

# Module 3

Implementing Microsoft Azure  
Virtual Machines and virtual  
machine scale sets

# Module Overview

- Overview of Virtual Machines and virtual machine scale sets
- Planning deployment of Virtual Machines and virtual machine scale sets
- Deploying Virtual Machine and virtual machine scale sets

# Lesson 1: Overview of Virtual Machines and virtual machine scale sets

- Demonstration: Preparing the lab environment
- What are Virtual Machines?
- What are virtual machine scale sets?

# Demonstration: Preparing the lab environment

In this demonstration, you will learn how to prepare the lab environment

**Note:** To prepare the lab environment for this module, you must complete these tasks

# What are Virtual Machines?

- Virtual machine sizes:
  - Basic tier (development and test workloads):
    - Five sizes: A0 to A4
  - Standard tier (production workloads):
    - Multiple series: A, Av2, B, D, Dv2, Dv3, DS, DSv2, DSv3, Ev3, ESv3, F, Fs, Fsv2, G, GS, H, Ls, M, NC, NV, NCv2, NCv3, and ND
    - 90+ sizes with up to 128 vCPUs, 3800 GB of RAM, and 64 disks
- Virtual machine disks:
  - Size limit: 2 TB (operating system) and 4 TB (data)
  - Performance limit:
    - Standard. 60 MBps or 500 8-KB IOPS per disk
    - Premium. 250 MBps or 7500 256-KB IOPS per disk
  - Disk type and format: .vhd fixed only
- Virtual machine generations: Generation 1 only

# What are virtual machine scale sets?

- A collection of identically configured VMs:
  - Up to 1,000 when using Marketplace image and managed disks
    - Requires setting **singlePlacementGroup** to **False**
  - Up to 300 when using custom image and managed disks
    - Requires setting **singlePlacementGroup** to **False**
  - Up to 100 when using Marketplace image and unmanaged disks
  - Up to 20 when using custom image and unmanaged disks
    - You can increase this number to 40 if you disable overprovisioning
- Deploys into a single subnet and an availability set
- Integrates with Azure load balancers:
  - Basic Azure Load Balancer – layer 4, up to 100 VMs
  - Standard Azure Load Balancer – layer 4, up to 1,000 VMs
  - Azure Application Gateway – layer 7, up to 1,000 VMs
- Supports manual and automatic horizontal scaling

## Lesson 2: Planning deployment of Virtual Machines and virtual machine scale sets

- Identifying workloads for Virtual Machines and virtual machine scale sets
- Virtual Machines and virtual machine scale set sizing
- Virtual Machine and virtual machine scale set availability and scalability
- Virtual Machines and virtual machine scale set storage
- Overview of unmanaged and managed disks
- Demonstration: Creating an availability set by using the Azure portal

# Identifying workloads for Virtual Machines and virtual machine scale sets

- Virtual Machine support:
  - Windows Server:
    - All currently supported versions (CSA required for older ones)
    - All roles and features, except:
      - DHCP, Direct Access, RMS, Windows DS
      - iSNS, MPIO, NLB, PNRP, SNMP, Storage Manager for SANs, WINS, Wireless LAN Service
  - Linux distributions:
    - CentOS, CoreOS, Debian, Oracle Linux, Red Hat, SUSE, openSUSE, and Ubuntu
  - Windows Server software:
    - FIM, MIM, SharePoint Server, SQL Server, System Center, and more
- Virtual machine scale sets support:
  - Stateless, auto-scaling workloads (big data, big compute, containers)



# Virtual Machines and virtual machine scale set sizing

- General purpose:
  - Balanced CPU-to-memory ratio (A0-A7, Av2, D, Dv2, Dv3, DS, DSv2, Dsv3 series)
- Burstable:
  - Throttled CPU performance with credit-based CPU burst allocation (B series)
- Compute optimized:
  - High CPU-to-memory ratio (F, Fs, and Fsv2 series)
- Memory optimized:
  - High memory-to-CPU ratio (D, Dv2, DS, DSv2, Ev3, Esv3, M, G, and GS series)
- Storage optimized:
  - High-performance disk I/O (Ls series)
- GPU:
  - Graphic Processing Unit support (NC, NCv2, NCv3, ND, and NV series)
- High performance compute:
  - Fastest CPUs and optional high-throughput RDMA (H series and A8-A11)

# Virtual Machine and virtual machine scale set availability and scalability

- Azure VMs in an availability zone:
  - 99.99% availability SLA
  - Logical grouping of two or more standalone Azure VMs, Azure VMs in availability sets, or Azure VM scale sets in the same virtual network
  - Must be assigned during Azure VM or Azure VM scale set deployment
  - Supports Standard Azure Load Balancer or Web Application Gateway
- Azure VMs in an availability set:
  - 99.95% availability SLA
  - Logical grouping of two or more Azure VMs in the same subnet
  - Must be assigned during Azure VM deployment
  - Up to 3 fault domains and up to 20 update domains
  - Supports Azure Load Balancer (Standard and Basic) and Web Application Gateway
- Standalone VMs:
  - 99.9% availability SLA if using Premium storage disks

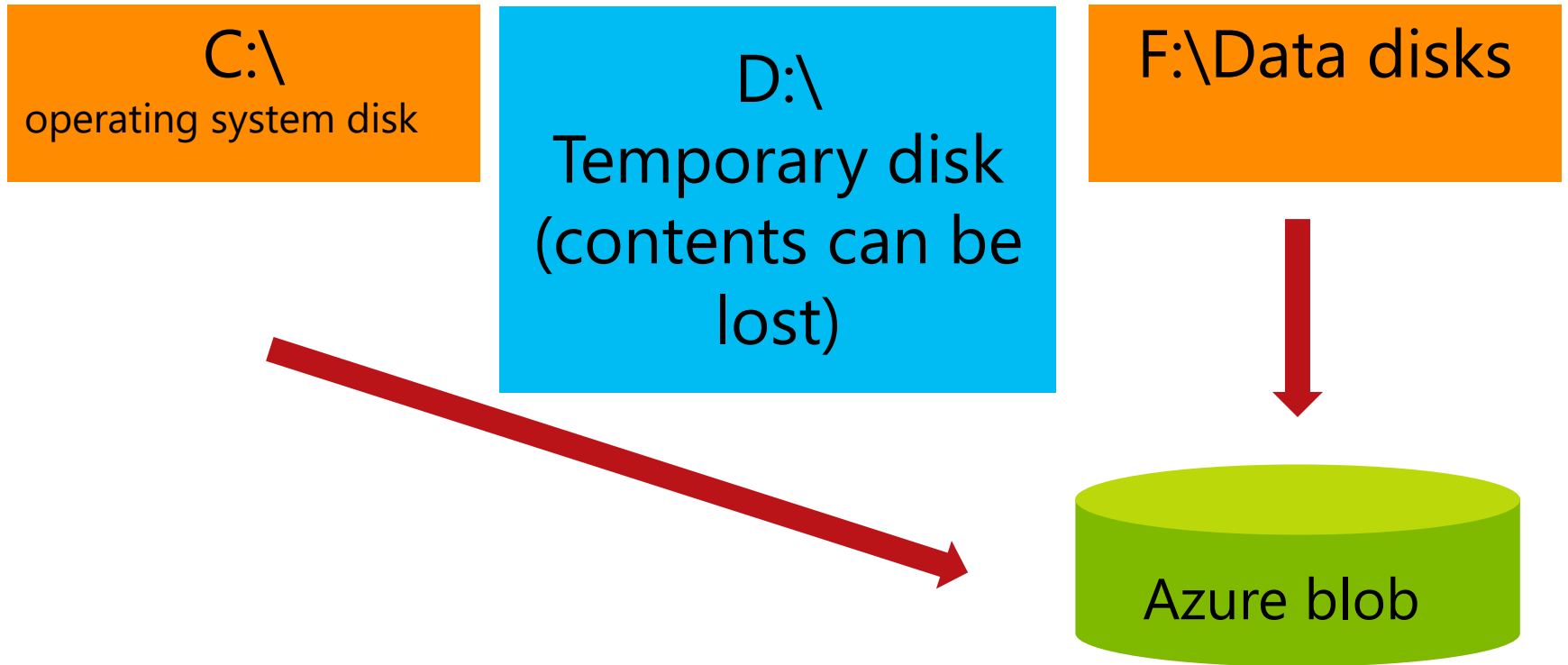
# Virtual machine scale set availability and scalability

## Virtual machine scale sets:

- One or more placement group with up to 100 VMs each
- Up to 5 fault domains and up to 5 update domains
- Support scaling:
  - On-demand
  - Scheduled
  - Automatic (performance base):
    - Based on host metrics
    - Based on guest OS metrics (requires Virtual Machine diagnostics extension)

# Virtual Machines and virtual machine scale set storage

## Virtual Machine



# Overview of unmanaged and managed disks

- Unmanaged disks:
  - Up to 250 storage accounts per subscription
  - Up to 40 disks per Standard storage account
  - Storage accounts for VMs in the same availability set might be in the same storage stamp
  - A custom image must be in the same storage account as VM disks
- Managed disks:
  - Up to 10,000 disks per region per disk type
  - Storage account performance limits not relevant
  - Disks of VMs in the same availability set in different stamps
  - A custom image must be in the same region as VM disks

# Demonstration: Creating an availability set by using the Azure portal

In this demonstration, you will see how to create an availability set by using the Azure portal

## Lesson 3: Deploying Virtual Machine and virtual machine scale sets

- Determining the Virtual Machine and virtual machine scale set deployment method
- Using the Azure portal to create Virtual Machines and virtual machine scale sets
- Using Azure PowerShell to create Virtual Machines and virtual machine scale sets
- Using Azure CLI to create a Virtual Machine and virtual machine scale set
- Creating Virtual Machines and virtual machine scale sets by using deployment templates
- Demonstration: Creating a Virtual Machine and virtual machine scale set by using the Azure portal

# Determining the Virtual Machine and virtual machine scale set deployment method

- Tools for deploying Azure VMs and Azure VM scale sets:
  - Azure portal
  - Azure PowerShell
  - Azure CLI
  - Azure Resource Manager templates
- Create Azure VMs and Azure VM scale set from:
  - Azure Marketplace images
  - Custom images
    - Managed
    - Unmanaged



# Using the Azure portal to create Virtual Machines and virtual machine scale sets

## Azure VM deployment:

- VM name
- VM disk type (HDD or SSD)
- User name and either password or SSH public key (Linux)
- Subscription
- Resource group
- Location
- VM size
- High availability (availability zone or availability set)
- Storage (managed or unmanaged disks)
- Virtual network and subnet
- Public IP address
- Network security group (allow inbound TCP 3389 for Windows and TCP 22 for Linux)
- Extensions
- Monitoring (boot and OS diagnostics)
- Auto-shutdown and Backup

# Creating virtual machine scale sets by using the Azure portal

## Virtual machine scale set deployment:

- Virtual machine scale set name
- Operating system disk image (Windows or Linux)
- Subscription
- Resource group
- Location
- Availability zone
- User name and either password or SSH public key (Linux)
- Instance count
- Instance size
- Enable scaling beyond 100 instances
- Use managed disks
- Public IP address name, allocation method, and domain name label
- Autoscale

# Using Azure PowerShell to create Virtual Machines and virtual machine scale sets

- Virtual Machine Marketplace image–based deployment
  1. Authenticate and select the target subscription
  2. Create a resource group
  3. Create a virtual network and a subnet
  4. Create a public IP address
  5. Create a network adapter
  6. Create a NSG and associate it with the subnet
  7. Set admin credentials for the OS
  8. Assign the OS to the VM configuration
  9. Assign the image to the VM configuration
  10. Add the OS settings to the VM configuration
  11. Add the network adapter to the VM configuration
  12. Create the VM
- Virtual Machine custom image–based deployment

# Creating virtual machine scale sets by using Azure PowerShell

## Virtual machine scale set Marketplace image–based deployment

1. Authenticate and select the target subscription
2. Create a resource group
3. Create a virtual network and a subnet
4. Create a public IP address
5. Create and configure an Azure load balancer
6. Define the IP configuration of the virtual machine scale set
7. Create the virtual machine scale set:
  - a. `New-AzureRmVmssConfig`
  - b. `New-AzureRmVmssStorageProfile`
  - c. `New-AzureRmVmssOsProfile`
  - d. `New-AzureRmVmssNetworkInterfaceConfiguration`

# Using Azure CLI to create a Virtual Machine and virtual machine scale set

## Virtual Machine deployment:

- Quick start

```
az login
az account set --subscription <subscription name>
az group create --name <resource group name> \
               --location <Azure region>
az vm create --resource-group <resource group name> \
            --name <VM name> \
            --image <Azure Marketplace image> \
            --admin-username <user name> \
            --generate-ssh-keys
```

- Complete deployment
- Custom image-based deployment

# Creating virtual machine scale sets by using the Azure CLI 2.0

## Virtual Machine scale set deployment:

- Quick start

```
az login
az account set --subscription <subscription name>
az group create --name <resource group name> \
               --location <Azure region>
az vmss create --resource-group <resource group name> \
              --name <VM name> \
              --image <Azure Marketplace image> \
              --admin-username <user name> \
              --generate-ssh-keys
```

- Complete deployment

# Creating Virtual Machines and virtual machine scale sets by using deployment templates

Azure VM deployment template:

```
{
  "apiVersion": "2017-12-01",
  "type": "Microsoft.Compute/virtualMachines",
  "name": "vm0",
  "location": "[resourceGroup().location]",
  "properties": {
    "hardwareProfile": {
    },
    "osProfile": {
    },
    "storageProfile": {
    },
    "networkProfile": {
    },
  }
}
```

# Creating virtual machine scale sets by using deployment templates

Virtual machine scale set deployment template:

```
{
  "apiVersion": "2017-12-01",
  "type":
"Microsoft.Compute/virtualMachineScaleSets",
  "name": "vmss0",
  "location": "[resourceGroup().location]",
  "properties": {
    "virtualMachineProfile": {
      "storageProfile": {
      },
    },
    "osProfile": {
    },
    "networkProfile": {
    },
  },
}
```



# Demonstration: Creating a Virtual Machine and virtual machine scale set by using the Azure portal

In this demonstration, you will see how to create a Virtual Machine and a virtual machine scale set from a Marketplace image by using the Azure portal

# Lab: Deploying Virtual Machines

- Exercise 1: Creating Virtual Machines by using the Azure portal, Azure PowerShell, and Azure CLI
- Exercise 2: Validating Virtual Machine deployment
- Exercise 3: Using Visual Studio and an Azure Resource Manager template to deploy Virtual Machines
- Exercise 4: Using Azure PowerShell and an Azure Resource Manager template to deploy Virtual Machines
- Exercise 5: Using Azure CLI and an Azure Resource Manager template to deploy Virtual Machines

## Logon Information

Virtual machine: **20533E-MIA-CL1**

User name: **Student**

Password: **Pa55w.rd**

Estimated Time: 40 minutes

# Lab Scenario

As part of the planning for deployment of Virtual Machines to Azure, Adatum Corporation has evaluated its deployment options. You must use the Azure portal and Azure PowerShell to deploy two Microsoft Virtual Machines for the database tier of the Research and Development application. To facilitate resource tracking, you should ensure that the virtual machines are part of the same resource group. Both VMs should be part of the same availability set.

You must use an Azure Resource Manager template to deploy two additional Linux VMs and two additional Windows VMs that the ResDev application will use. The virtual machines should be part of the resource group, to facilitate resource tracking. Linux virtual machines should reside on the virtual networks' app subnet, and Windows virtual machines should reside on the web subnet of the **20533E0301-LabVNet** virtual network.

# Lab Review

- What differences regarding Virtual Machine storage did you notice when you created a virtual machine in the Azure portal versus in Azure PowerShell?
- Can Microsoft Visual Studio and Azure PowerShell use the same Azure Resource Manager template to deploy a Virtual Machine?
- How would you configure an Azure Resource Manager template to deploy multiple Virtual Machines with different configurations?

# Module Review and Takeaways

- Review Questions
- Best Practices