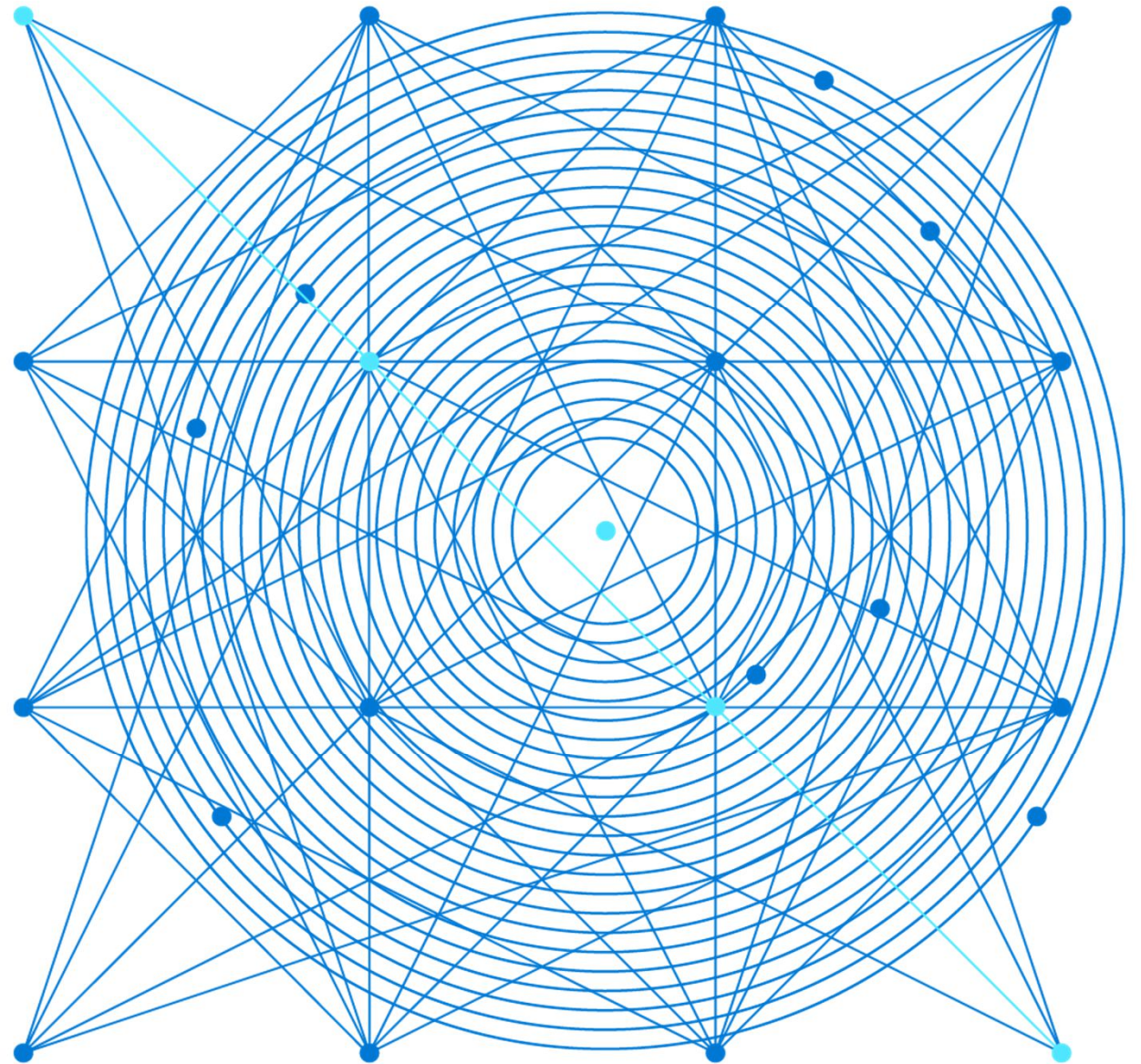


# AZ-303: Microsoft Azure Architect Technologies



# Module 4: Implement VMs for Windows and Linux

Azure Dedicated Hosts, Scale Sets, Disk Encryption, and High Availability

# Learning Objectives

You will learn the following:

- Running Linux and Windows Virtual Machines on Azure
- Select Virtual Machine Size
- Configure High Availability
- Implement Azure Dedicated Hosts
- Deploy and Configure Scale Sets
- Configure Azure Disk Encryption



# Overview: Running Linux and Windows Virtual Machines on Azure

# Checklist for creating an Azure Virtual Machine

Required resources for IaaS Virtual Machines:

- Start with the network
- Name the VM
- Decide the location for the VM
- Determine the size of the VM
- Understanding the pricing model
- Storage for the VM
- Select an operating system



# Start with the Network

## Segregate the network

- Create one or more subnets

## Secure the network

- Create and assign Network Security Groups (NSGs)

## Plan each VM deployment



# Naming the VM (1 of 2)

Naming convention considerations:

- The VM name is configured as part of the operating system.
- This name defines a manageable Azure resource—not trivial to change later.

Recommended naming conventions include the following:

| Element            | Example                    | Notes   |
|--------------------|----------------------------|---|
| Environment        | dev, prod, QA              | The environment for the resource                        |
| Location           | uw (US West), ue (US East) | The Azure region  |
| Instance           | 01, 02                     | Instance of a resource                                  |
| Product or service | Service                    | Product, application, or service that resource supports |
| Role               | sql, web, messaging        | Role of the resource                                    |

# Naming the VM (2 of 2)

A VM deployment includes several resources:

- The VM itself
- Storage account for the disks
- Virtual network (shared with other VMs and services)
- Network interface to communicate on the network
- Network Security Group(s) to secure network traffic
- Public internet address (optional)





# Decide the Location of the VM

- Azure has datacenters all over the world
- Datacenters are grouped into geographic regions
- Select a region where you want the resources to be allocated



# Determine the Size of the VM (1 of 2)

Azure provides different VM sizes that offer variations of

- Processing power
- Memory
- Storage capacity

Azure provides a wide range of VM size options

- General purpose
- Compute optimized
- Memory optimized
- Storage optimized
- GPU
- High performance compute
- Confidential computing



# Determine the Size of the VM (2 of 2)

| Option                   | Description  |
|--------------------------|--|
| General purpose          | Balanced CPU-to-memory ratio. Ideal for testing and development, small to medium databases, and low to medium traffic web servers. |
| Compute optimized        | High CPU-to-memory ratio. Suitable for medium traffic web servers, network appliances, batch processes, and application servers.   |
| Memory optimized         | High memory-to-CPU ratio. Great for relational database servers, medium to large caches, and in-memory analytics.                  |
| Storage optimized        | High disk throughput and IO. Ideal for VMs running databases.  |
| GPU                      | Heavy graphics rendering and video editing. These VMs are ideal options for model training and inferencing with deep learning.     |
| High performance compute | The fastest and most powerful CPU with optional high-throughput network interfaces.  |
| Confidential compute     | Designed to protect the confidentiality and the integrity of data and code while it's processed in the cloud.                      |



# Virtual Machine Sizes (Windows and Linux)

| Type                     | Sizes   | Description   |
|--------------------------|---|---|
| General purpose          | B, Dsv3, Dv3, Dasv4, Dav4, DSv2, Dv2, Av2, DC, DCv2, Dv4, Dsv4, Ddv4, Ddsv4 | Balanced CPU-to-memory ratio. Ideal for testing and development, small to medium databases, and low to medium traffic web servers.  |
| Compute optimized        | Fsv2  | High CPU-to-memory ratio. Good for medium traffic web servers, network appliances, batch processes, and application servers.  |
| Memory optimized         | Esv3, Ev3, Easv4, Eav4, Ev4, Esv4, Edv4, Edsv4, Mv2, M, DSv2, Dv2           | High memory-to-CPU ratio. Great for relational database servers, medium to large caches, and in-memory analytics.   |
| Storage optimized        | Lsv2  | High disk throughput and IO ideal for Big Data, SQL, NoSQL databases, data warehousing and large transactional databases.   |
| GPU                      | NC, NCv2, NCv3, ND, NDv2 (Preview), NV, NVv3, NVv4                          | Specialized virtual machines targeted for heavy graphic rendering and video editing, as well as model training and inferencing (ND) with deep learning. Available with single or multiple GPUs. |
| High performance compute | HB, HBv2, HC, H   | Our fastest and most powerful CPU virtual machines with optional high-throughput network interfaces (RDMA).   |
| Confidential compute     | DCsv2-Series  | Supports a larger range of deployment capabilities, have 2x the Enclave Page Cache (EPC) and a larger selection of sizes compared to the DC-Series VMs.   |

Virtual Machine by series: <https://azure.microsoft.com/en-us/pricing/details/virtual-machines/series/>

# The Pricing Model

There are two separate costs charged for every VM

- Compute costs
- Storage costs

There are two main payment options for compute costs

- Pay as you go
- Reserved Virtual Machine instances



# Select an Operating System

Azure provides a variety of OS images you can install into the VM, including:

- All currently supported versions of Windows
- All major Linux distributions
- You can search Azure Marketplace for more install images
- You can create your own custom images to create Azure VMs



# Storage for the VM

Each Azure VM has two or more disks:

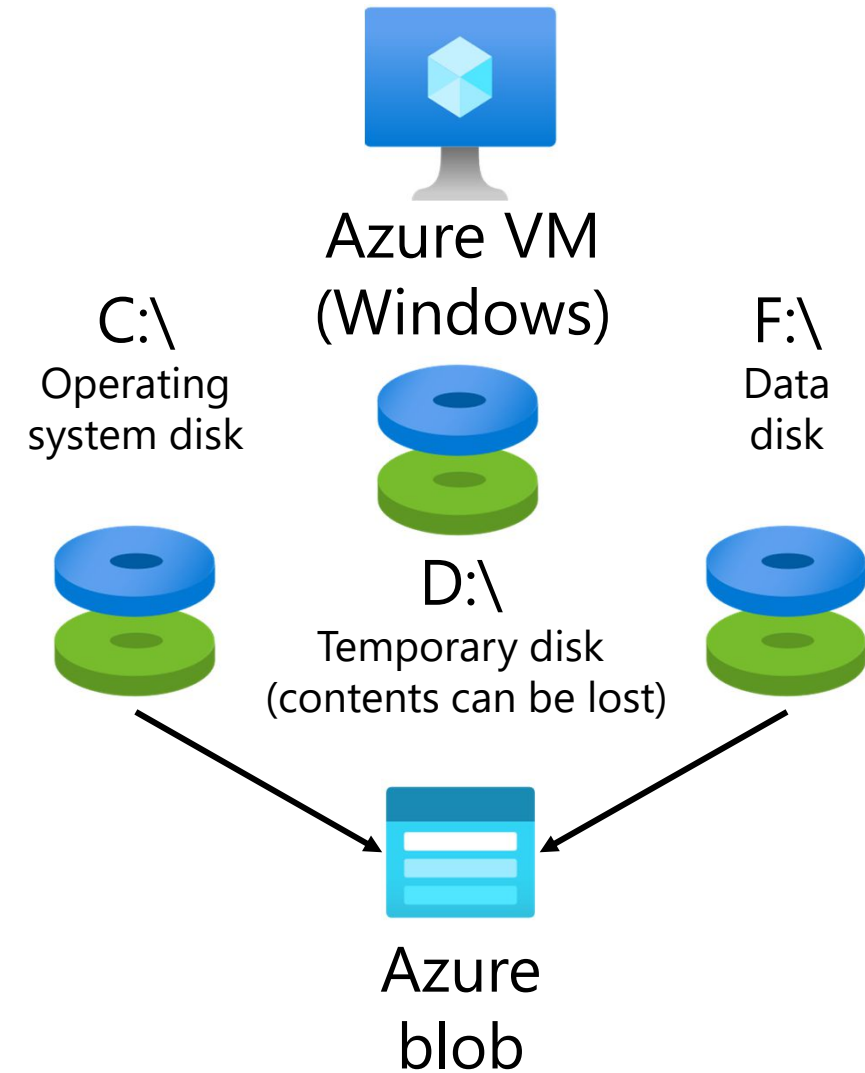
- OS disk
- Temporary disk
- Data disks (optional)

OS and data disks reside in Azure Storage accounts:

- Azure-based storage service
- Standard (HDD, SSD) or Premium (SSD), or Ultra (SSD)

When creating an Azure VM, you can choose between:

- Managed disks (recommended)
- Unmanaged disks



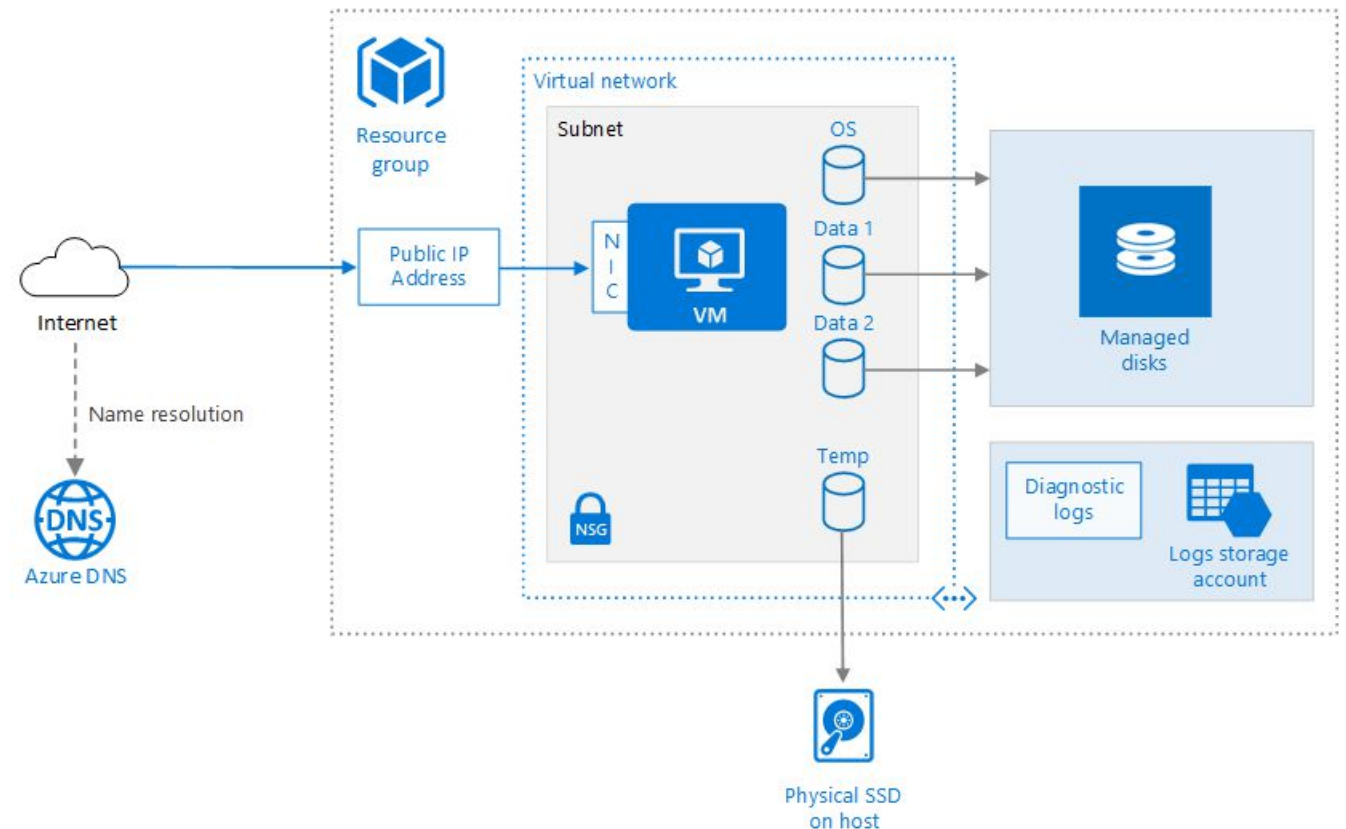
# Running Linux and Windows Virtual Machines on Azure

Azure VM deployments includes other resources

- Networking
- Storage

Place related resources in the same resource group to simplify

- Management
- Cost tracking
- deprovisioning



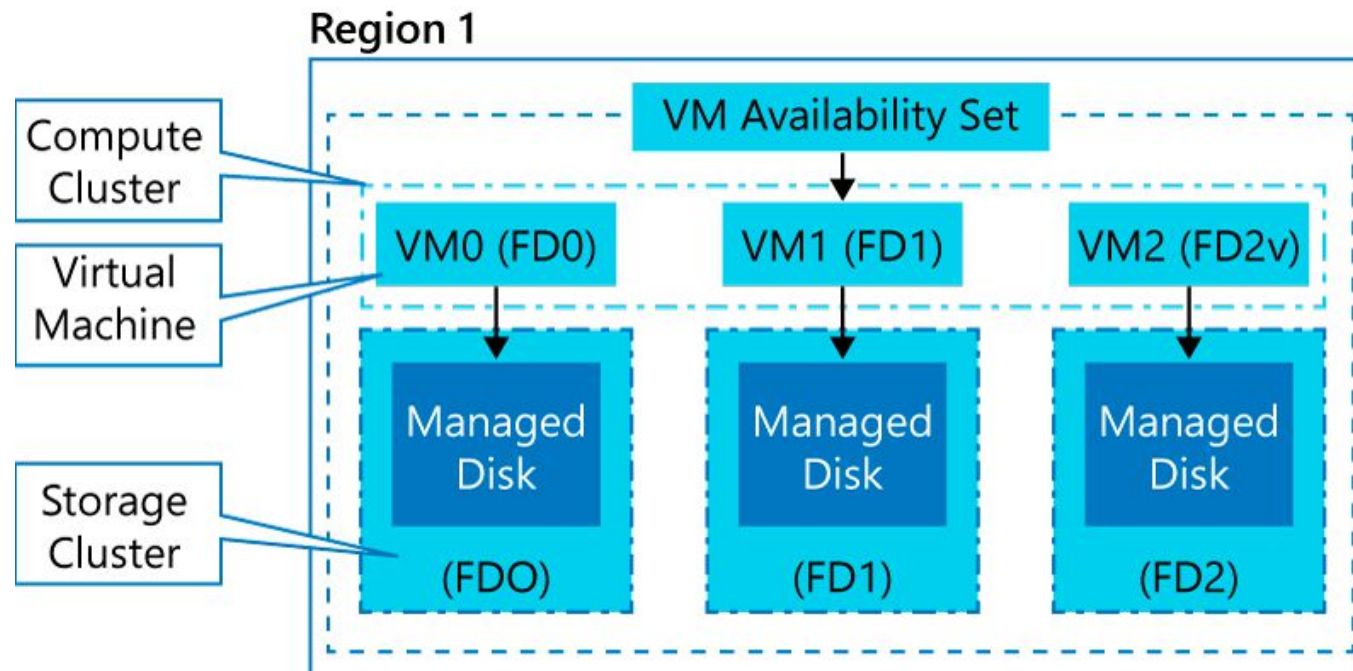


# Configure High Availability

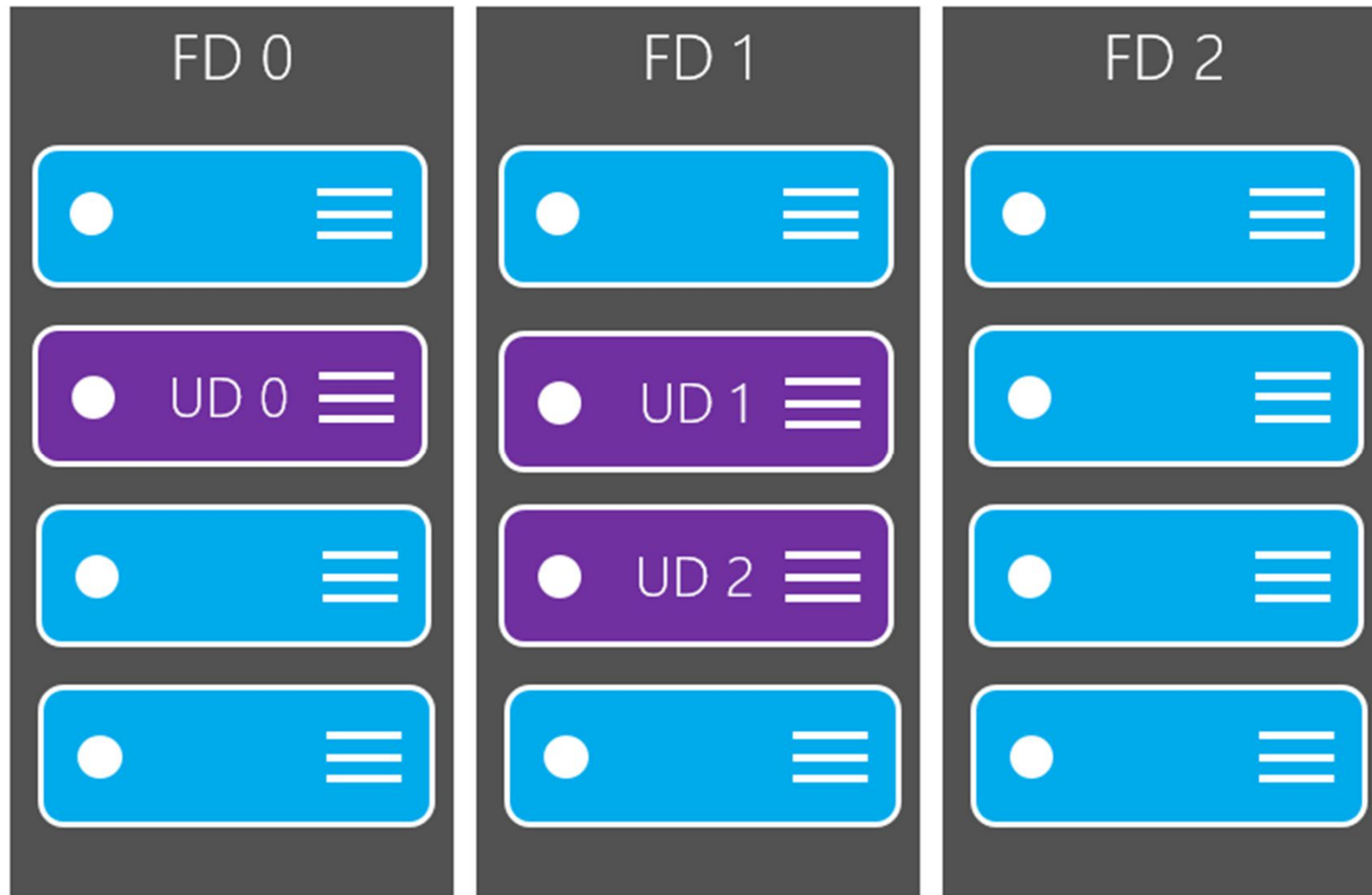
# Availability Sets (1 of 2)

An availability set is a logical grouping of VMs within a datacenter:

- Automatically distributes VMs across fault and update domains on compute clusters
- With managed disks, it provides equivalent resiliency on storage clusters
- Provides 99.95% availability SLA (for 2 or more VMs)



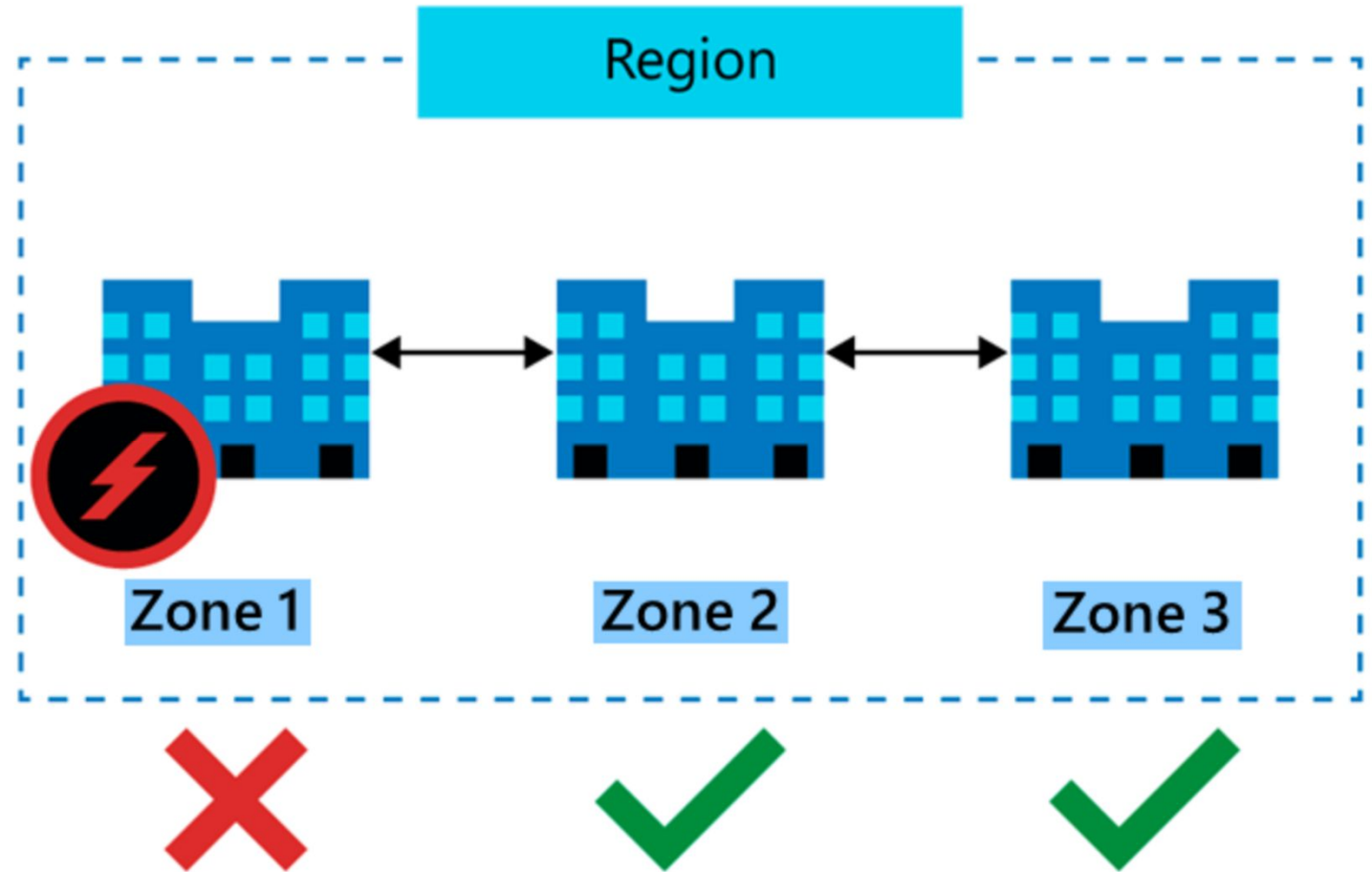
# Availability Sets (2 of 2)



# Availability Zones

## Core concepts:

- Availability zones
- Fault domains
- Update domains



# Virtual Machine Scale Sets

- Consist of identically configured, load balanced VMs
- Support manual, scheduled and automatic scaling
- Automatically distributes VMs across fault domains and update domains

# Deploy and Configure Scale Sets

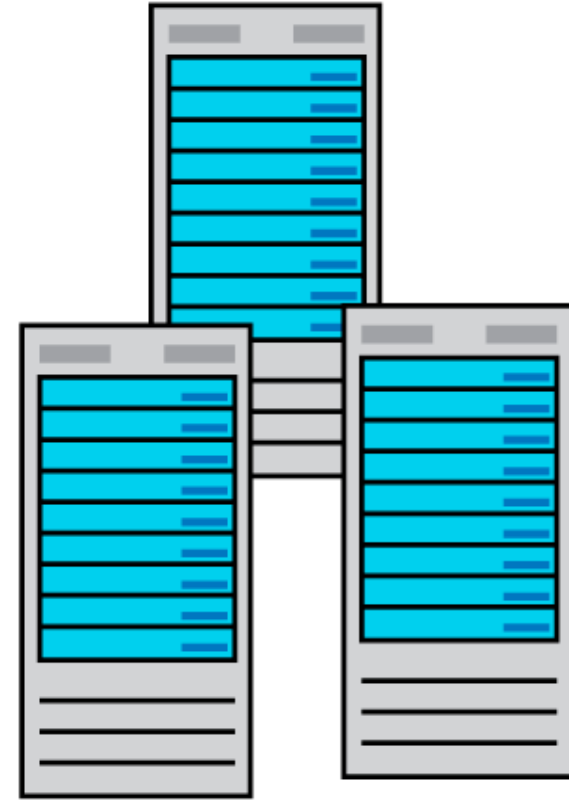
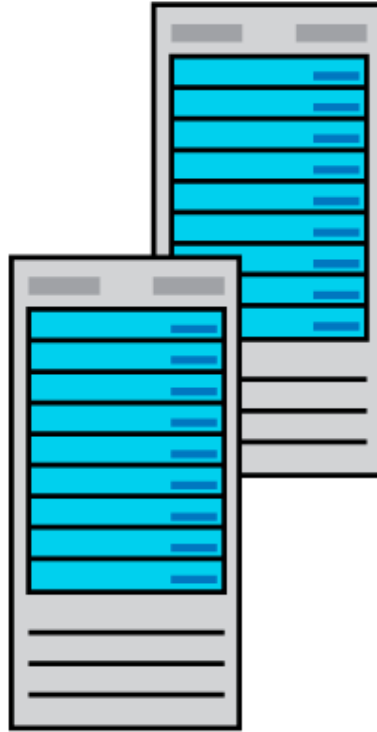
# Scaling Concepts (1 of 2)

## Vertical scaling



# Scaling Concepts (2 of 2)

## Horizontal scaling

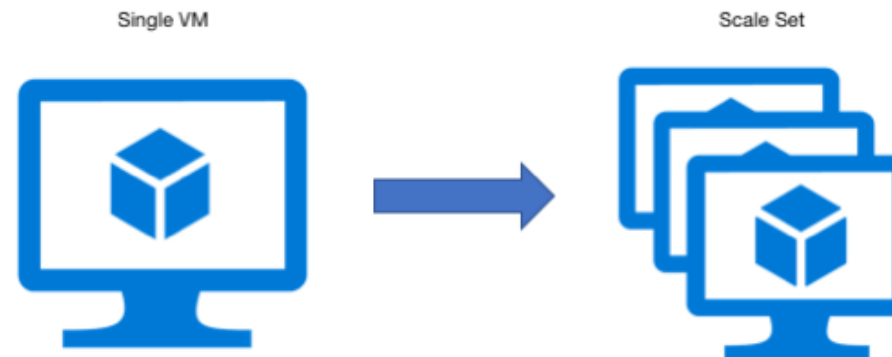




# Scale Sets

## Scale set benefits

- Simplicity: All VM instances are created using the same based OS
- Load balancer support: layer 4 and layer 7
- High availability: multiple instances of the same workload
- Autoscaling: the number of instances adjusts dynamically based on demand
- Scalability: up to 1,000 VM instances (600 when using custom images)



# Implementing Scale Sets

- Initial instance count
- Instance size
- Azure spot instance
- Use managed disks
- Enable scaling beyond 100 instances
- Spreading algorithm

**Instance**

Initial instance count \* ⓘ

Size \* ⓘ **Standard D2s v3**  
2 vcpus, 8 GiB memory (\$85.41/month)  
[Change size](#)

Azure Spot instance ⓘ ☐ Yes ☒ No

Use managed disks ⓘ ☐ No ☒ Yes

**Allocation policy**

Enable scaling beyond 100 instances ⓘ ☒ No ☐ Yes

Spreading algorithm ⓘ ☐ Max spreading ☒ Fixed spreading (not recommended with zones)



# Create a VM Scale Set in the Azure Portal

- Create a public load balancer
- Create virtual machine scale set

Home > Virtual machine scale sets > Create a virtual machine scale set

## Create a virtual machine scale set

[Basics](#) [Instance](#) [Disks](#) [Networking](#) [Scaling](#) [Management](#) [Health](#) [Advanced](#) [Tags](#) [Review + create](#)

Azure virtual machine scale sets let you create and manage a group of load balanced VMs. The number of VM instances can automatically increase or decrease in response to demand or a defined schedule. Scale sets provide high availability to your applications, and allow you to centrally manage, configure, and update a large number of VMs.  
[Learn more about virtual machine scale sets](#)

### 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 scale set name \*

Region \*

Availability zone ⓘ

Orchestrator \* ⓘ ☐ ☒

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

Size \* ⓘ **Standard D2s v3**  
2 vcpus, 8 GiB memory  
[Change size](#)

### Administrator account

Authentication type ⓘ ☐ ☒

Username \* ⓘ

SSH public key \* ⓘ

[Review + create](#) [< Previous](#) [Next : Instance >](#)

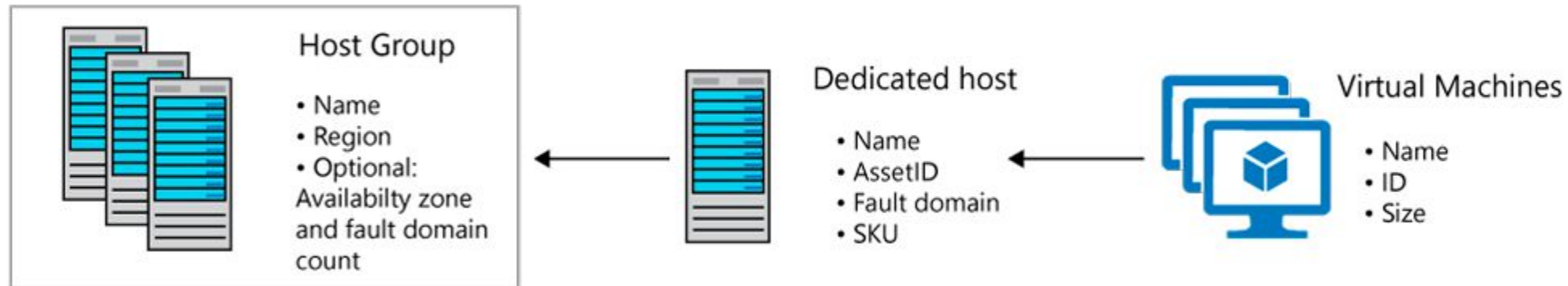


# Implement Azure VM Dedicated Hosts

# Azure Dedicated Hosts

## Benefits:

- Implement hardware isolation at the physical server level
- Control impact of maintenance events initiated by the Azure platform



# High Availability Considerations

## Use Availability Zones for fault isolation

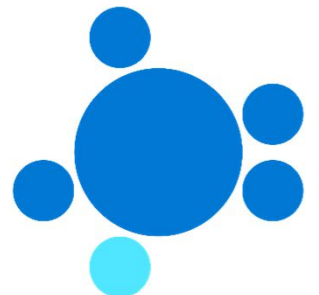
- Create one host group per zone

## Use Fault Domains for fault isolation

- Assign a fault domain for each host in the same host group

## Use Availability Zones and Fault Domains

- Create one host group per zone
- Assign a fault domain for each host in the same host group



# Azure Dedicated Hosts Capacity

## Quotas

- Limit vCPUs for dedicated hosts per region
- Support quota increase

## Pricing

- Per dedicated host (regardless of the number of deployed VMs)
- Based on VM family, type, and region

Home > Subscriptions > Pay-As-You-Go - Usage + quotas

**Pay-As-You-Go - Usage + quotas**

Search (Ctrl+/) Refresh

You can use each Microsoft Azure resource up to its quota. Each subscription has separate quotas and usage is tracked per subscription. If you reach a quota cap, you can request an increase via Help + Support. [Learn more](#) [Request Increase](#)

All service quotas Microsoft.Compute East US Show all

dsv3

| QUOTA                      | PROVIDER          | LOCATION | USAGE       |
|----------------------------|-------------------|----------|-------------|
| Standard DSv3 Family vCPUs | Microsoft.Compute | East US  | 0 % 0 of 10 |

# Deploy VMs to Dedicated Hosts

## Limitations:

- Virtual machine scale sets are supported on dedicated hosts
- The sizes and hardware types available for dedicated hosts vary by region

## To deploy highly available VMs to dedicated hosts:

- Create one or more host groups
- Create one or more hosts in each group
- Create a VM on each host

**Host**  
Optionally placing your virtual machine in a host [Learn more](#)

Host group ⓘ

myHostGroup | Zone 1 | eastus ▼

Host ⓘ

myHost ▼



# Configure Azure Disk Encryption

# Azure Encryption Technologies

Two main encryption-based disk protection methods Azure VMs

- Storage Service Encryption (SSE)
- Azure Disk Encryption (ADE)

## Storage Service Encryption (SSE)

- enabled for all new and existing storage accounts
- cannot be disabled

## Azure Disk Encryption (ADE)

- managed by the VM owner
- uses **BitLocker** on Windows VMs and **DM-Crypt** on Linux VMs
- stores encryption keys in Azure Key Vault

# Deciding When to use Encryption

- Disk encryption methods are complementary
  - Storage Service Encryption (SSE) is part of Azure (mandatory)
  - Azure Disk Encryption (ADE) makes use of OS tools (optional)
- Using both provides a defense-in-depth protection

# Encrypt an Existing VM Disk

## Azure Disk Encryption prerequisites:

- An Azure key vault
- A key vault access policy that enables support for disk encryption
- ADE encryption keys stored in the key vault

## To encrypt an existing VM disk, use:

- Azure PowerShell
- Azure CLI

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 ⓘ

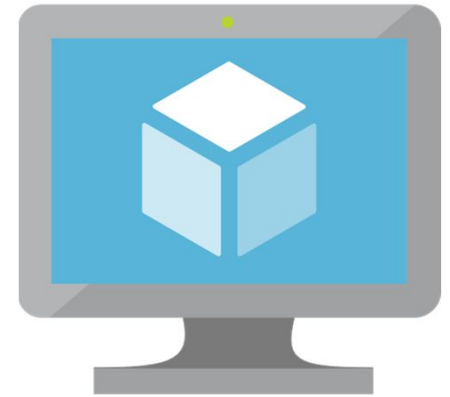
☐ Enable access to Azure Resource Manager for template deployment ⓘ

☒ Enable access to Azure Disk Encryption for volume encryption ⓘ

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+ Add new ...

# Module Review Questions



# Online Role-based training resources:

Microsoft Learn

<https://docs.microsoft.com/en-us/learn/>

Thank you.