



# Azure Administration: Compute Management

Aligned with Microsoft Certification Exam AZ-104

[ine.com](https://ine.com)

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## 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

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# Advanced Virtual Machine Deployment

# Advanced Virtual Machine Deployment

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

# Advanced Virtual Machine Deployment

```
$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-AZVMDataDisk -Name "vm0-datadisk0" -
DiskSizeInGB 10
              -Caching None -Lun 0 -CreateOption Empty |
              Add-AZVMDataDisk -Name "vm0-datadisk1" -
DiskSizeInGB 10
              -Caching None -Lun 1 -CreateOption Empty
```

- + Deploy Multiple NICs
- + Deploy Multiple Disks

# Demo: Deploy Virtual Machines

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# ARM Template Deployment

# ARM Template Deployment

- Repeatabe 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 \* ⓘ

Resource group \* ⓘ   
[Create new](#)

### Instance details

Virtual machine name \* ⓘ

Region \* ⓘ

Availability options ⓘ

Image \* ⓘ   
[Browse all public and private images](#)

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# 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
$vnet = 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": {}}  
  }  
}
```

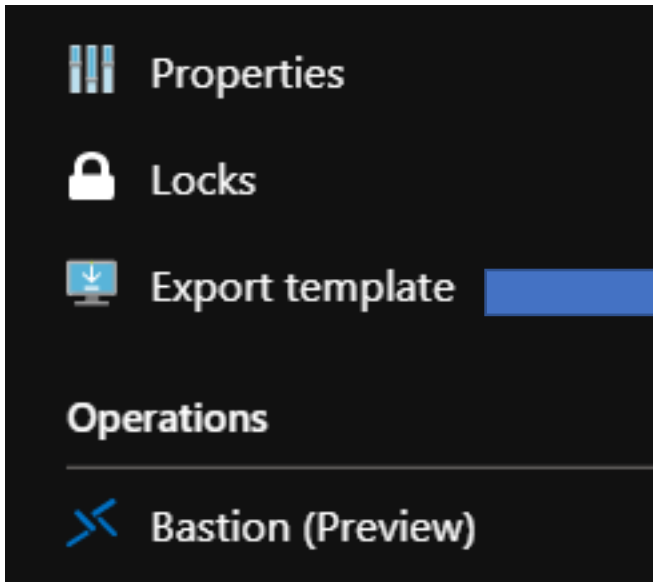
# VHD Template Elements

```
"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/2015-08-19/management.azure.json",
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

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# 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": {
          "lun": "1",
          "name": "datadisk1",
          "caching": "None",
          "writeAcceleratorEnabled": "false",
          "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

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# Virtual Machine Extensions

# Virtual Machine Extensions

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

# Virtual Machine Extensions

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# 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",
                    "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

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# 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





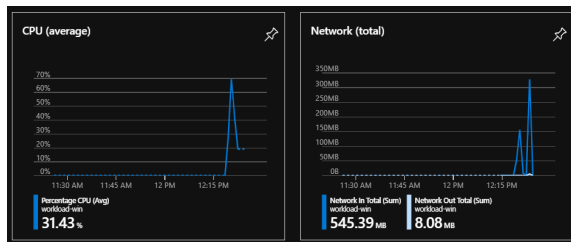
# Manage Virtual Machines

# 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

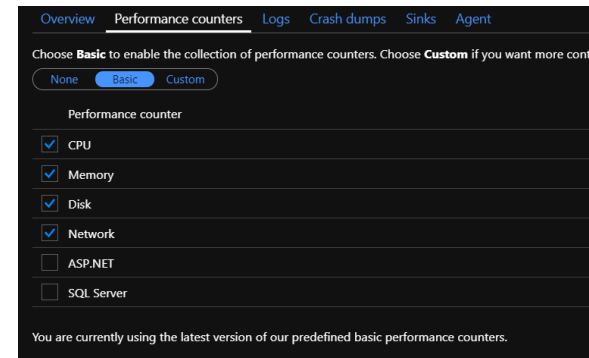
- > Start Virtual Machine
- > Health Event Resolved
- > Health Event Updated

## Boot Diagnostics



```
Updated: Wednesday, October 16, 2019, 4:15:05 PM UTC. Download serial log.
[9:54C][22mC][25mC][27mC][48mC][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>[22][1;38C][20][Hx]ml version="1.0">
<machine-info>
<name>workload-winc</name>
<guid>77767f85-ffe1-4d51-bd91-88bc1034b128c</guid>
<processor-architecture>AMD64</processor-architecture>
<os-version>10.0</os-version>
<os-build-number>17763</os-build-number>
<os-product-id>68958631-6895-6895-6895-6895</os-product-id>
```

## 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

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# 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

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# Azure Disk Encryption

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# Azure Disk Encryption

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- ▶ 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

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# Create an Azure App Service Web App

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- ▶ 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

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# Web App Development Support

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

# Demo: Manage a Web App

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# Azure Container Instance

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# Azure Container Instance

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

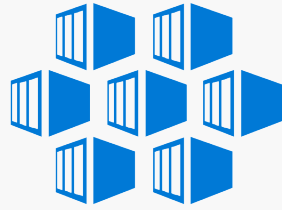
# Azure Container Instance Concepts

## ▷ 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

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# Kubernetes Crash Course

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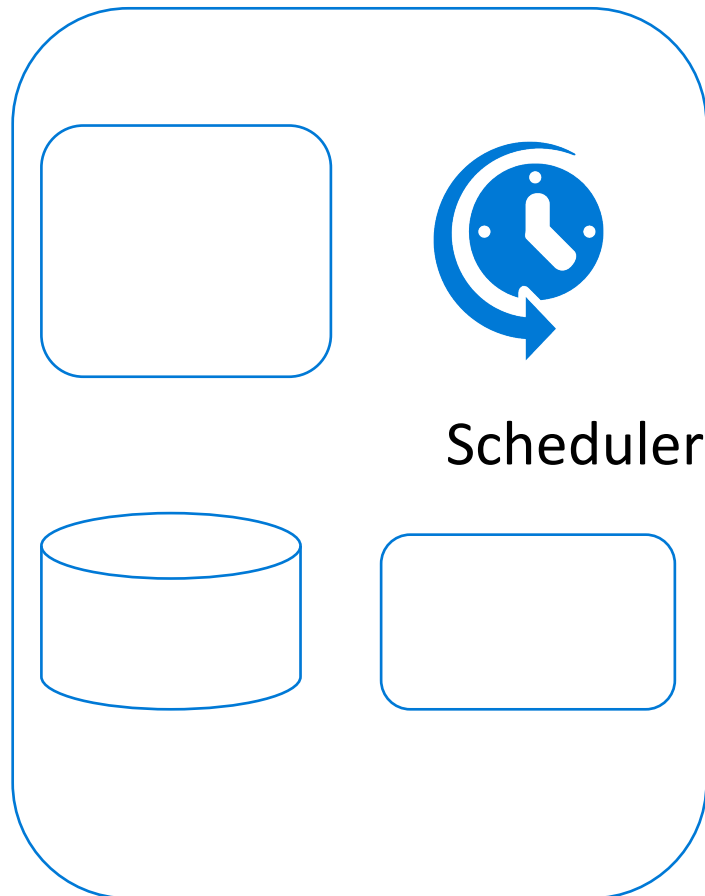
- ▷ What is Kubernetes?
- ▷ Azure Kubernetes Service
- ▷ Azure Kubernetes Components

# Azure Kubernetes Service

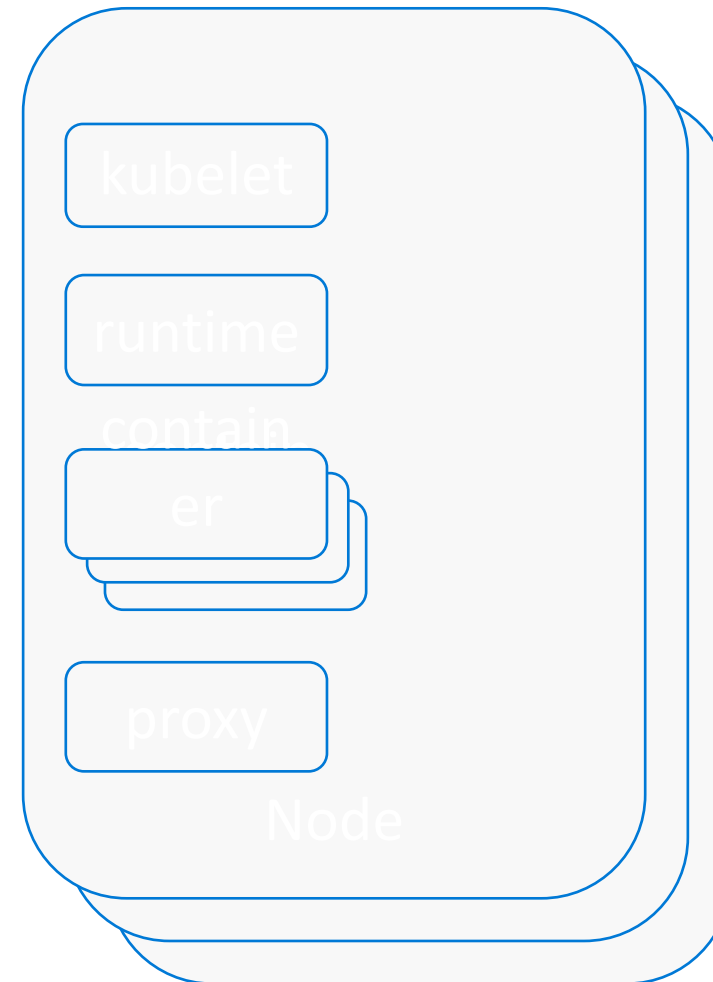
- ▷ Managed Kubernetes cluster
- ▷ Master managed by Azure
- ▷ Infrastructure provisioned and managed by Azure
- ▷ Pay for and manage agent nodes
- ▷ Auto-scale at node and pod level\*
- ▷ RBAC security (integrate with Azure AD)
- ▷ Integrated logging
- ▷ Ingress options

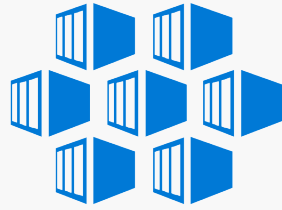
# Azure Kubernetes Components

Managed by Azure



Managed by you





# Create an Azure Kubernetes Service

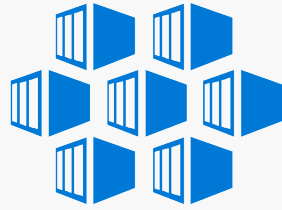
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# Create an Azure Kubernetes Service

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▶ Demonstration: Create an Azure Kubernetes Service



# Deploy a Web Site to an Azure Kubernetes Service

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# Deploy a Web Site to an Azure Kubernetes Service

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