Microsoft

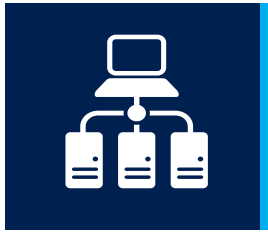
Azure Virtual Machines

Microsoft Services

Agenda

- Virtual Machines Overview
- Virtual Machines Image Mobility
- Virtual Machines Disks
- Virtual Machines Sizes
- Virtual Machines Accelerated Networking
- Virtual Machines Availability
- Virtual Machine Agent and Extensions
- Virtual Machine Management
- Virtual Machine Scale Sets
- Monitoring

Overview



Support for key server applications

Disk and storage manageability

High availability features

Integration with compute Platform as a Service (PaaS)

Azure Virtual Machines Workloads

Development & Test

Quickly provision and un-provision entire environments

Running applications in the cloud

Custom applications
Customer Relationship Management (CRM)
Content Management Server (CMS)
Enterprise Resource Planning (ERP)
Business Intelligence (BI)

Hybrid applications

Applications that span your data center and the cloud

Disaster recovery

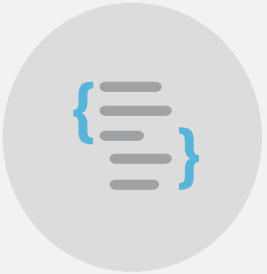
IaaS-based disaster recovery solution

What do I need to think about before creating a VM?

Naming	Locations	VM size	Limits	OS disks & images	Extensions	Related resources
The names of your application resources	The location where the resources are stored	The size of the VM	The maximum number of VMs that can be created	The operating system that the VM runs	The configuration of the VM after it starts	The related resources that the VM needs

Tools to create and manage VMs

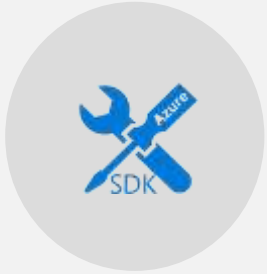
Azure Portal



ARM Templates

Azure CLI

Azure Powershell



Client SDK

REST API

Azure Virtual Machine Benefits

Get more choice

Choose Linux or Windows.

Choose to be on-premises, in the cloud, or both.

Choose your own virtual machine image or an image in our marketplace.

Scale to what you need

Scale from one to thousands of virtual machine instances.

Scale globally so you're closer to where your customers are.

Pay only for what you use

Per-second billing based on VM size and OS.

You only pay for the compute time you use.

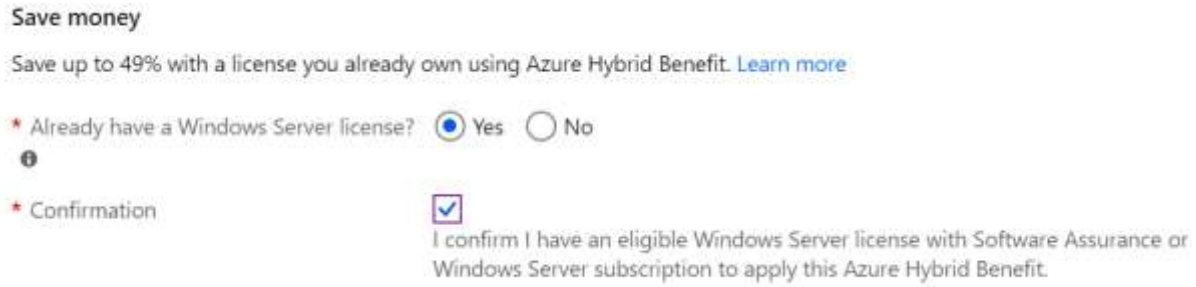
Enhance security and compliance

We'll help you:

- encrypt sensitive data,
- protect virtual machines from viruses and malware,
- secure network traffic,
- and meet regulatory and compliance requirements.

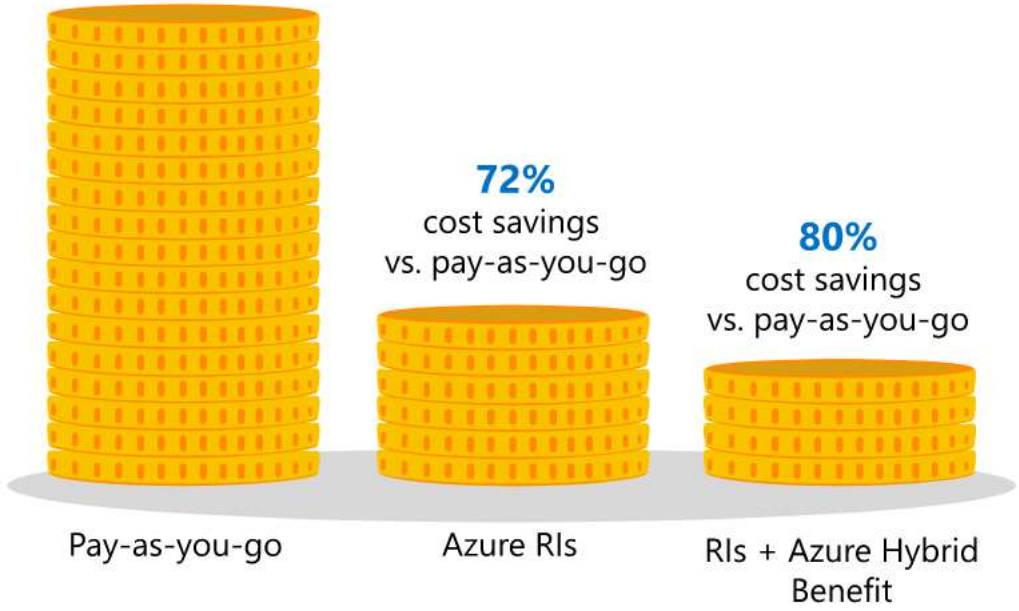
Azure Hybrid Use Benefit (HUB)

- Prerequisite
  - Windows Server or Windows Client licenses with Software Assurance
- Benefit
  - Save up to 49% with a license you already own
- How to use
  - With an EA subscription: Enable this option during VM creation or afterwards
  - Without an EA subscription: upload a custom VM and deploy using a Resource Manager template or Azure PowerShell



Azure Reserved Instances (RIs)

- One or three-year terms on Windows and Linux virtual machines
- Specify your Azure region, virtual machine type, and term
- Up to 72 percent discount compared to pay-as-you-go prices



Azure Spot VMs

- Azure Spot VMs are created using unused compute capacity
- Significantly cheaper than Standard VMs
- Great for workloads that can handle interruptions like batch processing jobs, dev/test environments, large on-going compute workloads etc.
- Evicted at any point in time when Azure needs the capacity back, with 30 seconds notice
- The amount of available capacity can vary based on size, region, time of day, and more
- No SLA and no high availability guarantees
- Select VM sizes only

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Virtual Machines Image Mobility

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Introduction to Disks and Images

Generalized VM

VM Creation from Image

"I want to create several VMs based on this model"

- VHD to be provisioned
- Prepared with syspred (removed computer name, SID, etc)
- Created by uploading or by capture

Specialized VM

VM Creation from Disk

"I want to create a VM based on this "ready-to-use" disk"

- VHD already provisioned
- "Snapshot" to deploy a VM to a good known point in time
- Created by uploading or by taking a disk snapshot

Azure Marketplace Images

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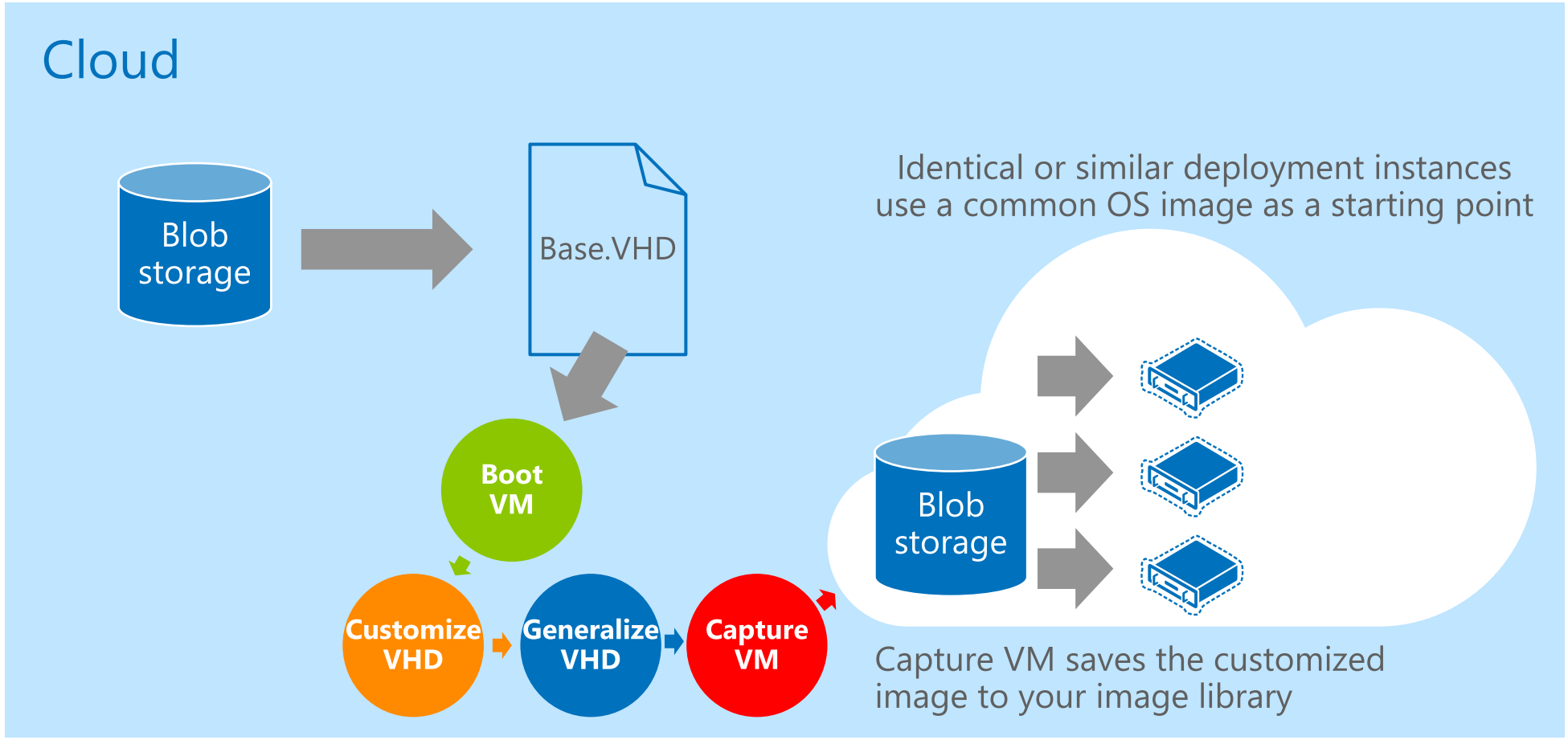
- Windows Server 2008 R2 / 2012 / 2016 / 2019
- SQL Server 2012 / 2014 / 2016 / 2019
- BizTalk Server 2013 / 2016
- SharePoint Server 2013 / 2016
- Visual Studio 2013 / 2015 / 2019

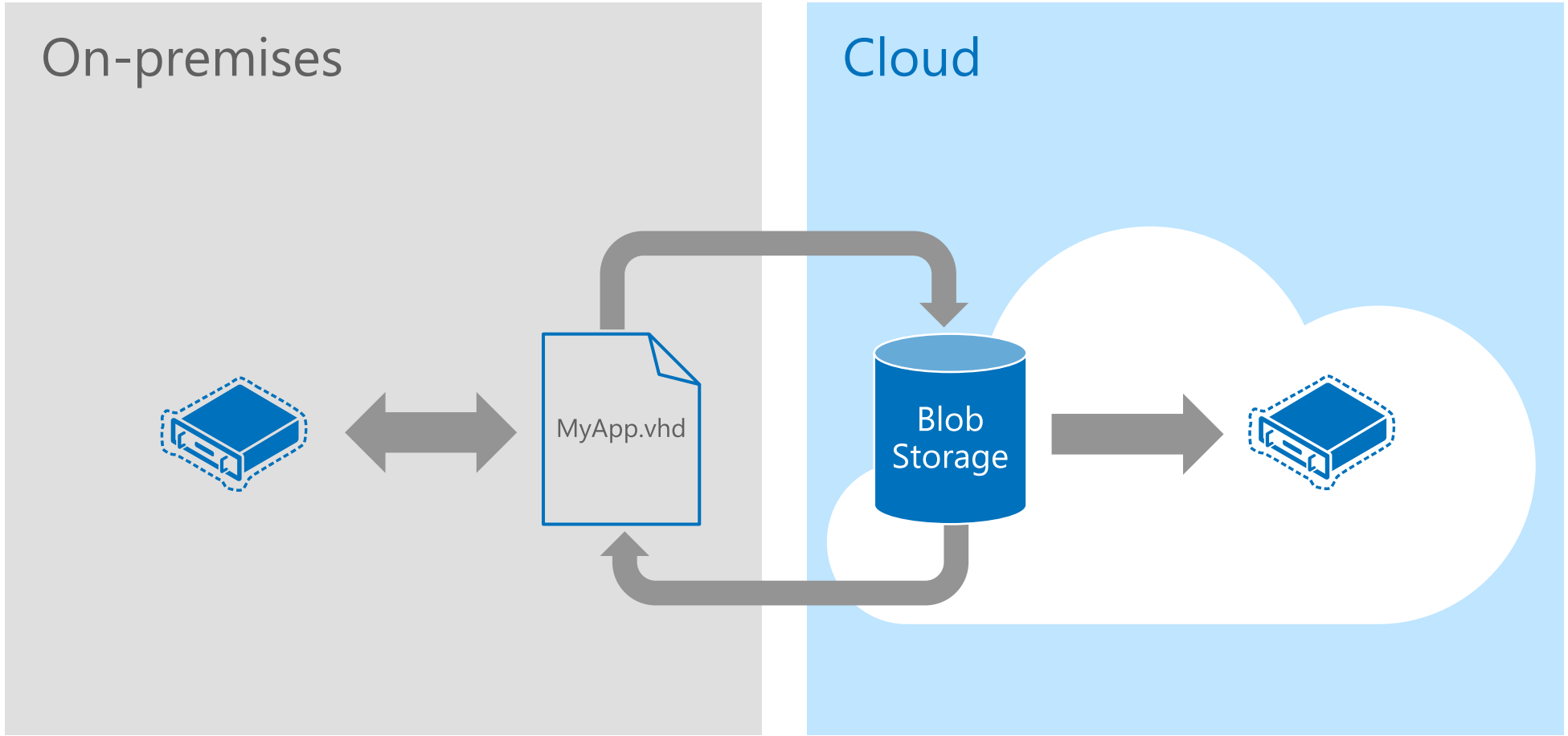
Open Source

- OpenSUSE 42.3
- CentOS 7.5
- Ubuntu 19.04
- SUSE Linux Enterprise Server 15
- Red Hat Enterprise Linux 8

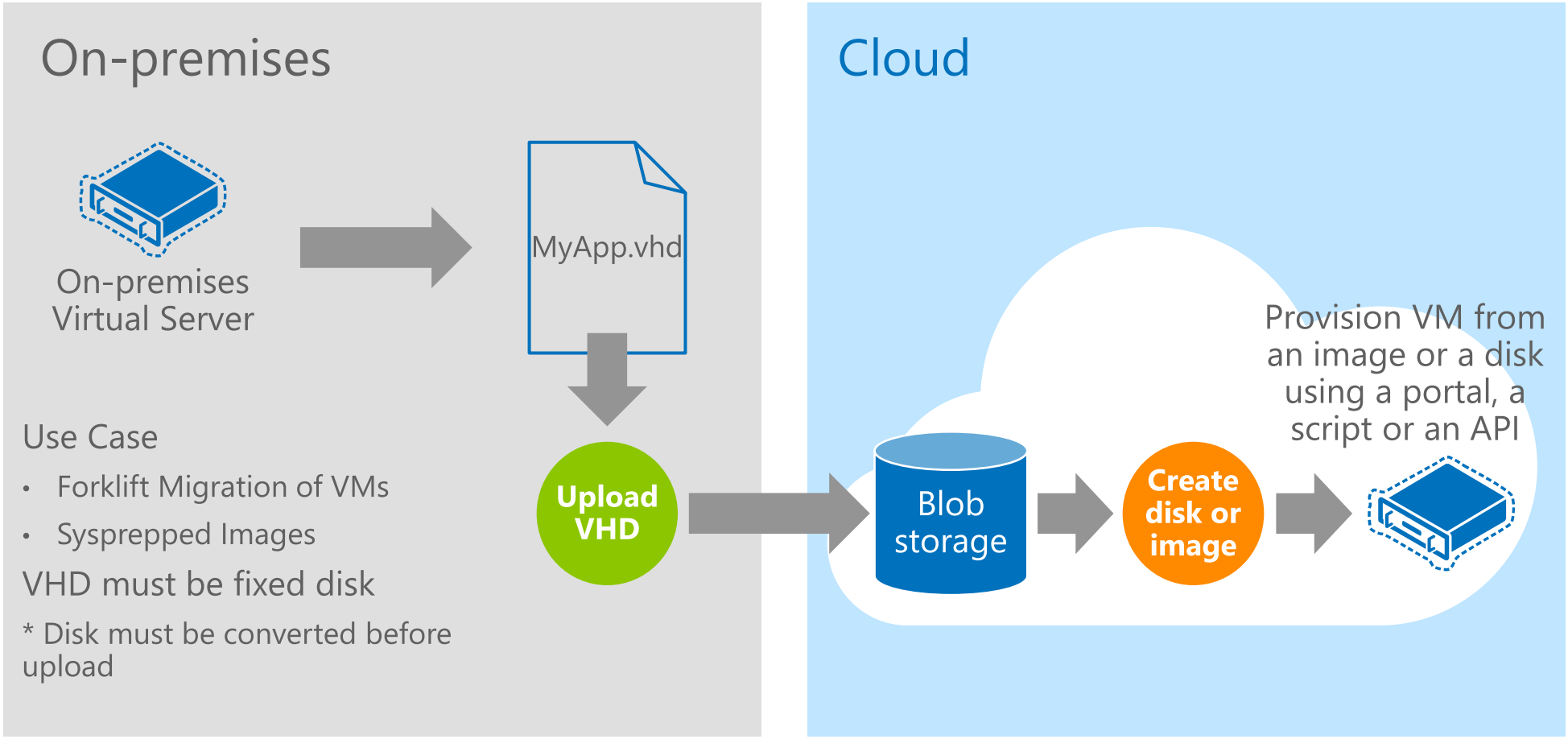
Azure Custom Images



Disks and Images Mobility

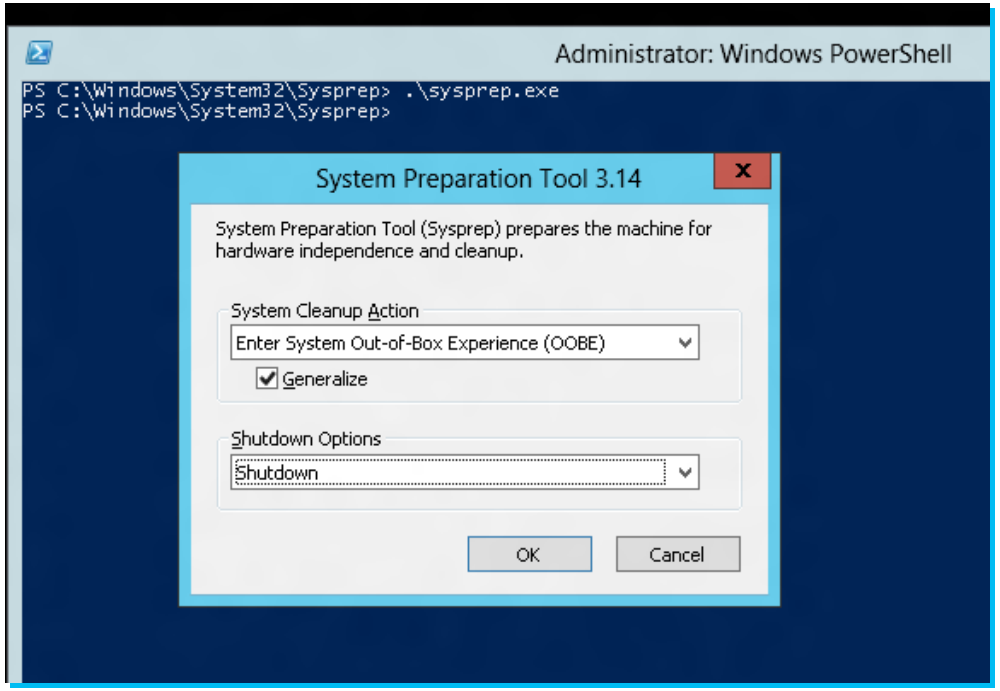


Bring Your Own Image or Disk



Tips on Bring Your Own (BYO) Generalized Images

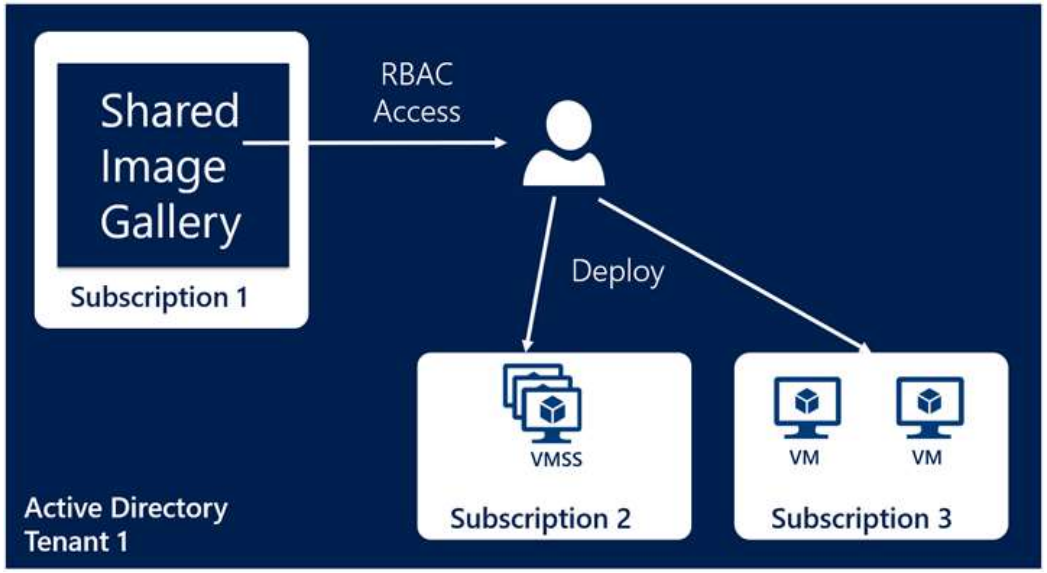
- Sysprep and **Generalize** is expected
- Do not put **unattend.xml** on the disk
- Do not install virtual machine Integration Components
- Install the Azure VM Agent
- Enable RDP



Azure Shared Image Gallery

- Share your images to different users, service principals, or AD groups within your organization

- Helps you build structure and organization around your managed images:
  - Global replication
  - Versioning and grouping
  - High availability
  - Can be shared across subscriptions or Azure AD, using RBAC



Demo: Create a Virtual Machine in Azure Portal based on a Marketplace image

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Virtual Machines Disks

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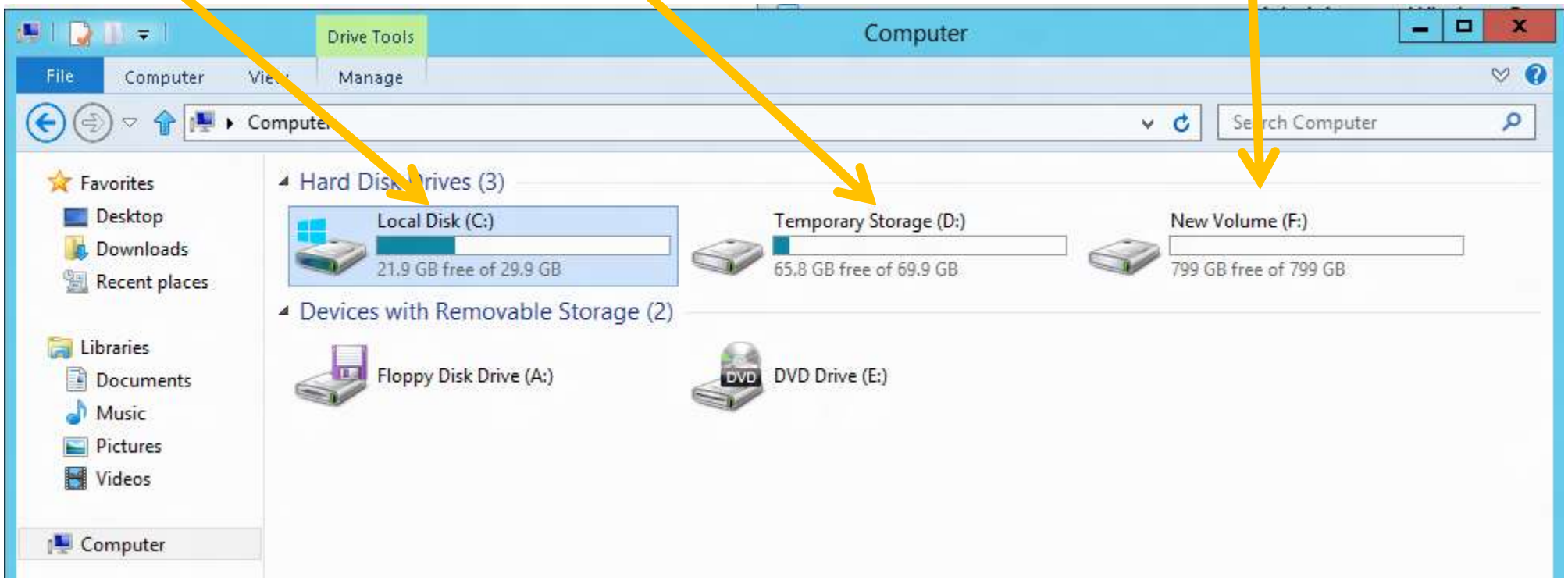
VM disk layout – Windows OS

OS Disk
- Persistent
- SATA
- **Drive C:**

Temporary Storage Disk
- Local (Not Persistent)
- SATA
- **Drive D:**

Data Disk(s)
- Persistent
- SCSI
- **Customer Defined Letter**



Persistent Disk Management – Windows OS

- *C:* = OS Disk
- *D:* = Non-Persistent Cache Disk
  - Must not be used to store data that you are not willing to lose!
- *E:*, *F:*. *G:* and all subsequent Data Disks – you will need to attach and format them

Capability	OS Disk	Data Disk
Host Cache Default	ReadWrite	None
Max Capacity	64 TB	64 TB
Hot Update	Cache Setting requires a reboot	Change Cache without reboot, Add/Remove without reboot

Disk Caching – Windows OS

Supported Cache Modes:

Disk Type	Read Only	Read Write	None
OS Disk	Supported	Default	Supported
Data Disks	Supported	Supported	Default
Temporary Disk	Not stored in Microsoft Azure Storage Blob Service		

Ephemeral OS disks

- Ephemeral OS disks are not persistent and are created on the virtual machine host storage instead of remote Azure Storage
- Work well for stateless workloads, where applications are tolerant of individual VM failures, but are more affected by VM deployment time or reimaging the individual VM instances
- Lower read/write latency to the OS disk and faster VM reimage
- Supported on DSv1, DSv2, DSv3, Esv3, Fs, FsV2, GS, M VMs
- Free of charge

Types of Disks and Performance

Types		Performance		
Unmanaged disks (UMDs)	Managed disks (MDs)	Standard	Premium	Ultra (only MDs)
Create and specify storage account to store disks Manage scalability targets of the storage account	Azure creates and manages storage account and disks Specify disk size and performance tier Standard, Premium or Ultra	Backed by HDDs or SSDs Cost-effective storage Suitable for dev/test, non-critical, infrequent access Geo-replication options	Backed by SSDs only High-performance and low-latency disk support Suitable for mission critical production environment	Backed by SSDs only Sub-millisecond latency for the most demanding workloads Suitable for the most IO intensive workloads

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Virtual Machines Sizes

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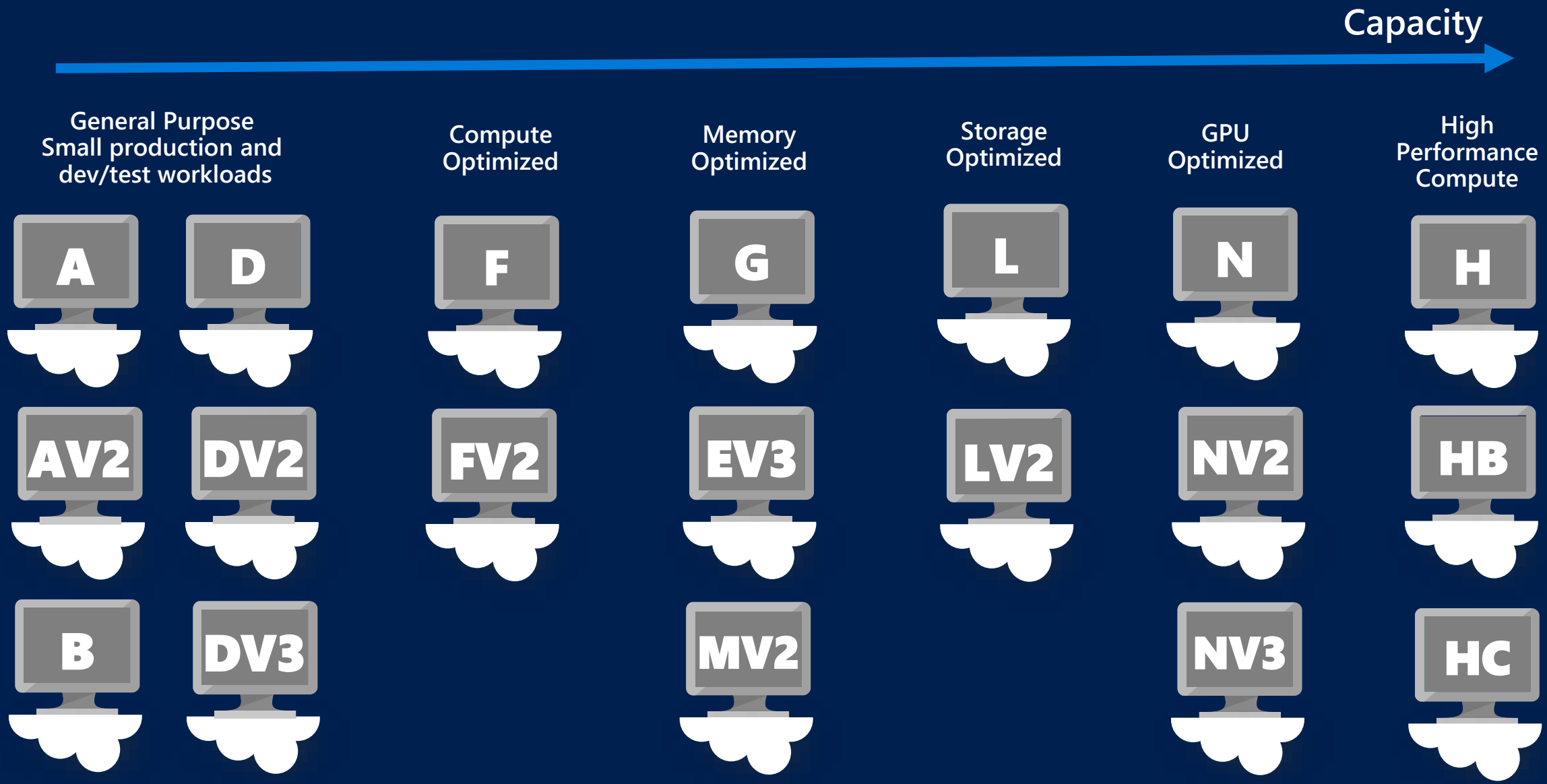
Series and Scale-up options



Specs example – VM Size Dv3

General Purpose

Processor: 2.4 GHz Intel Xeon® E5-2673 or 2.3 GHz Intel XEON ® E5-2673 v4

VM Size	vCPU	Memory (GiB)	Temp Disk (GiB)	Max Data Disks	Max IOPS/Read MBPS/Write MBPS	Max NICs / Network bandwidth
D2_v3	2	8	50	4	3000/46/23	2 / 1000
D4_v3	4	16	100	8	6000/93/46	2 / 2000
D8_v3	8	32	200	16	12000/187/93	4 / 4000
D16_v3	16	64	400	32	24000/375/187	8 / 8000
D32_v3	32	128	800	32	48000/750/375	8 / 16000
D48_v3	48	192	1200	32	96000/1000/500	8 / 24000
D64_v3	64	256	1600	32	96000/1000/500	8 / 30000

Use Case: Enterprise-grade applications, relational databases, in-memory caching, and analytics

Specs example – VM Size Ev3
Memory Optimized

Processor: 2.3 GHz Intel XEON ® E5-2673 v4

VM Size	vCPU	Memory (GiB)	Temp Disk (GiB)	Max Data Disks	Max IOPS/Read MBPS/Write MBPS	Max NICs / Network bandwidth
E2_v3	2	16	50	4	3000/46/23	2 / 1000
E4_v3	4	32	100	8	6000/93/46	2 / 2000
E8_v3	8	64	200	16	12000/187/93	4 / 4000
E16_v3	16	128	400	32	24000/375/187	8 / 8000
E20_v3	20	160	500	32	30000/469/234	8 / 10000
E32_v3	32	256	800	32	48000/750/375	8 / 16000
E48_v3	48	384	1200	32	96000/1000/500	8 / 24000

Use Case: processor in a hyper-threaded configuration, providing a better value proposition for most general purpose workloads

Specs example – VM Size Nv3
GPU Optimized

Processor: 2.3 GHz Intel XEON ® E5-2673 v4
GPU: NVIDIA Tesla M60

VM Size	vCPU	Memory (GiB)	Temp Disk (GiB)	GPU	GPU Memory (GiB)	Max Data Disks	Max IOPS/MBPS	Max NICs	Virtual WST	Virtual App
NV12s_v3	12	112	320	1	8	12	20000 / 200	4	1	25
NV24s_v3	24	224	620	2	16	24	40000 / 400	8	2	50
NV48s_v3	48	448	1280	4	32	32	80000 / 800	8	4	100

Use Case: Optimized and designed for remote visualization, streaming, gaming, encoding, and VDI scenario

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Virtual Machine Accelerated Networking

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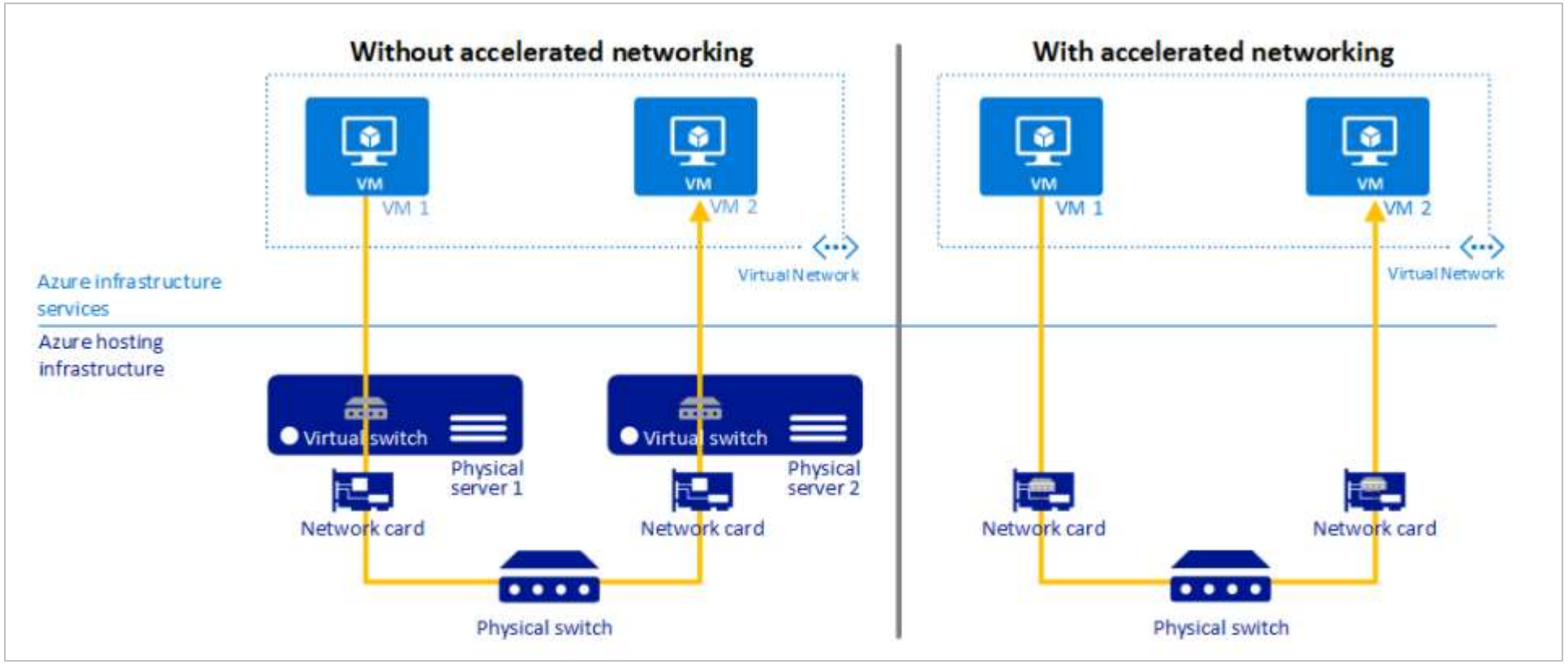
Accelerated Networking

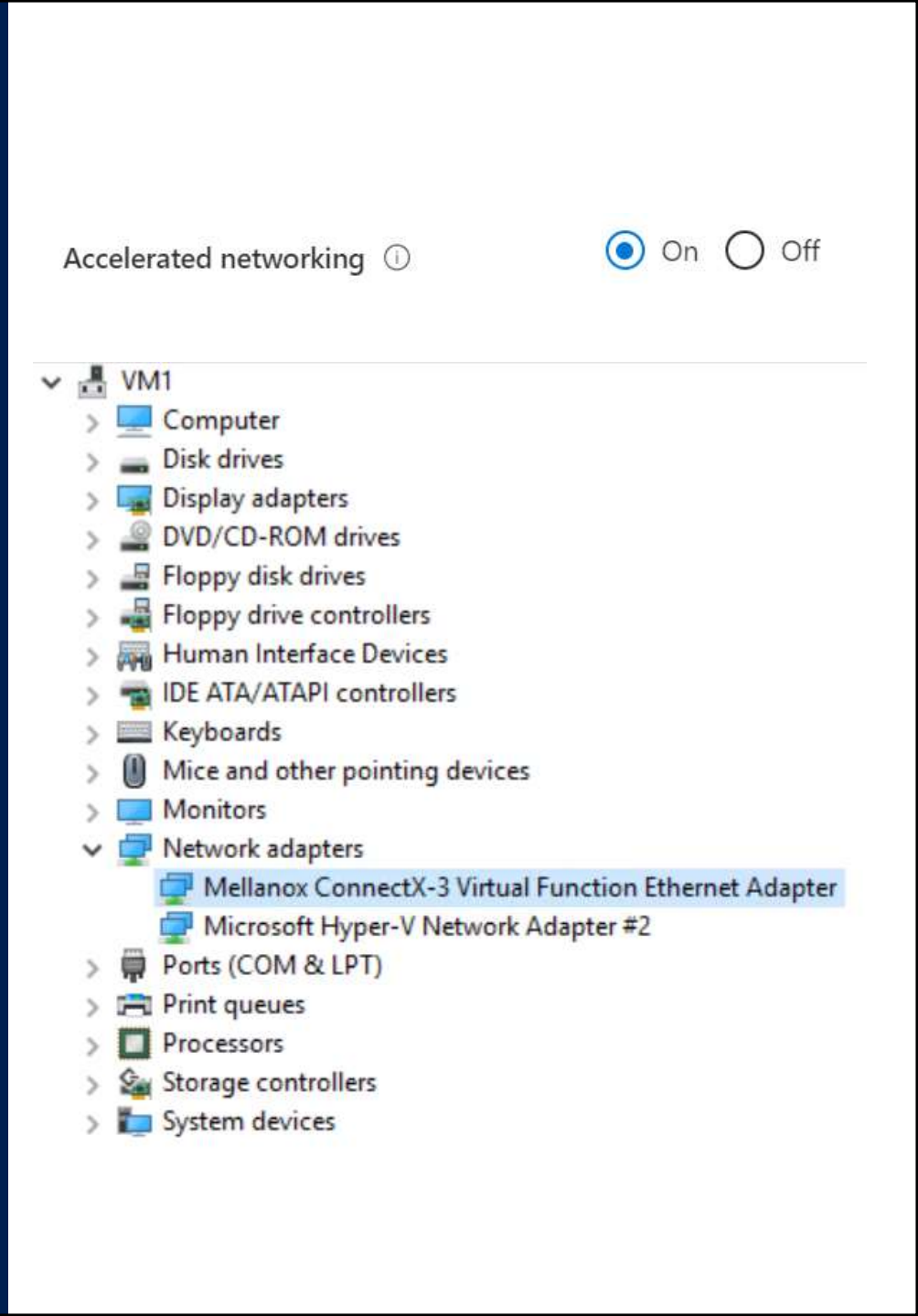
- Accelerated networking enables a single physical NIC on an Azure host machine to appear as multiple NIC's to the host OS.
- Allows an Azure guest VM to think that it has its own physical NIC so that it can send and receive traffic directly to and from this NIC instead of going via its virtual switch.
- Can be enabled during VM creation time or on an existing VM.
- Supported on Dv2/DSv2, F/Fs, D/Dsv3, D/Dsv4, E/Esv3, Ea/Easv4, Fsv2, Lsv2, Ms/Mms, and Ms/Mmsv2 VMs.

Virtual Machine with and without Accelerated Networking



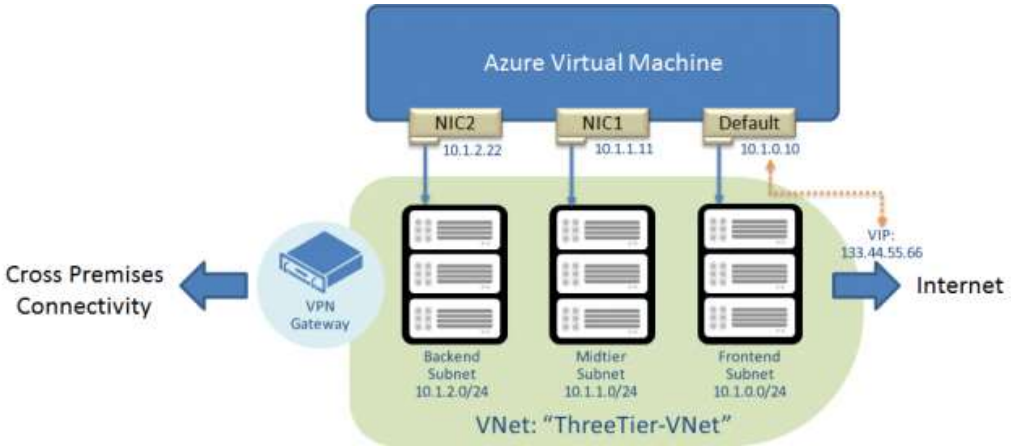
Virtual Machine with Accelerated Networking Deployment

- Deploy a VM instance with 8 or more cores and enable accelerated networking during deployment.
- Install the accelerated networking driver and reboot.
- Confirm the presence of the **Mellanox ConnectX-3 Virtual Function Ethernet Adapter**.



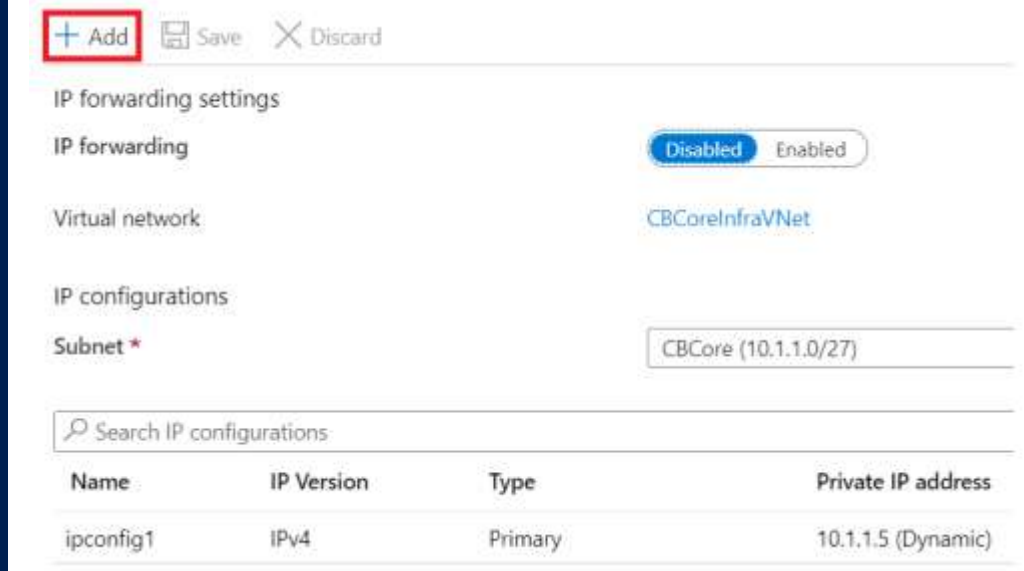
Multi-NIC Support

- Using multiple NICs on your VM allows you to manage network traffic better
- Isolate traffic between front-end NICs and backend NICs
- Different VM sizes support a varying number of NICs
- On-premises VM's with multiple NIC's can be migrated to Azure



Multiple IPs Per NIC

- Up to 256 private and public IP addresses can be assigned to each NIC
- Private IP addresses support Network Security Groups (NSGs) and User Defined Routes (UDRs)
- Through multiple IPs per NIC, load balancing can be configured across both primary and secondary NICs
- Allows NVAs to enforce different security policies based on the NICs and also provide bandwidth isolation among different traffic types
- Configured using the Azure portal, PowerShell, Azure CLI or ARM templates



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Virtual Machines Availability

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Understand planned vs. unplanned maintenance

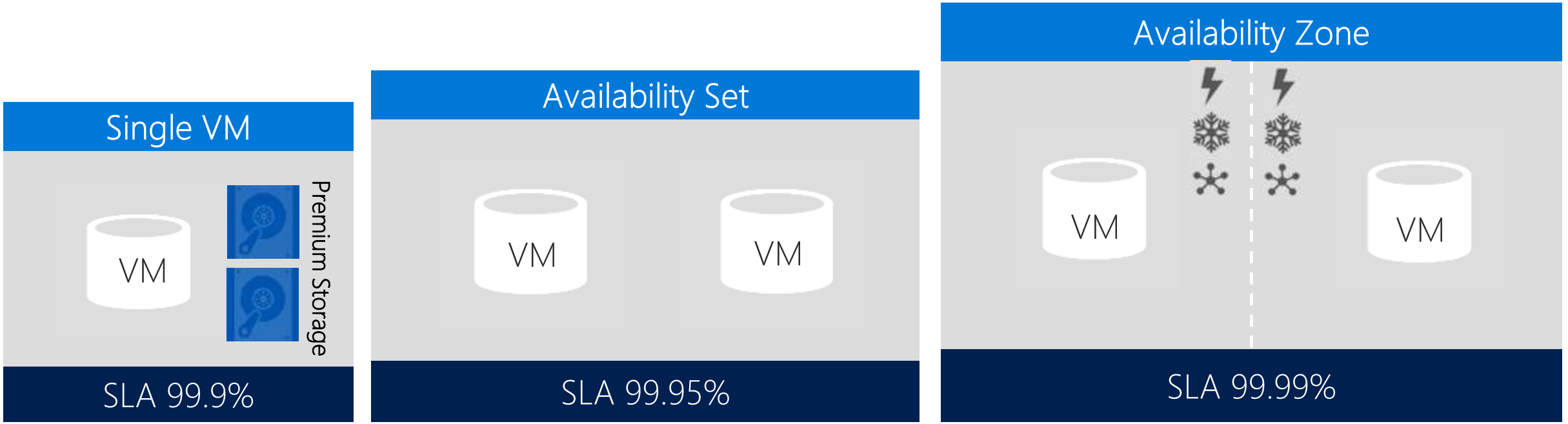
Planned maintenance events

- Periodic updates made by Microsoft
- The majority are performed without any impact
- Some updates require a reboot of your virtual machine to apply the required updates

Unplanned maintenance events

- Faults on the hardware or physical infrastructure
- Azure platform will automatically migrate your virtual machine from the unhealthy physical machine hosting to a healthy physical machine
- Such events are rare, but may also cause your virtual machine to reboot

VM Connectivity Service Level Agreements (SLA)



More information about SLAs on https://azure.microsoft.com/support/legal/sla

Best practices for high availability

Configure multiple virtual machines in an availability set/zone for redundancy

Configure each application tier into separate availability sets/zones

Combine Load Balancers with availability sets/zones

Fault and Update Domains

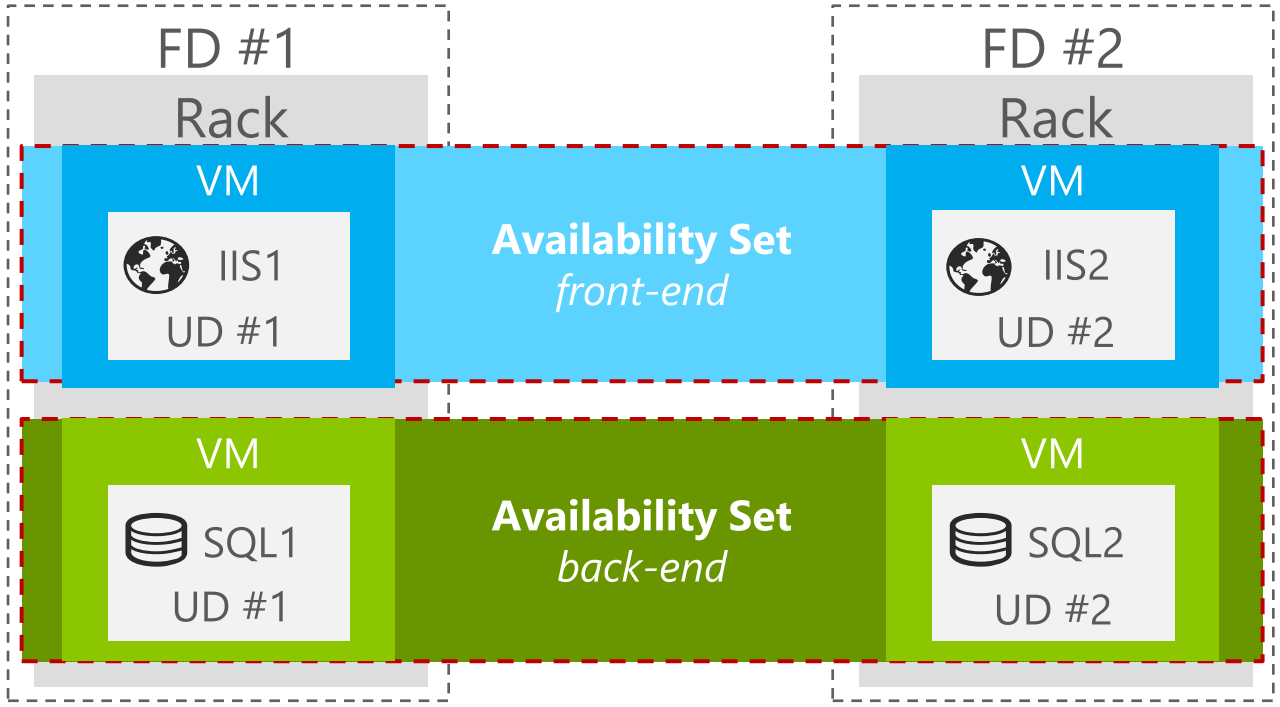
Fault Domain (FD)

- Represent groups of resources anticipated to fail together, i.e. same rack
- Fabric spreads instances across fault at least two fault domains
- The number of fault domains is controlled by the Azure Fabric
- Anticipated to fail together: share power source and network switch
- 2 or 3 fault domains by default

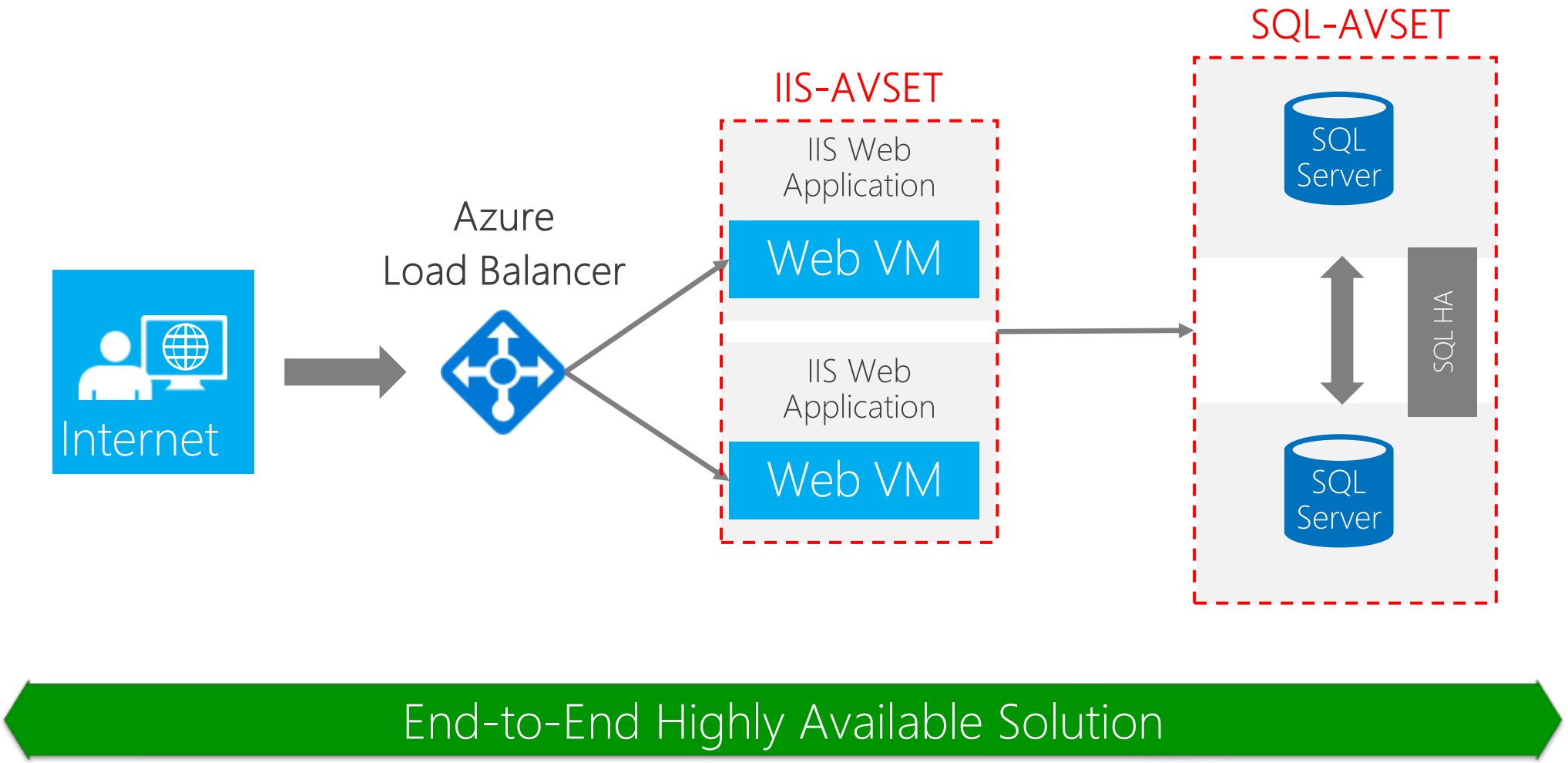
Update Domain (UD)

- Represents groups of resources that will be updated together
- Host OS updates honor service update domains
- Specified in service definition
- Until 20 update domains

Application tiers into separate Availability Sets

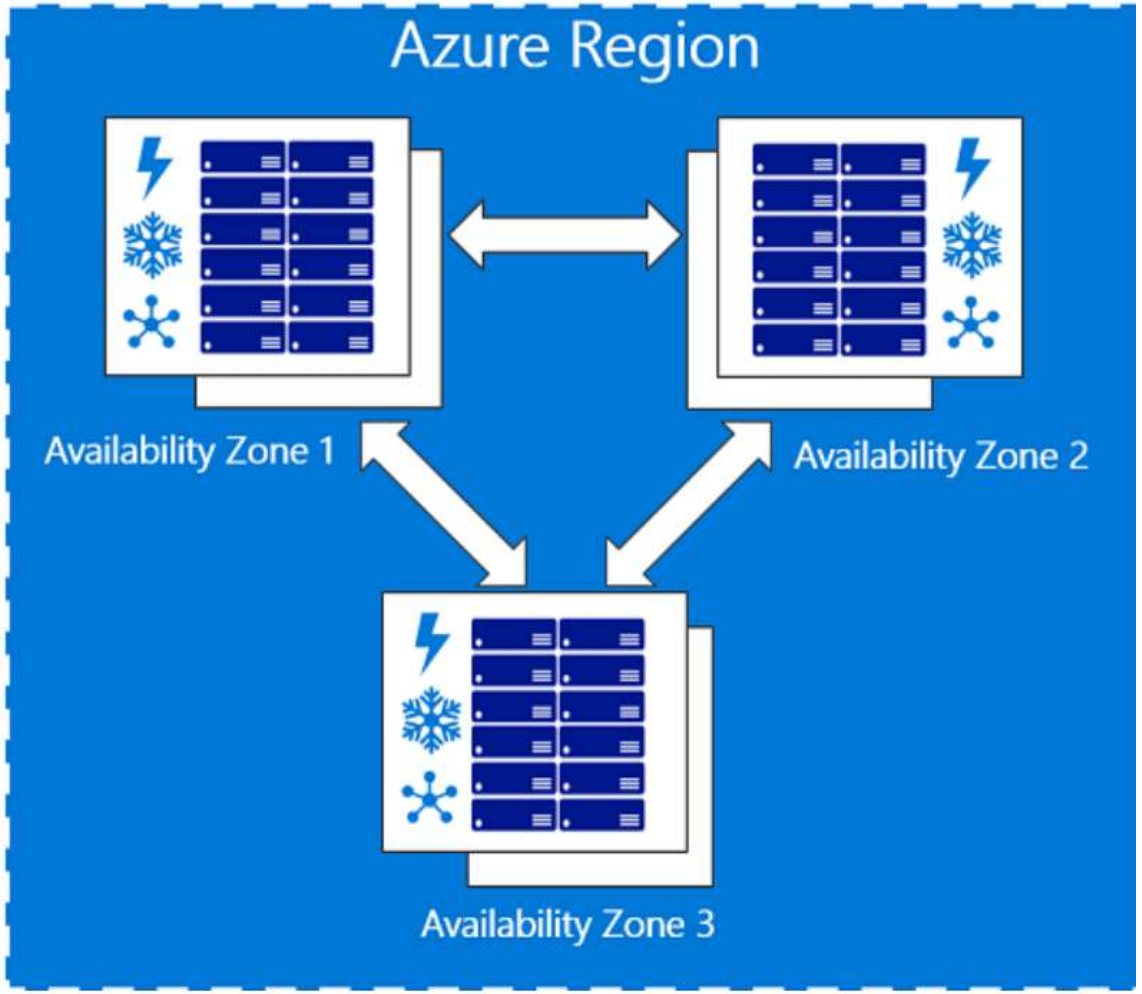


Combine a load balancer with availability sets



Availability Zones

- An Availability Zone is a physically separate datacenter in an Azure region
- Ensures high availability in the event of a datacenter outage
- Resources are deployed across 1 – 3 zones in the same region
- Each zone is equipped with independent power, cooling, and networking
- ~1.2 ms latency between zones



Supported Availability Zones Services

- Windows & Linux Virtual Machines
- Virtual Machine Scale Sets
- Azure App Services
- Azure Kubernetes
- Managed Disks
- Zone-Redundant Storage
- Load Balancer

- Public IP address
- VPN & ExpressRoute Gateway
- Application Gateway (v2)
- Azure Firewall
- SQL Database
- Event Hubs
- Service Bus

- Azure Data Explorer
- SQL Database
- Azure Cache for Redis
- Azure Cosmos DB
- Event Hubs
- Service Bus
- Event Grid
- Azure AD Domain Services

Demo: Create an Availability Set in Azure Portal

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Virtual Machines Agent and Extensions

Microsoft Services

Azure VM Agent

Manages VM interaction with the Azure Fabric Controller

Enables and executes Azure virtual machine extensions

Installed by default on Windows VMs deployed from Azure Gallery

Can be manually installed using a Windows installer package

Virtual Machine Extensions

- **Small applications** that provide **post-deployment configuration** and **automation tasks** on Azure virtual machines.
- **Custom script extension** allows any PowerShell script to be run on a VM

Prerequisites

- Azure VM Agent
- Each VM Extension may have its own set of prerequisites

Virtual Machine Extensions

Use cases

1. Apply **PowerShell Desired State configurations** to a virtual machine by using the **DSC extension** for Windows
2. **Configure** virtual machine **monitoring** by using the **Microsoft Monitoring Agent VM extension**
3. **Configure** an Azure virtual machine by using **Chef extension**
4. **Configure Disk Encryption** levering BitLocker by using **ADE extension**

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Virtual Machine Management

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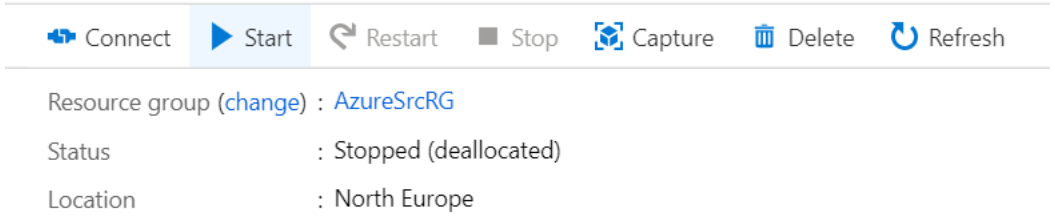
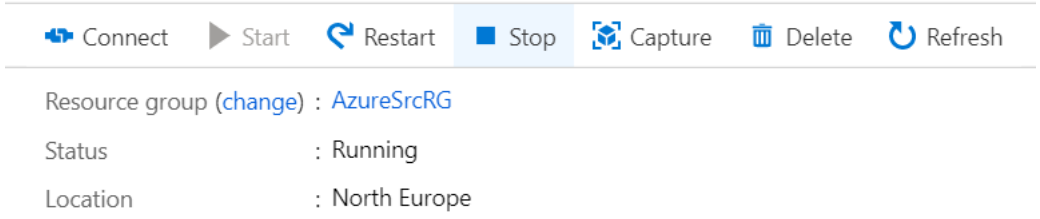
Start/Stop a Virtual Machine

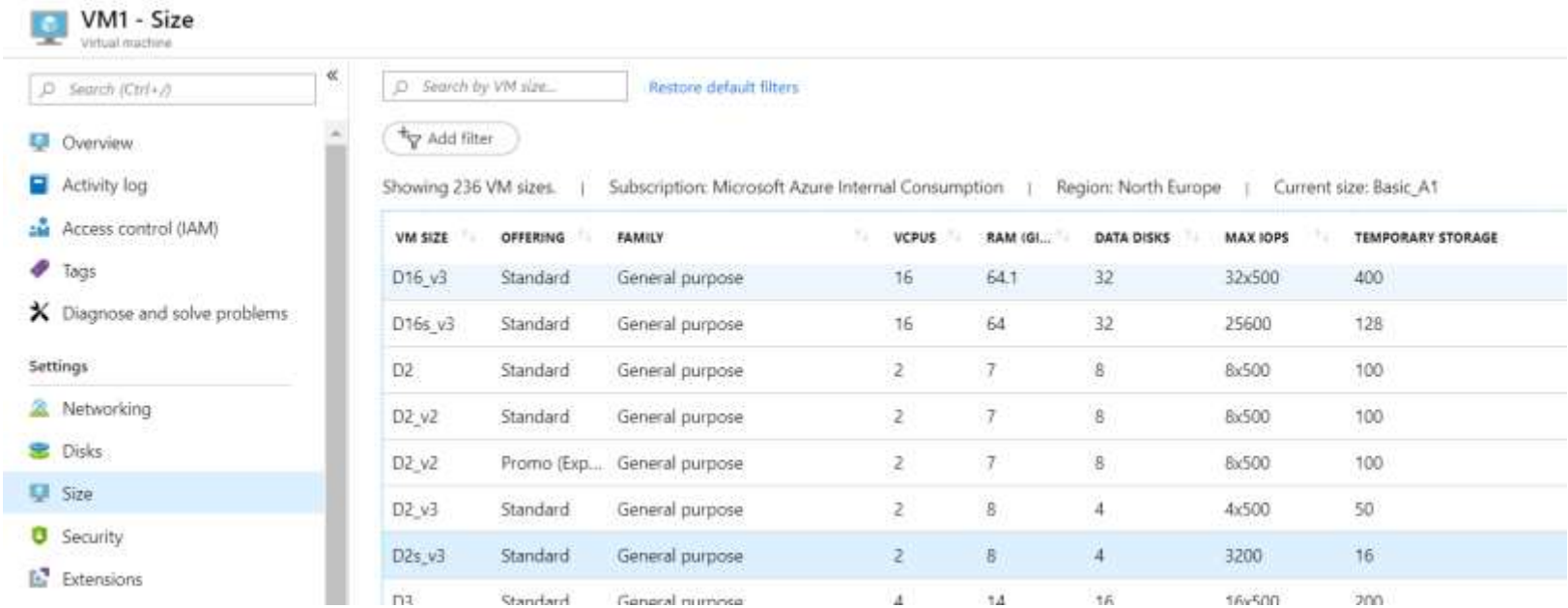
- Start and Stop are **1-click operations** in Azure Portal
- **Stopping** a VM will **deallocate** compute resources
- Start and stop options can be automatically trigger through Azure Automation





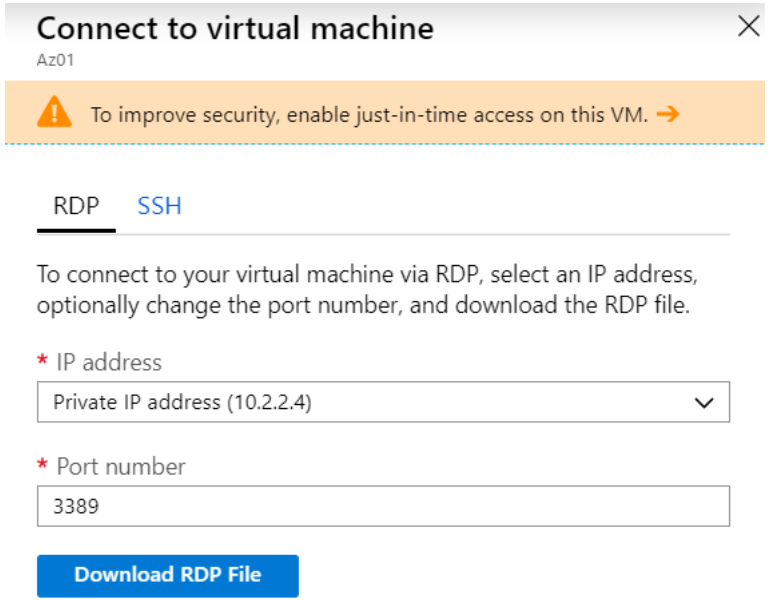
Resize a Virtual Machine

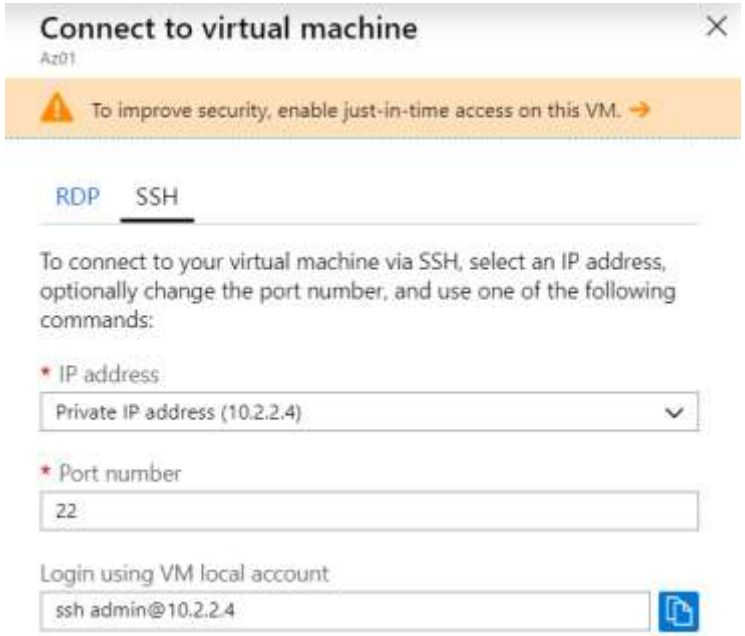
- After creation, a VM can be **scaled up or down** by changing its size
- It requires a simple **reboot**
- If the new size is not available on the hardware cluster that is hosting the VM, it must be deallocated first



Connect to a Virtual Machine

- To connect to a running VM use a **Remote Desktop (RDP)** or **Secure Shell (SSH)** session for Windows or Linux, respectively
- From AzurePortal:
  - Use the **Connect** button to connect through Private or Public IP





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Virtual Machines Scale Sets

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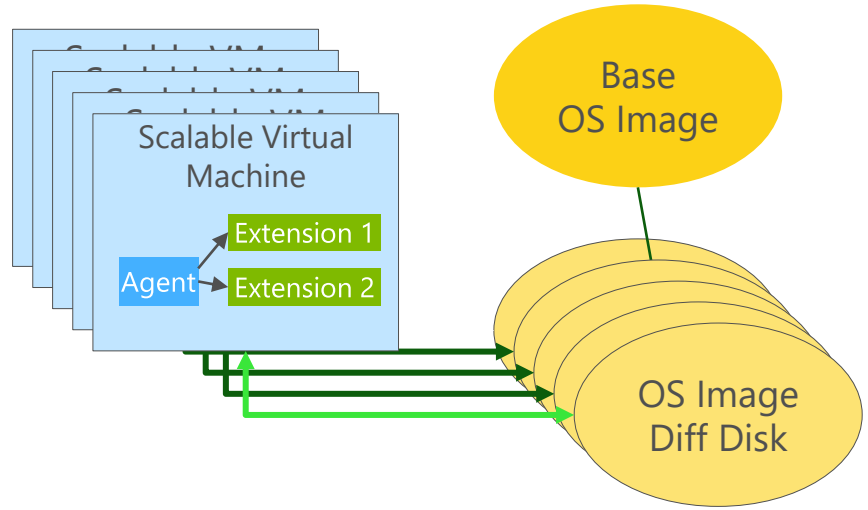
Virtual Machine Scale Sets

- Azure virtual machine scale sets let you create and manage a group of identical, load balanced VMs
- VM instances can automatically increase or decrease in response to demand or a defined schedule
- Provide high availability to your applications, and allow you to centrally manage, configure, and update a large number of VMs
- Build large-scale services for areas such as compute, big data, and container workloads



Virtual Machine Scale Sets Benefits

Easy to create and manage multiple VMs

All VM instances are created from the same base OS image and configuration allowing you to easily manage multiple VMs without additional configuration tasks or network management.

Provides high availability and application resiliency

If one of the VM instances has a problem, customers continue to access your application through one of the other VM instances with minimal interruption.

Allows your application to automatically scale as resource demand changes

Scale sets can automatically increase the number of VM instances as application demand increases, then reduce the number of VM instances as demand decreases.

Works at large-scale

Supports up to 1000 VM instances

Virtual Machine Scale Sets vs. Virtual Machines

Scenario	Manual group of VMs	Virtual machine scale set
Add additional VM instances	Manual process to create, configure, and ensure compliance	Automatically create from central configuration
Traffic balancing and distribution	Manual process to create and configure Azure load balancer or Application Gateway	Can automatically create and integrate with Azure load balancer or Application Gateway
High availability and redundancy	Manually create Availability Set or distribute and track VMs across Availability Zones	Automatic distribution of VM instances across Availability Zones or Availability Sets
Scaling of VMs	Manual monitoring and Azure Automation	Autoscale based on host metrics, in-guest metrics, Application Insights, or schedule

Demo: VM Scale Sets

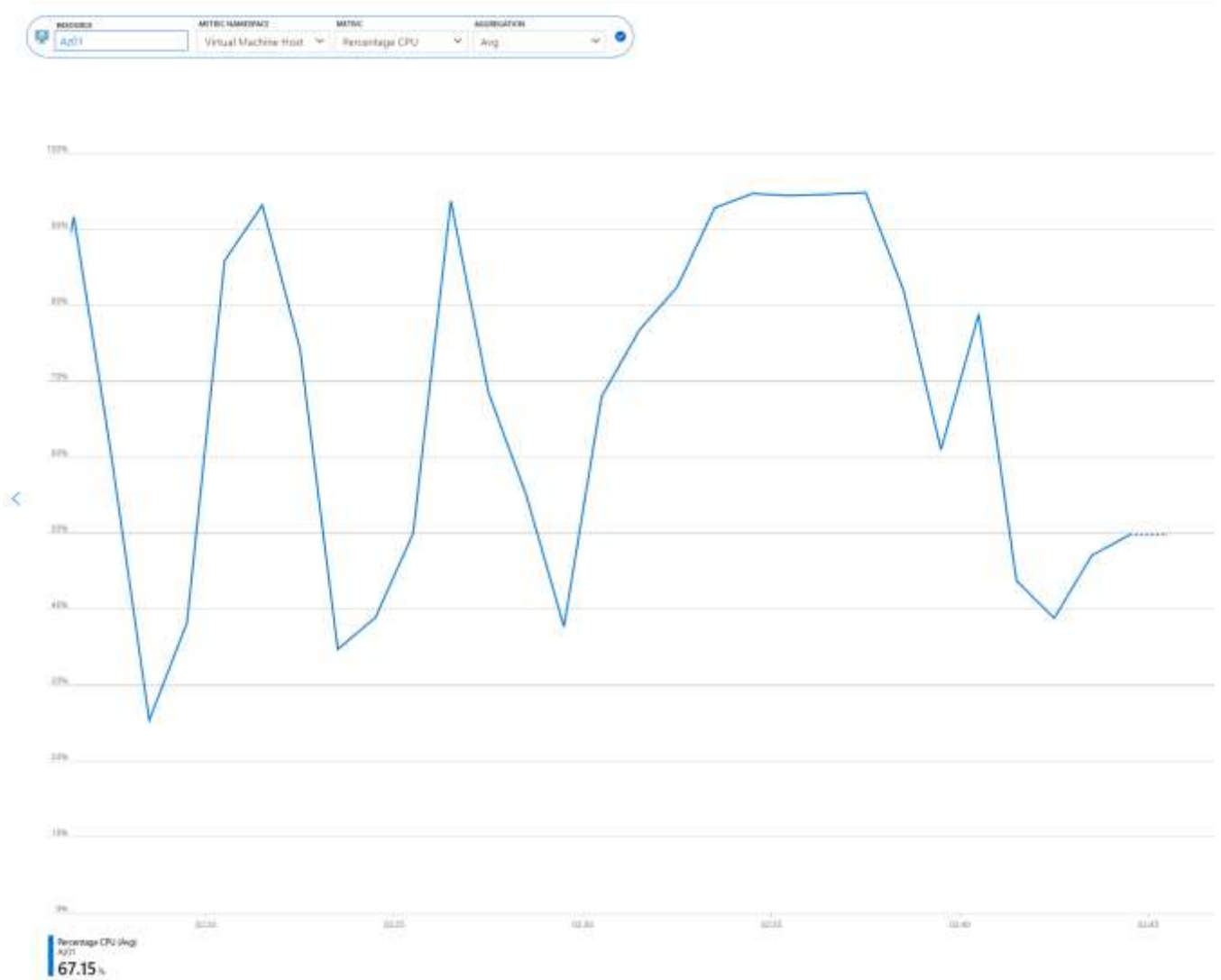
Microsoft

Azure Monitoring

Microsoft Services

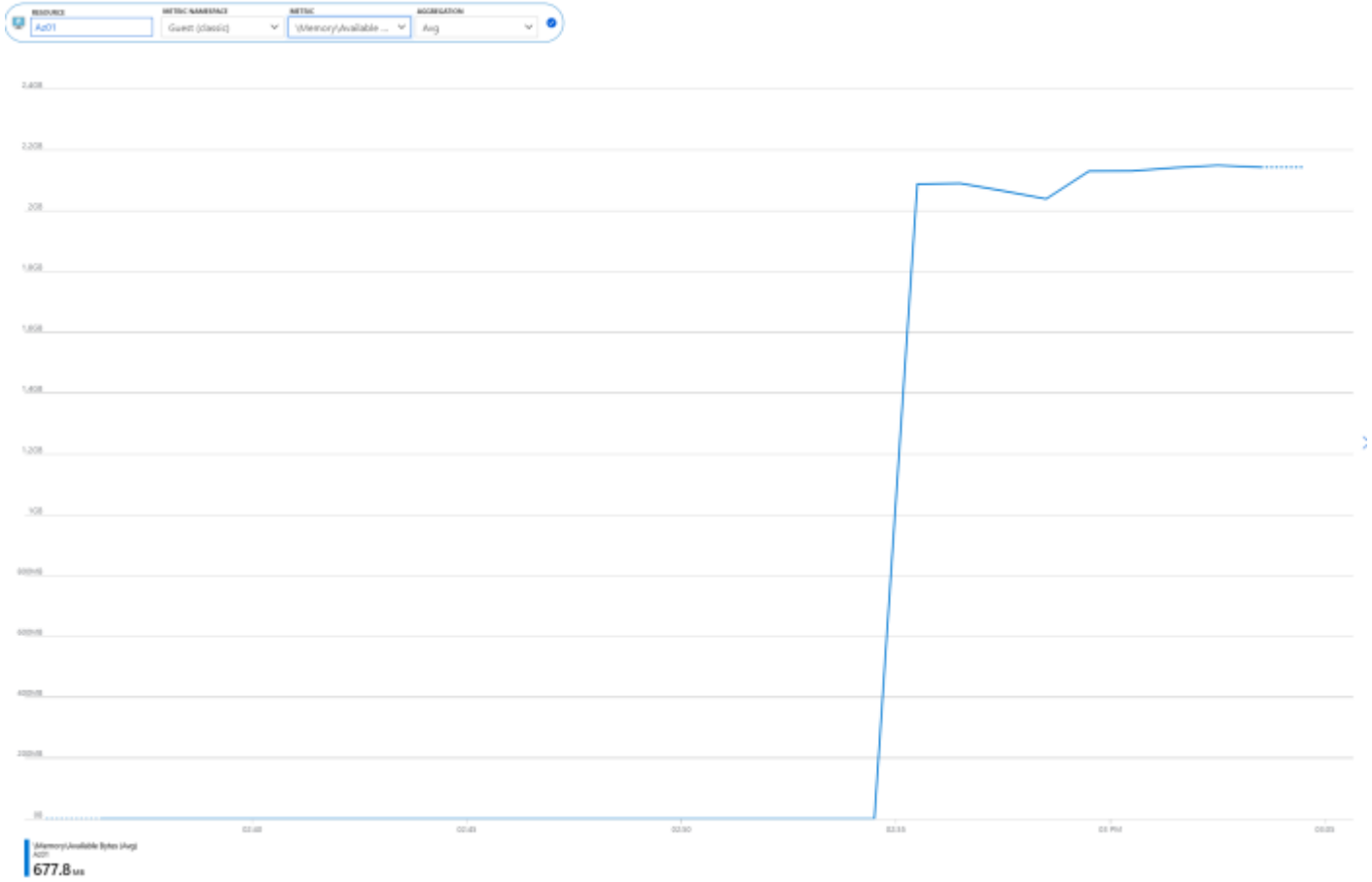
Azure Host Metrics

- Standard metrics are **host** computer metrics that are enable by default in all VMs
- Host metrics Examples:
  - Percentage CPU
  - Network In/Out
  - Disk Read/Write Operations
- For checking it, in Azure Portal click in **Metrics**



Azure Guest Metrics

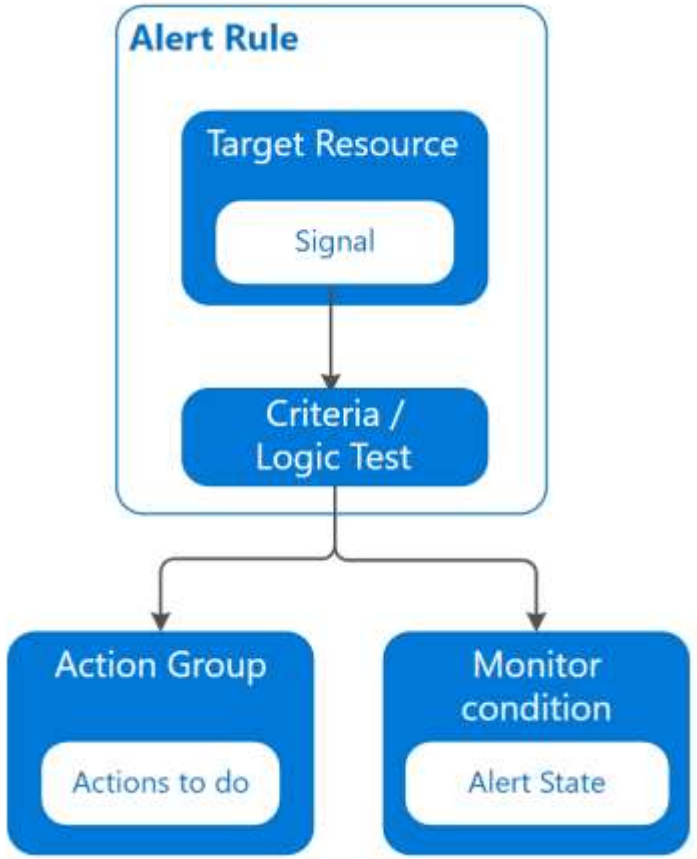
- **Guest** metrics can also be configured to be directly seen in Azure Portal
- Guest metrics Examples:
  - \Memory% Committed Bytes
  - \LogicalDisk(_Total)\% Free Space
  - \System\System Up Time
- For enabling it:
  - Azure Portal click in **Diagnostic Settings**
  - Enable **guest level monitoring**
  - Select what are the **Perf Counters** and **Rate**
- This will install Azure Diagnostics Extension and collect logs to a Storage Account



Azure VM Alerts

- Based on **host** or **guest** metrics, you can set up alerts that will trigger actions

- Possible actions examples:
  - Send a notification via SMS, Phone, Email, APP
  - Trigger an Automation Runbook (Resize VM, Start another VM, etc)
  - Trigger a Logic App or Azure Function
  - Trigger a Webhook

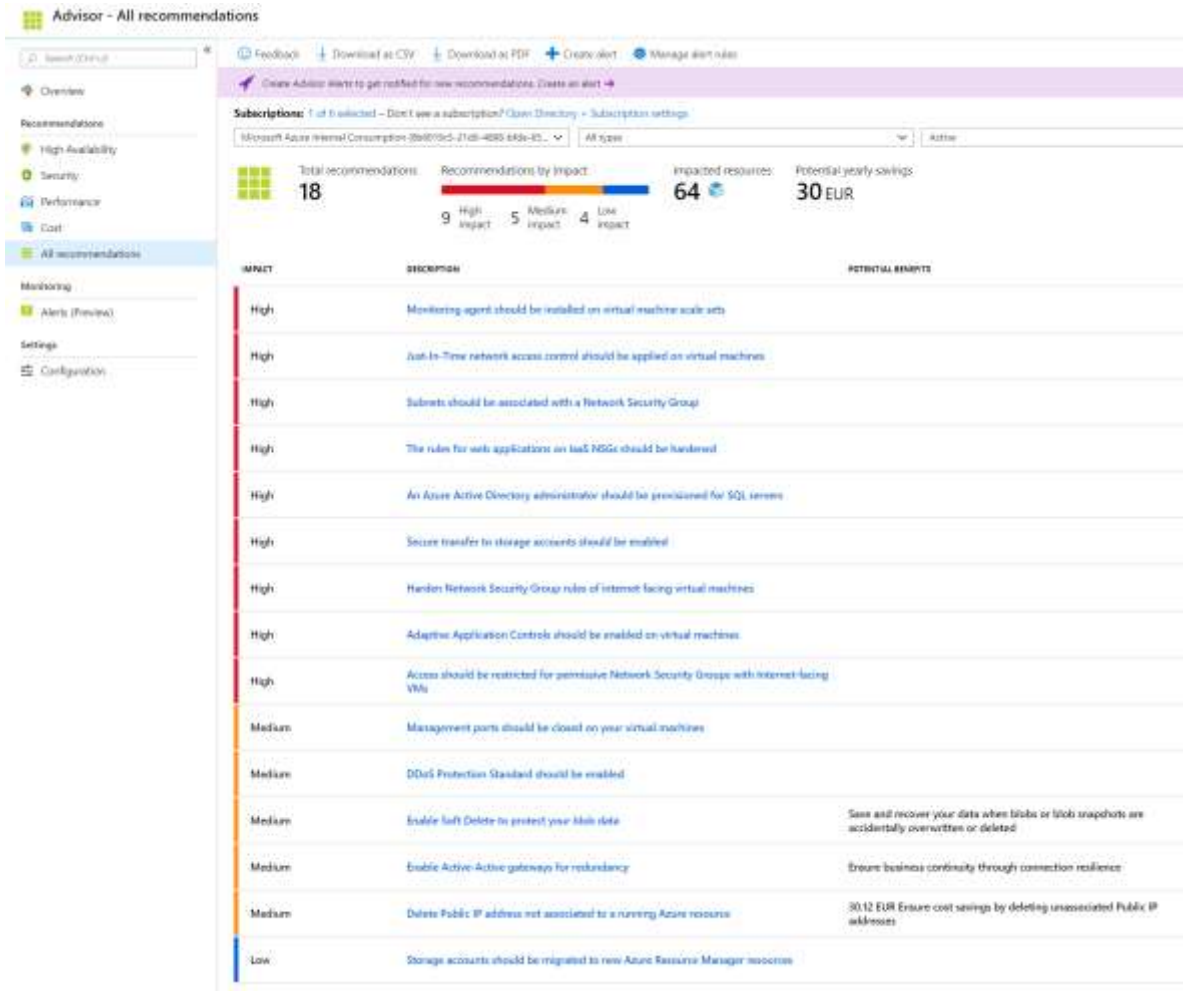


Azure Advisor

- Azure Advisor is a best practice analyzer for Azure deployments.
- Used to analyze your resource configuration and usage telemetry and recommend solutions to help improve the cost effectiveness, performance, high availability, and security of your Azure resources.
- Accessed via Azure portal or REST API, no PowerShell support yet.
- Is a free service.

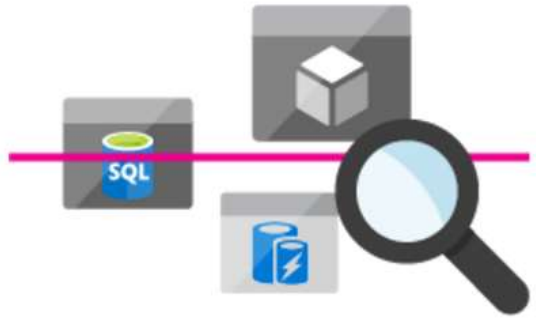
Azure Advisor Recommendation Categories

- **High Availability**: To ensure and improve the continuity of your business-critical applications.
- **Security**: To detect threats and vulnerabilities that might lead to security breaches.
- **Performance**: To improve the speed of your applications.
- **Cost**: To optimize and reduce your overall Azure spend.



Azure Advisor Operations & Management

- Provides recommendations for Virtual Machines, Availability Sets, Application Gateways, App Services, SQL servers, SQL databases, and Redis Cache.
- Advisor recommendations are updated hourly.
- Access Advisor recommendations as Owner, Contributor, or Reader for a subscription, a resource group, or a specific resource.
- Snooze or dismiss a recommendation.



Demo: Azure Monitoring and Azure Advisor

Microsoft

Lab: Introduction to Azure Virtual Machines

Microsoft Services