Module 3

Implementing virtual machines

Module Overview

- Overview of Azure Resource Manager virtual machines
- Planning for Azure Virtual Machines
- Deploying Azure Resource Manager virtual machines
- Authoring Azure Resource Manager templates
- Overview of classic virtual machines

Lesson 1: Overview of Azure Resource Manager virtual machines

- Demonstration: Preparing the environment for the lab and demos in this module
- What are Azure virtual machines?
- Comparing classic and Azure Resource Manager virtual machines

Demonstration: Preparing the environment for the lab and demos in this module

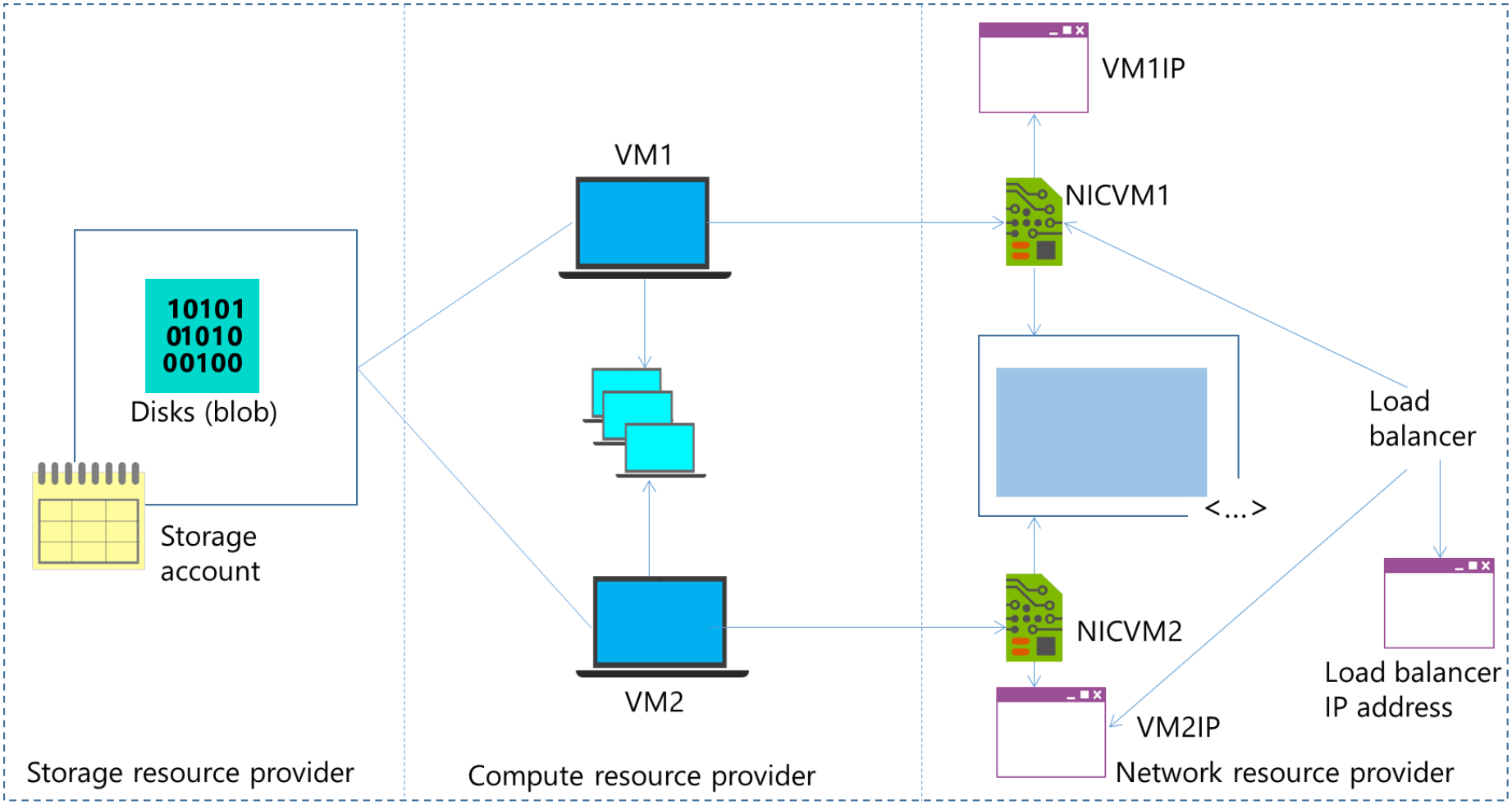
To prepare the demonstration and lab environment for this module, you must:

1. Launch Windows PowerShell as an administrator
2. Run the **Setup-Azure** command
3. Specify the module number, and confirm your selection

What are Azure virtual machines?

- Virtual machine sizes:
  - Basic tier (development and test workloads):
    - Five sizes: A0 to A4
  - Standard tier (production workloads):
    - Multiple series: A, Av2, D, Dv2, DS, DSv2, F, Fs, G, GS, NV, NC
    - 70+ sizes with up to 32 cores, 448 GB of RAM, and 64 disks
- Virtual machine disks:
  - Size limit: 1TB
  - Performance limit:
    - Standard. 60 MBps or 500 8KB IOPS per disk
    - Premium. 200 MBps or 5000 256 KB IOPS per disk
  - Disk type and format: .vhd fixed only
- Virtual machine generations: Generation 1 only

Comparing classic and Azure Resource Manager virtual machines



Lesson 2: Planning for Azure Virtual Machines

- Identifying workloads for Azure Virtual Machines
- Virtual machine sizing
- Migrating workloads to Azure
- Evaluating the use of Azure containers

Identifying workloads for Azure Virtual Machines

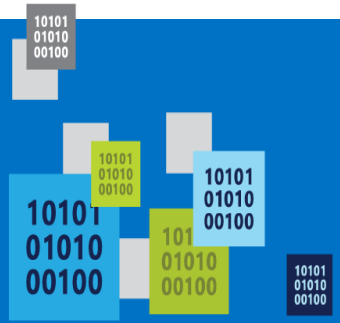
- Azure virtual machines support:
  - Windows Server:
    - All currently supported versions (CSA required for older ones)
    - All roles and features, except:
      - DHCP, Hyper-V, Direct Access, RMS, Windows DS
      - iSNS, MPIO, NLB, PNRP, SNMP, Storage Manager for SANs, WINS, Wireless LAN Service
  - Linux:
    - CentOS, CoreOS, Debian, Oracle Linux, Red Hat, SUSE, openSUSE, Ubuntu
  - Windows Server software:
    - FIM, MIM, SharePoint Server, SQL Server, System Center, and more

Virtual machine sizing

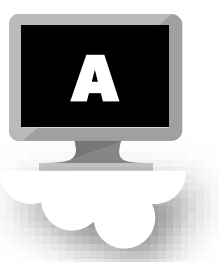
- Azure virtual machine sizing:
  - A-series: General-purpose compute
  - A-series with compute-intensive instances
  - D-series: Local SSD storage
  - Dv2-series: 35 percent faster CPU (compared with the D-series)
  - F-series: Lower-priced compute (comparable to Dv2-series)
  - G-series: Largest virtual machine sizes (up to 448GB of memory, 64 disks)
  - DS, DSv2, Fs, and GS:
    - CPU, RAM, and number of disks are equivalent to D, Dv2, F, and G
    - Support for Premium Storage
  - N-series: NVIDIA GPU for graphics-intensive workloads
- In migration scenarios, use Microsoft Azure (IaaS) Cost Estimator tool

Virtual Machine Sizess

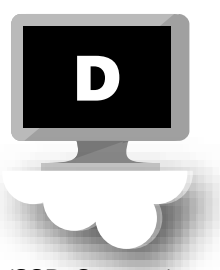
- General Purpose compute: **Basic**
- General Purpose compute: **Standard**
- Optimized Compute
- Performance Optimized
- Network Optimized



Scale-up options



Highest value



SSD storage

Faster CPUs

35% faster than D

Intel E5-2673 v3 CPUs

Most memory

fastest CPUs

NVIDIA GPUs

Remote visualization

Compute-intensive + RDMA

Largest virtual machines
Fastest storage in the public cloud

The G family

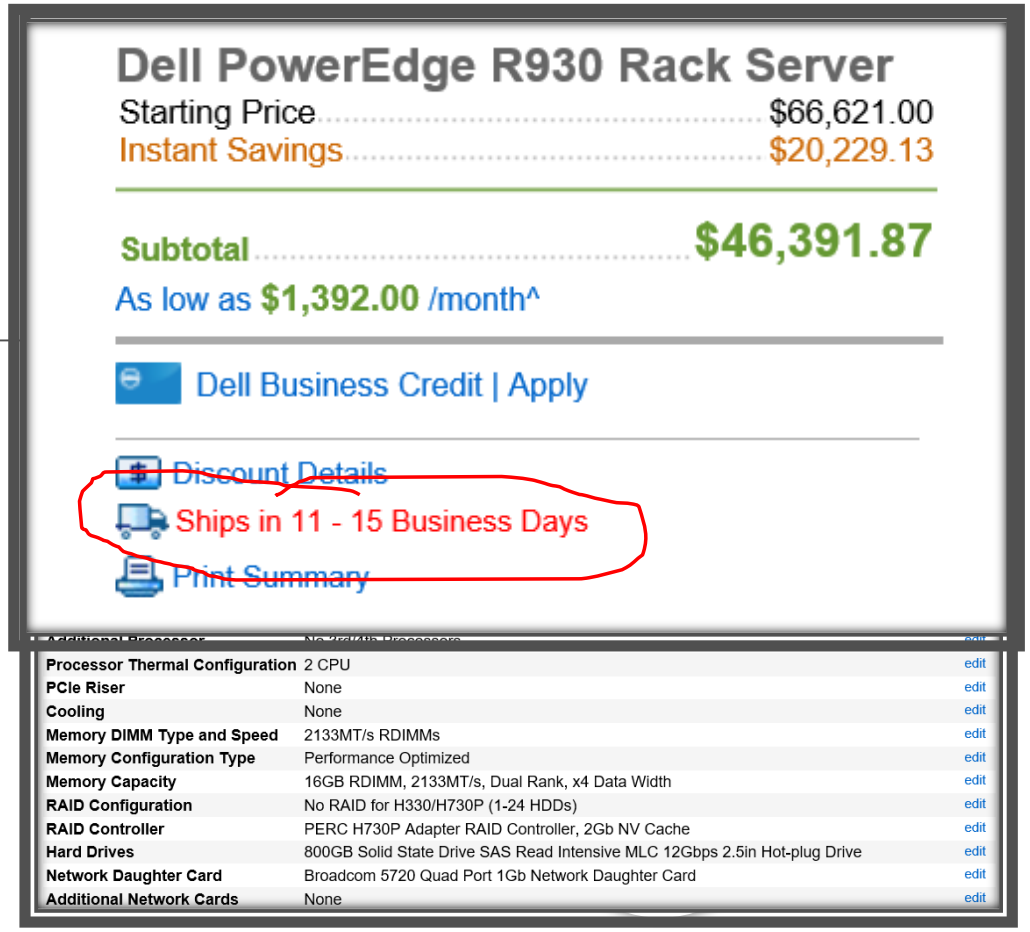
Optimized for data workloads

Up to 32 CPU cores, 448 GB RAM

6.5 TB local SSD

Latest generation Intel processor

Up to 64 attached disks!!



General Purpose Compute

Microsoft Azure

Basic Tier

An economical option for development workloads, test servers, and other applications that don't require load balancing, auto-scaling, or memory-intensive virtual machines.

Instance	Cores	RAM	Disk sizes
A0	1	0.75 GB	20 GB
A1	1	1.75 GB	40 GB
A2	2	3.5 GB	60 GB
A3	4	7 GB	120 GB
A4	8	14 GB	240 GB

Microsoft

General Purpose Compute

Microsoft Azure

Standard Tier

Offers the most flexibility. Supports all virtual machine configurations and features

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_A0\ExtraSmall	1	768 MB	1	Temporary = 20 GB	1	1x500
Standard_A1\Small	1	1.75 GB	1	Temporary = 70 GB	2	2x500
Standard_A2\Medium	2	3.5 GB	1	Temporary = 135 GB	4	4x500
Standard_A3\Large	4	7 GB	2	Temporary = 285 GB	8	8x500
Standard_A4\ExtraLarge	8	14 GB	4	Temporary = 605 GB	16	16x500
Standard_A5	2	14 GB	1	Temporary = 135 GB	4	4X500
Standard_A6	4	28 GB	2	Temporary = 285 GB	8	8x500
Standard_A7	8	56 GB	4	Temporary = 605 GB	16	16x500

Microsoft

General Purpose Compute

Microsoft Azure

Network optimized with Infiniband support

Adds a 40Gbit/s InfiniBand network with remote direct memory access (RDMA) technology.

Instance	Cores	RAM	Disk sizes
A8	8	56 GB	382 GB
A9	16	112 GB	382 GB

Adds a 40Gbit/s InfiniBand network with remote direct memory access (RDMA) technology. Ideal for Message Passing Interface (MPI) applications, high-performance clusters, modeling and simulations, video encoding, and other compute or network intensive scenarios.

Microsoft

Optimized Compute (D Tier)- 60% faster CPUs, more memory, and local

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_D1	1	3.5 GB	1	Temporary (SSD) =50 GB	2	2x500
Standard_D2	2	7 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D3	4	14 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D4	8	28 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D11	2	14 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D12	4	28 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D13	8	56 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D14	16	112 GB	8	Temporary (SSD) =800 GB	32	32x500

Dv2 Series- 35% faster than D series, 2.4 GHz Intel Xeon® E5-2673 v3

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_D1_v2	1	3.5 GB	1	Temporary (SSD) =50 GB	2	2x500
Standard_D2_v2	2	7 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D3_v2	4	14 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D4_v2	8	28 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D5_v2	16	56 GB	8	Temporary (SSD) =800 GB	32	32x500
Standard_D11_v2	2	14 GB	2	Temporary (SSD) =100 GB	4	4x500
Standard_D12_v2	4	28 GB	4	Temporary (SSD) =200 GB	8	8x500
Standard_D13_v2	8	56 GB	8	Temporary (SSD) =400 GB	16	16x500
Standard_D14_v2	16	112 GB	8	Temporary (SSD) =800 GB	32	32x500

DS-series VMs can use Premium Storage- high-performance, low-latency storage.

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Cache size (GB)	Max. disk IOPS & bandwidth
Standard_DS1	1	3.5	1	Local SSD disk = 7 GB	2	43	3,200 32 MB per second
Standard_DS2	2	7	2	Local SSD disk = 14 GB	4	86	6,400 64 MB per second
Standard_DS3	4	14	4	Local SSD disk = 28 GB	8	172	12,800 128 MB per second
Standard_DS4	8	28	8	Local SSD disk = 56 GB	16	344	25,600 256 MB per second
Standard_DS11	2	14	2	Local SSD disk = 28 GB	4	72	6,400 64 MB per second

G-series VMs offer the most memory and run on hosts that have Intel Xeon E5 V3 family processors.

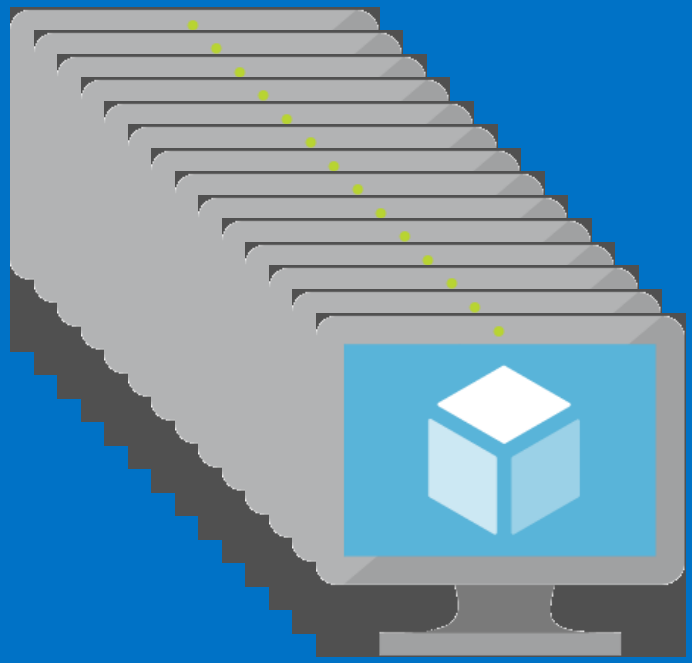
Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Max. IOPS (500 per disk)
Standard_G1	2	28 GB	1	Local SSD disk = 384 GB	4	4 x 500
Standard_G2	4	56 GB	2	Local SSD disk = 768 GB	8	8 x 500
Standard_G3	8	112 GB	4	Local SSD disk = 1,536 GB	16	16 x 500
Standard_G4	16	224 GB	8	Local SSD disk = 3,072 GB	32	32 x 500
Standard_G5	32	448 GB	8	Local SSD disk = 6,144 GB	64	64 x 500

GS-series VMs , Godzilla ++ (Premium Storage- high-performance, low-latency storage

Size	CPU cores	Memory	NICs (Max)	Max. disk size	Max. data disks (1023 GB each)	Cache size (GB)	Max. disk IOPS & bandwidth
Standard_GS1	2	28	1	Local SSD disk = 56 GB	4	264	5,000 125 MB per second
Standard_GS2	4	56	2	Local SSD disk = 112 GB	8	528	10,000 250 MB per second
Standard_GS3	8	112	4	Local SSD disk = 224 GB	16	1056	20,000 500 MB per second
Standard_GS4	16	224	8	Local SSD disk = 448 GB	32	2112	40,000 1,000 MB per second
Standard_GS5	32	448	8	Local SSD disk = 896 GB	64	4224	80,000 2,000 MB per second

Key Improvements: Azure Virtual Machines (v2)

- Massive and parallel deployment of Virtual Machines
- 3 Fault Domains in Availability Sets
- Custom URLs for Custom Script VM Extensions for VMs



https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-app-frameworks/

NEW: VM Scale Sets

Virtual Machine Scale Sets

- "Next-Generation Worker Role"
- Supports Windows, Linux, and custom images
- Stateless and persistent disks
- Image-based OS patching
- Ideal for clusters

Migrating workloads to Azure

1. Verify prerequisites:
   - A Hyper-V virtual machine must be Generation 1
   - Disks must be no larger than 1,023 GB
2. Generalize the image
3. Capture and prepare disks for upload to Azure
4. Create an Azure storage account
5. Upload .vhd file to the Azure storage account
6. When creating an Azure virtual machine:
   - In the **Set-AzureRmVMOSDisk** cmdlet:
     - Add the **-SourceImageUri** parameter
     - Add the **–CreateOption fromImage** parameter
   - In the **Set-AzureRmVMOperatingSystem** cmdlet:
     - Add the **–ProvisionVMAgent** parameter

Evaluating the use of Azure containers

Feature	Virtual machines	Containers
Security level	Greater control	Lesser control, but easier implementation
Memory required	Must accommodate complete operating system and apps	Must accommodate apps only
Startup time	Includes the boot of the operating system, as well as the startup of services and apps	Incudes only the startup of apps and dependent services. Operating system is already running
Portability	Portable with proper configuration	Portable by design and typically smaller in size
Image automation	Dependent on operating system and apps	Based on Docker registry

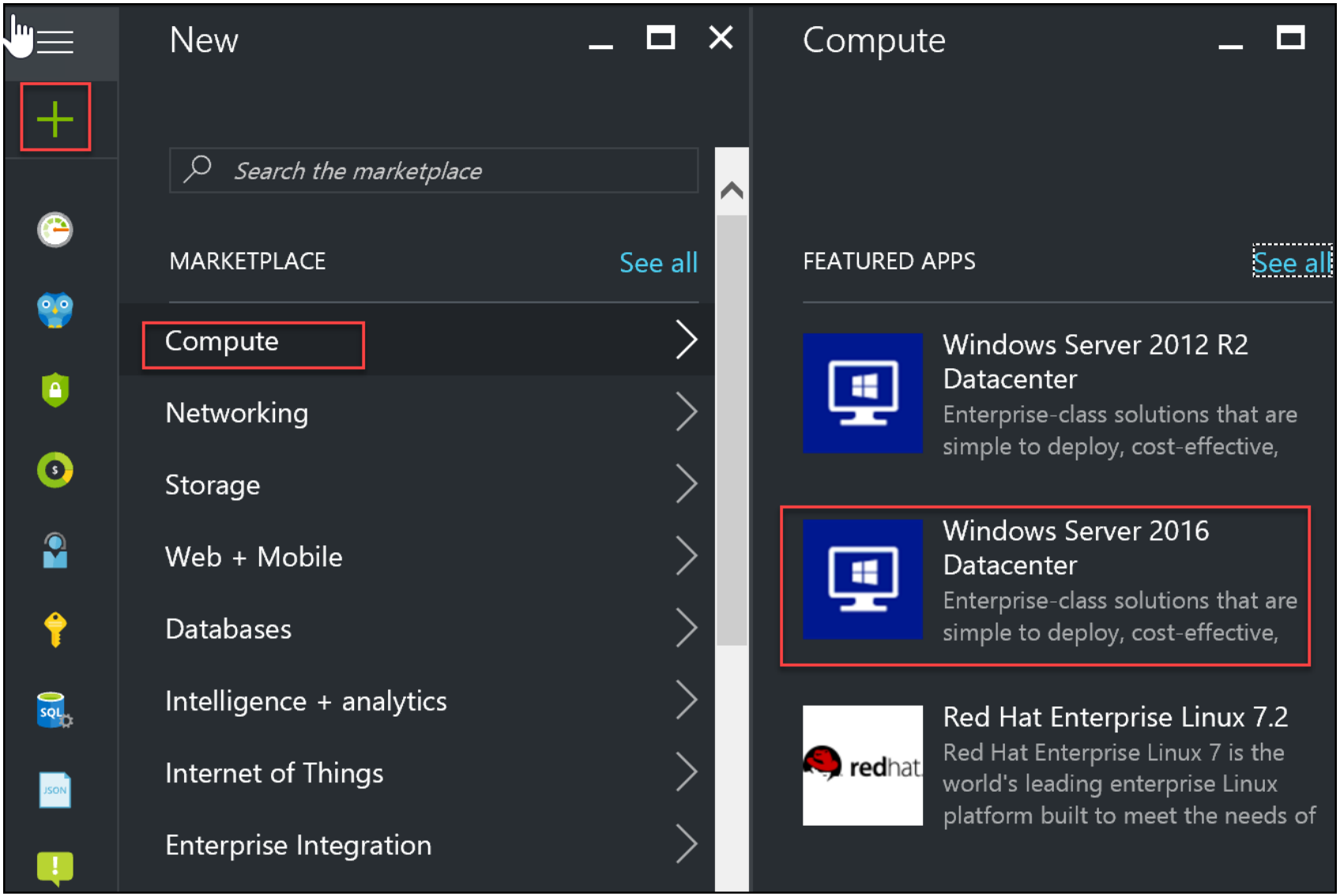
Lesson 3: Deploying Azure Resource Manager virtual machines

- Creating Azure Resource Manager virtual machines
- Using the Azure portal to create virtual machines
- Using Azure PowerShell to create virtual machines
- Creating virtual machines by using a deployment template
- Demonstration: Creating a virtual machine by using the Azure portal

Creating Azure Resource Manager virtual machines

- Tools
  - Azure portal
  - Azure PowerShell
  - Azure CLI
  - Azure Resource Manager templates
- Create Azure Virtual Machines from:
  - Azure Marketplace images
  - On-premises custom images uploaded to Azure
  - Captured Azure VMs

Using the Azure portal to create virtual machines



Using Azure PowerShell to create virtual machines

- Create a new virtual machine in Azure PowerShell by using the **New-AzureRmVM** cmdlet

```
$vm = New-AzureRmVMConfig -VMName WindowsVM -VMSize "Standard_A1"
$vm = Set-AzureRmVMOperatingSystem -VM $vm -Windows -ComputerName MyWindowsVM -Credential $cred -ProvisionVMAgent -EnableAutoUpdate
$vm = Set-AzureRmVMSourceImage -VM $vm -PublisherName MicrosoftWindowsServer -Offer WindowsServer -Skus 2012-R2-Datacenter -Version "latest"
$vm = Add-AzureRmVMNetworkInterface -VM $vm -Id $nic.Id
$osDiskUri = $storageAcc.PrimaryEndpoints.Blob.ToString() + "vhds/WindowsVMosDisk.vhd"
$vm = Set-AzureRmVMOSDisk -VM $vm -Name "windowsvmosdisk" -VhdUri $osDiskUri -CreateOption fromImage
New-AzureRmVM -ResourceGroupName $rgName -Location $locName -VM $vm
```

Creating virtual machines by using a deployment template

- Deploy the template by using:
  - Azure PowerShell

```
New-AzureRmResourceGroupDeployment -Name
<DeploymentName>-ResourceGroupName
<ResourceGroupName -TemplateUri <TemplateUri>
```

  - Azure CLI

```
azure group deployment create
```

  - Deploy to Azure link on GitHub

Demonstration: Creating a virtual machine by using the Azure portal

In this demonstration, you will see how to create a virtual machine by using the Azure portal

Lab A: Creating Azure Resource Manager virtual machines in Azure

- Exercise 1: Creating virtual machines by using the Azure portal and Azure PowerShell
- Exercise 2: Validating virtual-machine creation

Estimated Time: 35 minutes

Lab Scenario

As part of the planning for deployment of Azure Resource Manager virtual machines to Azure, A. Datum has evaluated its deployment options. You must use the Azure portal and Azure PowerShell to deploy two Windows virtual machines for the Database tier of the Research and Development application. Additionally, to facilitate resource tracking, you should ensure that the virtual machines are part of the same resource group.

Lab Review

- What differences regarding Azure VM storage did you notice when you created a virtual machine in the Azure portal versus in Azure PowerShell?

Lesson 4: Authoring Azure Resource Manager templates

- Azure Resource Manager templates overview
- Modifying Azure Resource Manager templates
- Demonstration: Authoring an Azure Resource Manager template

Azure Resource Manager templates overview

- When creating and working with resource templates, consider:
  - Which resources you are going to deploy
  - Where your resources will be located
  - Which version of the resource provider API you will use
  - Whether there are dependencies between resources
  - When you will specify values of resource properties
- The template consist of the following sections:

```
{
  "$schema": "http://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
  "contentVersion": "",
  "parameters": {  },
  "variables": {  },
  "resources": [  ],
  "outputs": {  }
}
```

Modifying Azure Resource Manager templates

- Azure Resource Manager template components:
  - Parameters
  - Variables
  - Resources
  - Outputs

- Azure Resource Manager template functions types:
  - Numeric
  - String
  - Array
  - Deployment value
  - Resource

Demonstration: Authoring an Azure Resource Manager template

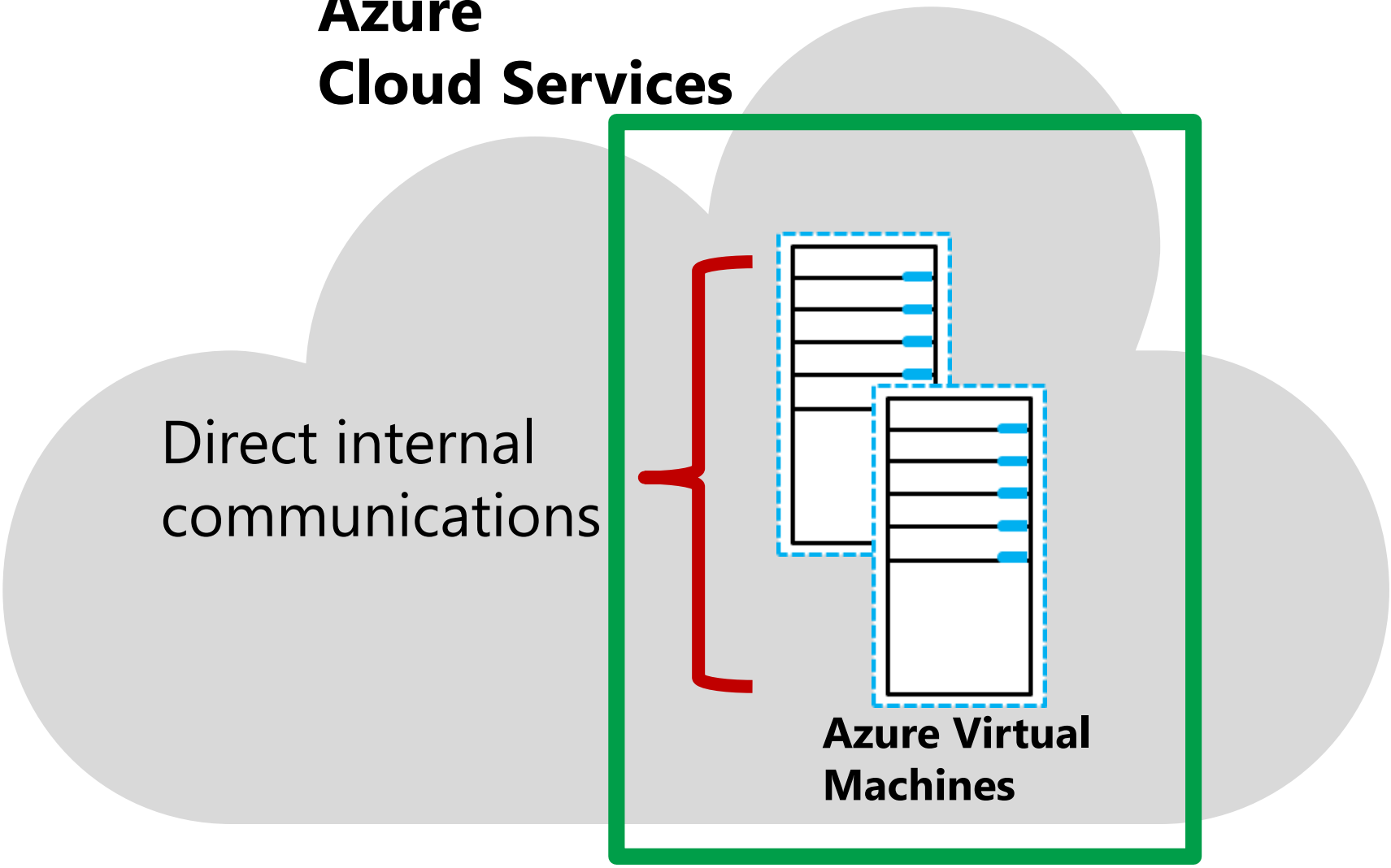
In this demonstration, you will see how to:

- Open an Azure Resource Manager template in Visual Studio
- View the different sections of an Azure Resource Manager template

Lesson 5: Overview of classic virtual machines

- Overview of IaaS Cloud Services
- Creating classic virtual machines

Overview of IaaS Cloud Services



DNS name: ***unique cloud service name*.cloudapp.net**

Creating classic virtual machines

- Deploy classic virtual machines by:
  - Using the Azure portal:
    - Networking settings include:
      - Cloud service (domain name)
      - Endpoints
  - Using Azure PowerShell:
    - Define the virtual-machine configuration first, and then create the virtual machine
    - Create and configure the virtual machine in one step

Lab B: Deploying Azure Resource Manager virtual machines by using Azure Resource Manager templates

- Exercise 1: Using Visual Studio and an Azure Resource Manager template to deploy Azure Resource Manager virtual machines
- Exercise 2: Using Azure PowerShell and an Azure Resource Manager template to deploy virtual machines

Estimated Time: 25 minutes

Lab Scenario

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

Lab Review

- Can Visual Studio and Windows 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