroup().location]"
 - + "name": "[concat(variables('basename'), '-vm')]"
 - + "id": "[resourceId('Microsoft.Compute/VirtualMachines', 'thisvm')]"
- Common Categories
 - + deployment
 - + resource
 - + array and object
 - + string
 - + numeric
 - + comparison
 - + logical

Multiple Instances

- Copy elements

```
"copy": {  
  "name": "vmCopy",  
  "count": 3  
}
```

- Arrays

```
"baseNames": ["onprem", "hub", "spoke"]
```

- Functions

```
"name": "[concat(variables('baseNames')[copyindex()],'-VM')]"
```

Update Via Template

- Template deployment "mode" option
 - + complete
 - + incremental
- New resources
 - + build a template incrementally
- Modify existing resources
 - + many "properties" are objects which can be deployed via template
 - + app service settings
 - + VM extensions
 - + network peering

Demo: Complex Deployments



Virtual Machine Extensions

Virtual Machine Extensions

- Virtual Machine Extensions
- Desired State Configuration
- Custom Script
- Demo: DSC Extension

Virtual Machine Extensions

Desired State Configuration

```
Configuration Main
{
    "name": "Microsoft.Powershell.DSC",
    "type": "extensions",
    "location": "[resourceGroup().location]",
    Param ( [string] $nodeName )
    "dependsOn": [
        "[resourceId('Microsoft.Compute/virtualMachines', parameters('winvmName'))]"
    ]
    Import-DscResource -ModuleName PSDesiredStateConfiguration
    Node $nodeName
    {
        "publisher": "Microsoft.Powershell",
        "type": "DSC",
        "typeHandlerVersion": "2.9"
        WindowsFeature WebServerRole,
        {
            "settings": {
                "configuration": {
                    Name = "Web-Server"
                    Ensure = "Present.ps1",
                    "function": "Main"
                }
            }
        }
        WindowsFeature WebManagementConsole
        {
            "configurationArguments": {
                "nodeName": "[parameters('winvmName')]"
            }
            Name = "Web-Mgmt-Console"
            Ensure = "Present"
            "protectedSettings": {
                "configurationUrlSasToken": "[parameters('_artifactsLocationSasToken')]"
            }
        }
        WindowsFeature WebManagementService
        {
            Name = "Web-Mgmt-Service"
            Ensure = "Present"
        }
    }
}
```

Custom Script

```
mkdir /webserver
cd /webserver
wget https://inedemoassets.blob.core.windows.net/taskfiles/azure/webserver.py
chmod +x /webserver.py
./webserver.py &

{
  "name": "myvm/customScript1",
  "type": "Microsoft.Compute/virtualMachines/extensions",
  "apiVersion": "2018-06-01",
  "location": "[resourceGroup().location]",
  "publisher": "Microsoft.Azure.WebSites",
  "properties": {
    "publisher": "Microsoft.OSTCExtensions",
    "type": "CustomScriptForLinux",
    "typeHandlerVersion": "1.4",
    "autoUpgradeMinorVersion": true,
    "settings": {
      "fileUris": [
        "https://inedemoassets.blob.core.windows.net/taskfiles/azure/webserverinstall.sh"
      ],
      "commandToExecute": "sh webserverinstall.sh"
    }
  }
}
```

Demo: DSC Extension



Virtual Machine Scale Set

Virtual Machine Scale Set

- Virtual Machine Scale Set Concepts
- Azure Autoscale
- Load Balancing Virtual Machine Scale Sets
- Demo: VMSS

Virtual Machine Scale Set Concepts

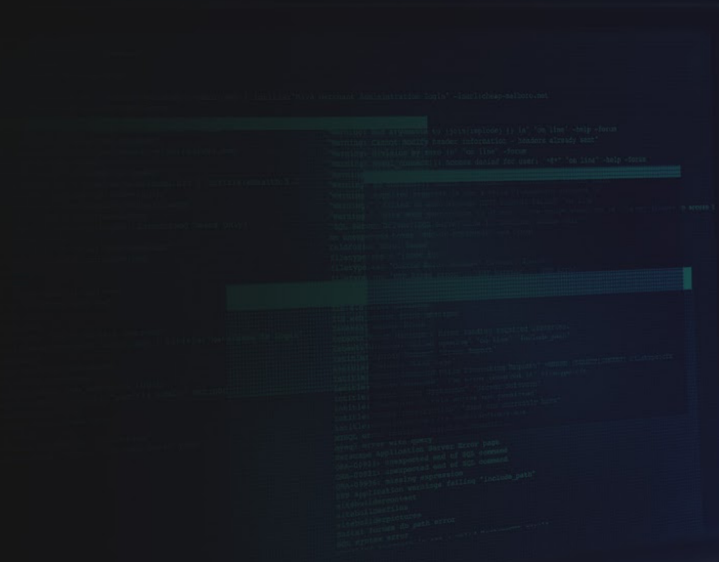
Azure Autoscale

- Applies to
 - + virtual machine scale set
 - + app service
 - + cloud service (classic)
- Microsoft.Insights

Load Balancing Virtual Machine Scale Sets

- Integrate with load balancer
- Automatically accounts for scale operations
- Set NAT rules for direct instance access
- Always deploy via template

Demo: VMSS





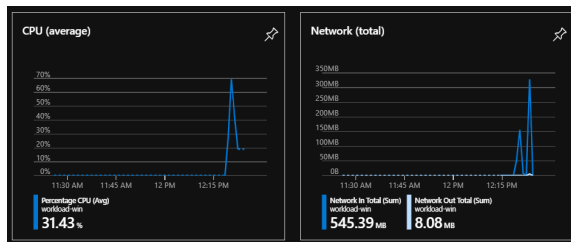
Manage Virtual Machines

Manage Virtual Machines

- Monitor Virtual Machines
- Move Virtual Machines
- Images and Snapshots
- Demo: Monitor Virtual Machines
- Demo: Create a VM from a Snapshot

Monitor Virtual Machines

Basic



Operation name

- > **Start Virtual Machine**
- > **Health Event Resolved**
- > **Health Event Updated**

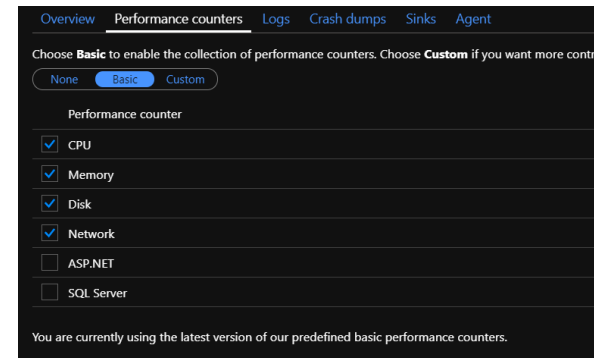
Boot Diagnostics



Updated: Wednesday, October 16, 2019, 4:15:05 PM UTC. Download serial log

```
[9;54C][22mC][25mC][27mC][40mC][37m
EVENT: A new channel has been created. Use "ch -?" for channel help.
Channel: SACSetupAct
SAC>
EVENT: A new channel has been created. Use "ch -?" for channel help.
Channel: SACSetupErr
SAC>
EVENT: A channel has been closed.
Channel: SACSetupAct
SAC>
EVENT: A channel has been closed.
Channel: SACSetupErr
SAC>
EVENT: The CMD command is now available.
SAC>[22C][1;38C][20C][H7m] version="1.0"
<machine-info>
<name>workload-win</name>
<guid>77767f85-ffef-4a51-bd91-88bc1034b128</guid>
<processor-architecture>AMD64</processor-architecture>
<os-version>10.0</os-version>
<os-build-number>17763</os-build-number>
</machine-info>
```

Diagnostics Extension



Log Analytics Extension



Move Virtual Machines

- Online operations
 - + move between resource groups
 - + move between subscriptions (must move all dependent resources)
 - + source and destination resource groups are locked
- Offline operations
 - + move between regions (de-provision and re-provision)

Snapshots and Images

Demo: Monitor Virtual Machines

Demo: Create a VM from a Snapshot



Virtual Machine Availability

Virtual Machine Availability

- Azure Virtual Machine SLAs
- Availability Sets
- Availability Zones
- Demo: Virtual Machine Availability

Virtual Machine Availability

- + Azure VM SLAs

- + Availability
Sets

- + Availability
Zones

99.9% - Single VM with premium storage

99.95% - Multiple VMs in an availability set

99.99% - Multiple VMs in different availability zones

Demo: Virtual Machine Availability



Azure Disk Encryption



Azure Disk Encryption

- ▶ Disk encryption overview
- ▶ Demonstration: Encrypt a VHD

Azure Disk Encryption Scenarios

- ▶ Encrypt new or existing Azure VMs
- ▶ Create new VMs based on pre-encrypted VHDs and encryption keys
- ▶ Encrypt Windows virtual machine scale sets.
- ▶ Encrypt Linux virtual machine scale set data drives.
- ▶ Disable encryption on Windows VMs.
- ▶ Disable encryption on data drives for Linux VMs.
- ▶ Disable encryption on Windows virtual machine scale sets.
- ▶ Disable encryption on data drives for Linux virtual machine scale sets.
- ▶ Update encryption settings of an existing encrypted VMs.
- ▶ Back up and restore encrypted VMs.

Azure Disk Encryption

▶ Pre-requisites:

- ▶ Supported OS
- ▶ Networking – connect to Azure AD, connect to key vault, extension storage access
- ▶ Windows requirements – Bitlocker policy (GPO)
- ▶ Linux requirements – 7GB RAM, vfat, /etc/fstab

▶ Key vault:

- ▶ Same region as VM
- ▶ Advanced access policy
- ▶ Add a key encryption key (KEK) – optional

▶ Encrypt – PowerShell, CLI, template

Azure Disk Encryption Take-aways

- ▶ Disk encryption options:
 - ▶ Storage – managed vs unmanaged
 - ▶ OS disk – BitLocker, DM-Crypt
- ▶ Managed disk encryption:
 - ▶ Pre-requisites
 - ▶ Process



Create an Azure App Service Web App



Create an Azure App Service Web App

- ▶ Web App Concepts
- ▶ Demonstration: Create an Azure Web App
- ▶ Demonstration: Deploy an Azure Web App



Manage a Web App

Manage a Web App

- + Web App Configuration
- + Platform Configuration
- + Web App Networking
- + Web App Development Support
- + Demo: Manage a Web App

Web App Configuration

- Host dependent – Windows or Linux
- Application settings
- General settings
 - + Stack (.NET Core, Python, Node.JS, etc.)
 - + FTP state
 - + HTTP version
 - + Web sockets
 - + Always on
 - + ARR affinity
 - + Client Certificate

Platform Configuration

- Authentication
- Identity
- Domains
- TLS/SSL
- Scale

Web App Networking

Web App Development Support

- Deployment Slots
- DevOps
 - + Azure DevOps integration
 - + GitHub, Bitbucket, Local Git
 - + Jenkins
 - + Containers
- Canary release support

Demo: Manage a Web App



Azure Container Instance



Azure Container Instance

- ▶ Azure Container Instance Concepts
- ▶ Demonstration: Provision an Azure Container Instance

Azure Container Instance Concepts

▶ Simple container hosting solution

- ▶ Port mapping
- ▶ File share mounting
- ▶ Charged by the second

▶ Use cases

- ▶ Single container solutions
- ▶ Simple services
- ▶ Automation
- ▶ Processes with a short lifetime



Kubernetes Crash Course



Kubernetes Crash Course

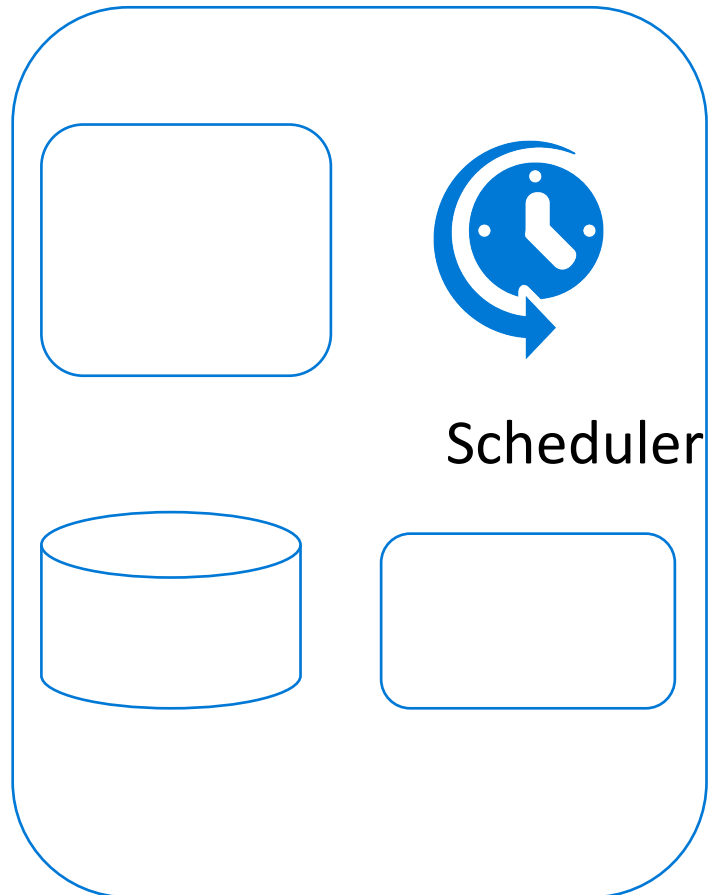
- ▶ What is Kubernetes?
- ▶ Azure Kubernetes Service
- ▶ Azure Kubernetes Components

Azure Kubernetes Service

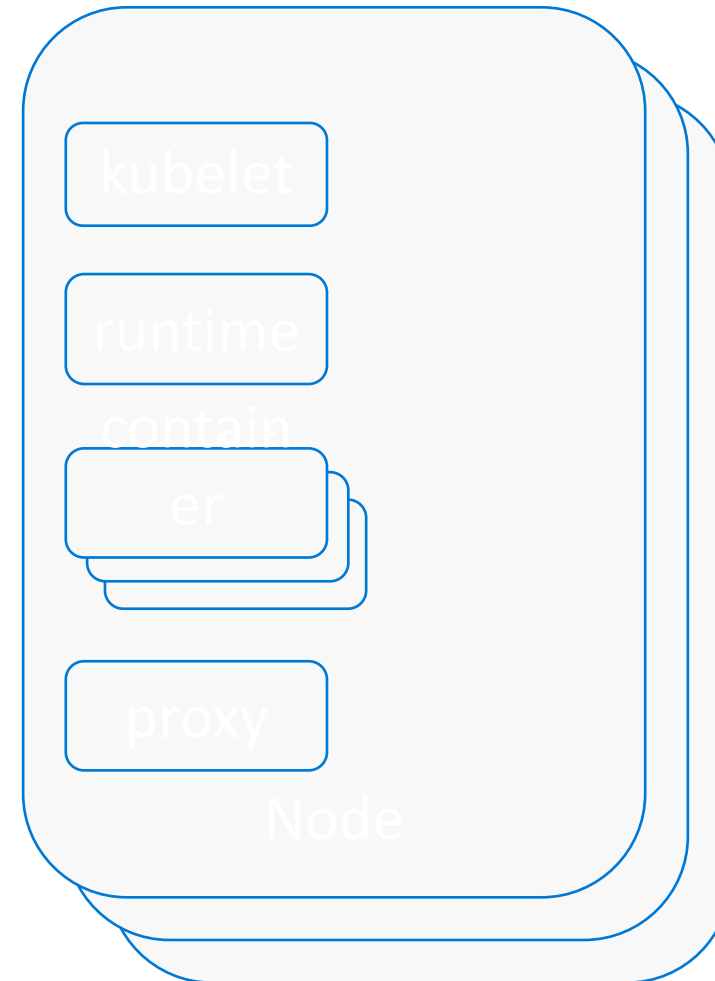
- ▶ Managed Kubernetes cluster
- ▶ Master managed by Azure
- ▶ Infrastructure provisioned and managed by Azure
- ▶ Pay for and manage agent nodes
- ▶ Auto-scale at node and pod level*
- ▶ RBAC security (integrate with Azure AD)
- ▶ Integrated logging
- ▶ Ingress options

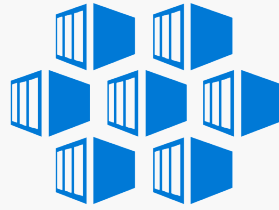
Azure Kubernetes Components

Managed by Azure



Managed by you



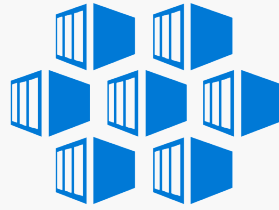


Create an Azure Kubernetes Service



Create an Azure Kubernetes Service

▶ Demonstration: Create an Azure Kubernetes Service



Deploy a Web Site to an Azure Kubernetes Service



Deploy a Web Site to an Azure Kubernetes Service

- ▶ Demonstration: Deploy a Web Site to an Azure Kubernetes Service