



Azure Virtual Machines

Microsoft Services



Agenda

- Virtual Machines overview
- Virtual Machines Sizes
- Virtual Machines Availability
- Virtual Machines Disks
- Virtual Machines Image Mobility
- Virtual Machines Agent and Extensions
- Virtual Machines Scale Sets
- Virtual Machine Accelerated Networking
- Azure Event Grid
- Azure Advisor

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

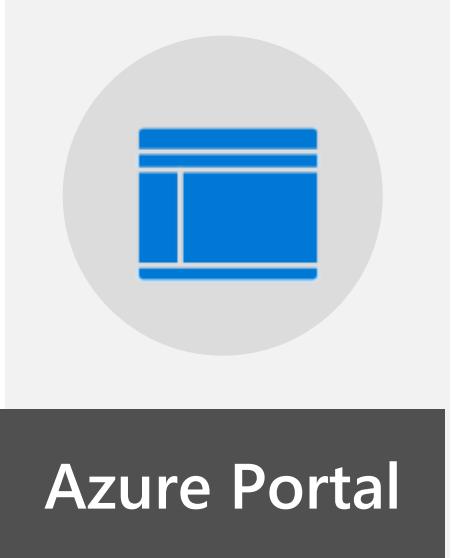
Disaster recovery

IaaS-based disaster recovery solution

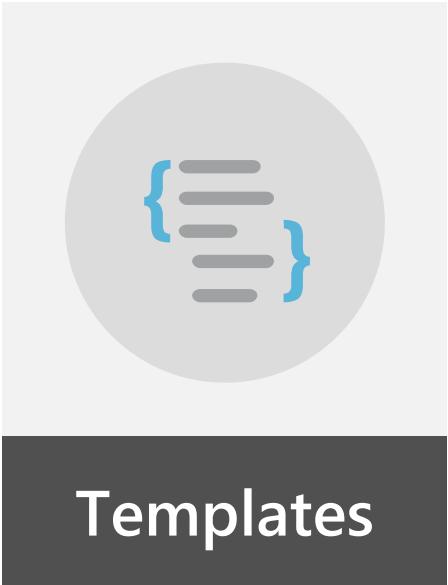
What do I need to think about before creating a VM?

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

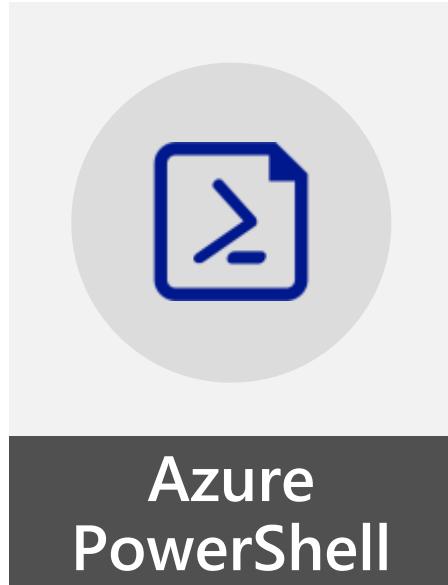
Tools to create and manage VMs



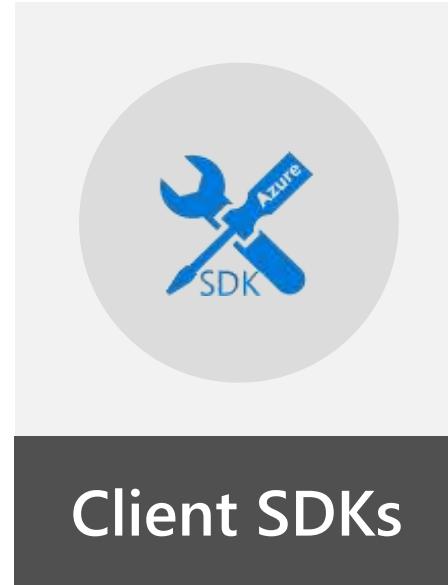
Azure Portal



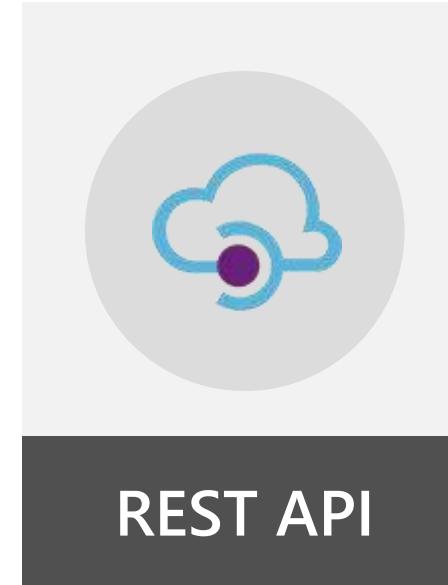
Templates



Azure
PowerShell

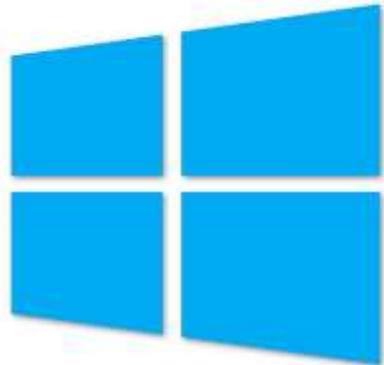


Client SDKs



REST API

Marketplace Images Available



Microsoft

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

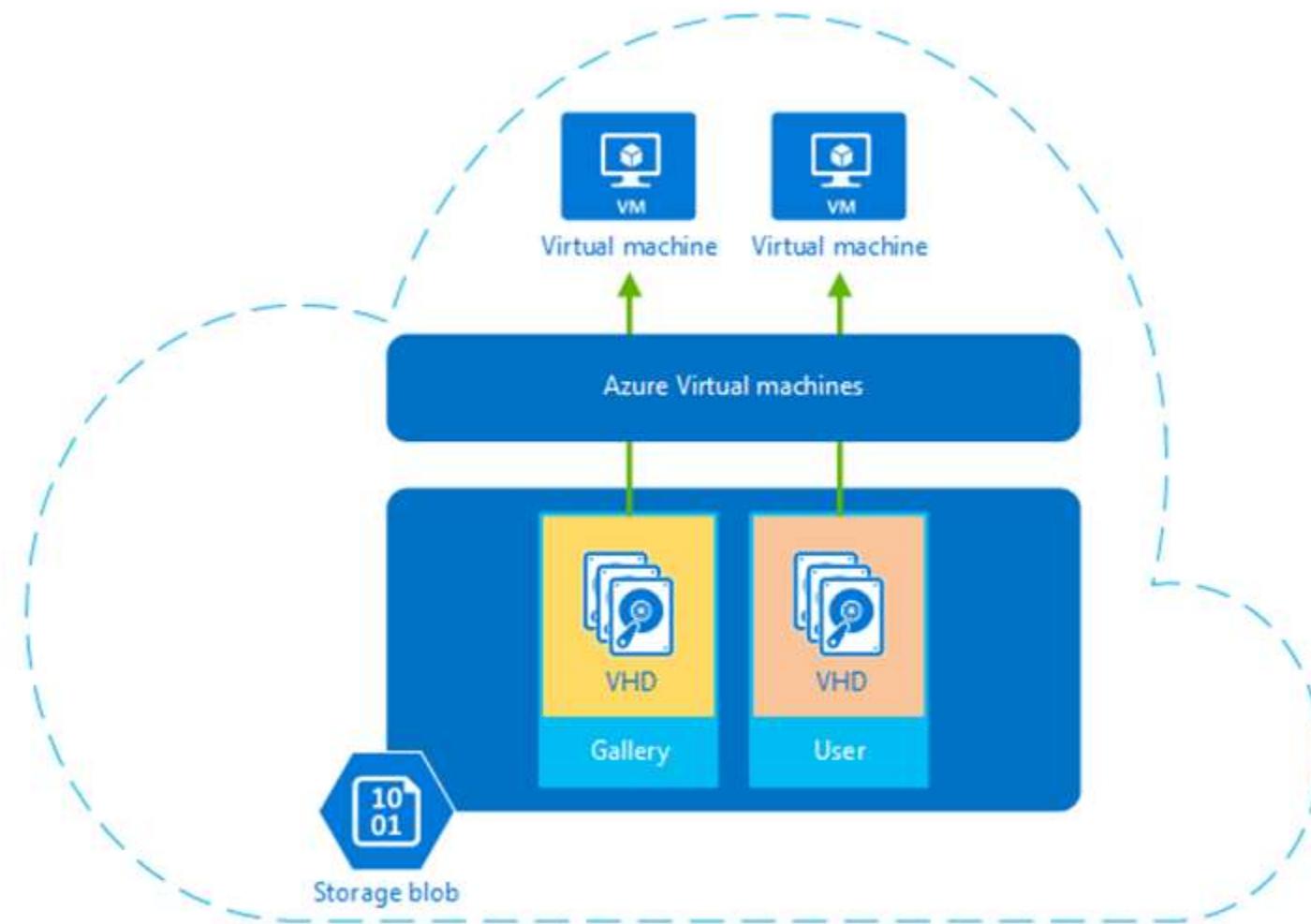


Open Source

- OpenSUSE 13.2
- CentOS 6.5 – 7.2
- Ubuntu 12.04/ Ubuntu 14.04 LTS
- SUSE Linux Enterprise Server 11 / 12
- Red Hat Enterprise Linux



Bring Your Own Server/VHD



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.



Pay only for what you use

Per-minute billing based on VM size and OS.

You only pay for the compute time you use.



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.



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.

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



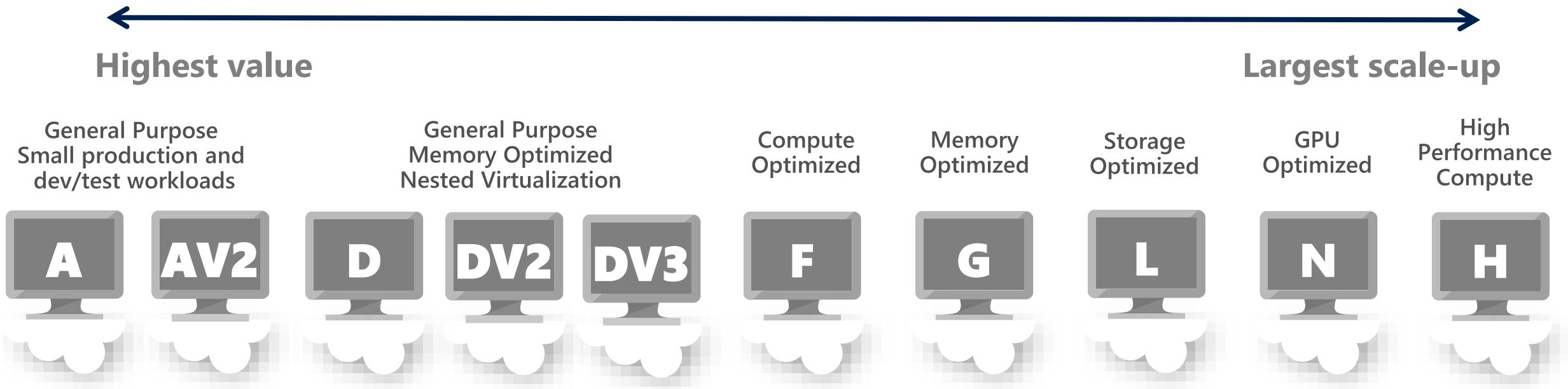


Virtual Machines Sizes

Microsoft Services



Series and Scale-up options



A-Series and Av2-Series

General Purpose



A-Series Basic

No load balancing
No auto-scaling

A-Series Standard

Best for dev & test and entry-level workloads
Earliest generation
Variety of hardware types and processors
Only supports HDD

Av2-Series

SSD temporary disk
Raised the amount of RAM per vCPU
Improved local disk random IOPS to be 2-10x faster than A-series

D-Series and Dv2-Series

General Purpose, Memory Optimized



D-Series

Good combination for most common production applications
Designed to run applications that demand higher compute power and temporary disk performance

Faster processors, higher memory-to-core ratio and
SSD temporary disk

Dv2-Series

More powerful CPU – 35% faster than D-series
Intel E5-2673 v3 CPUs
Same memory and disk configurations as the D-series

DS-series and DSv2-series can use Premium Storage
VM's disks hosted on Solid-State Drives (SSDs)

Dv3-Series

Memory to vCPU Optimized and Nested Virtualization Enabled



Dv3-Series

Good combination for most common production applications

Designed to run applications that demand higher compute power and temporary disk performance

Nested virtualization

Hyper-V Containers

Hyper-Threading Technology

Intel E5-2673 v4 CPUs

Same memory and disk configurations as the D-series

Faster processors, higher memory-to-vCPU ratio
and SSD temporary disk

DSv3-series can use Premium Storage
VM's disks hosted on Solid-State Drives (SSDs)

F-Series

Compute Optimized



F-Series

Optimized for compute-intensive applications, such as, Gaming or Analytics

More CPU to memory ratio

Same CPU performance as the Dv2-series (Intel E5-2673 v3 CPUs)

Lower per-hour list price

FS-series can use Premium Storage
VM's disks hosted on Solid-State Drives (SSDs)

G-Series

Memory Optimized



G-Series

Designed to run applications that demand faster CPUs, better local disk performance, or have higher memory demands.

Powerful combination for many enterprise-grade applications.

Intel Xeon E5 V3 family processors

GS-series can use Premium Storage
VM's disks hosted on Solid-State Drives (SSDs)

Ls-Series

Storage Optimized



Ls-Series

Optimized for workloads that require low latency local storage, such as, NoSQL databases (e.g. Cassandra, MongoDB, Cloudera, and Redis)

Intel Xeon processor E5 v3 family

Same CPU performance as the G/GS-Series and 8 GiB of memory per CPU core.

Local SSD based storage

NC-Series and NV-Series

GPU Optimized



NC-Series

Optimized to run GPU-Accelerated Workloads

Include NVIDIA's GPU cards, optimized for different scenarios and use cases.

The NC sizes are more optimized for compute-intensive and network-intensive applications and algorithms, including CUDA and OpenCL-based applications and simulations.

NVIDIA's Tesla K80 card

Supported operating systems
Windows Server 2016, Windows Server 2012 R2
Ubuntu 16.04 LTS

NV-Series

The NV sizes are optimized and designed for remote visualization, streaming, gaming, encoding and VDI scenarios utilizing frameworks such as OpenGL and DirectX.

NVIDIA's Tesla M60 GPU card and NVIDIA GRID

Supported operating systems
Windows Server 2016, Windows Server 2012 R2

H-Series and A-Series

High Performance Compute



H-Series

A-Series (A8-A11)

Optimized for compute-intensive and network-intensive applications, including high-performance computing (HPC) cluster applications, modeling, and simulations.

Intel Xeon E5-2667 v3 @ 3.2 GHz
DDR4 memory and local SSD based storage

Intel Xeon E5-2670 @ 2.6 GHZ

H-Series and A-Series

High Performance Compute



Key features

High-performance hardware

Designed and optimized for compute-intensive
and network-intensive applications

*E.g. high-performance computing (HPC), batch applications, modeling,
and large-scale simulations.*

Designed for HPC clusters

Deploy multiple compute-intensive instances
to create a stand-alone HPC cluster
or to add capacity to an on-premises cluster.

RDMA network connection for
MPI applications

Some sizes feature a second network interface
for remote direct memory access (RDMA) connectivity.



Virtual Machines Availability

Microsoft Services



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

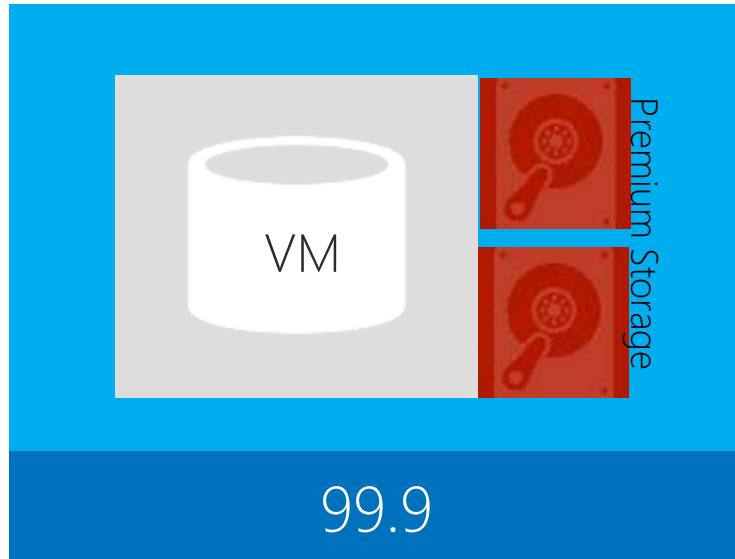
Best practices for high availability

Configure multiple virtual machines in an
availability set for redundancy

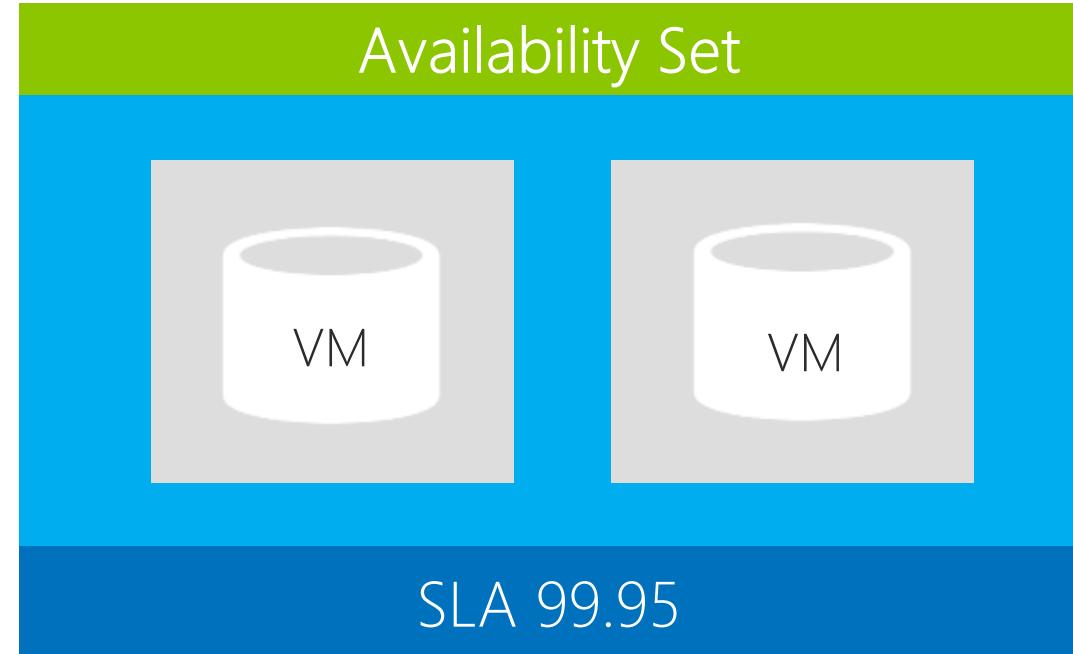
Configure each **application tier** into
separate availability sets

Combine **Load Balancers** with **availability sets**

VM Availability Sets and Service Level Agreements (SLA)



For any **Single Instance** Virtual Machine using **Premium Storage** for all disks, we guarantee you will have Virtual Machine Connectivity of at least 99.9%.



For all **Virtual Machines** that have **two or more instances** deployed in the same **Availability Set**, we guarantee you will have Virtual Machine Connectivity to at least one instance at least 99.95% of the time.

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

Fault and Update Domains

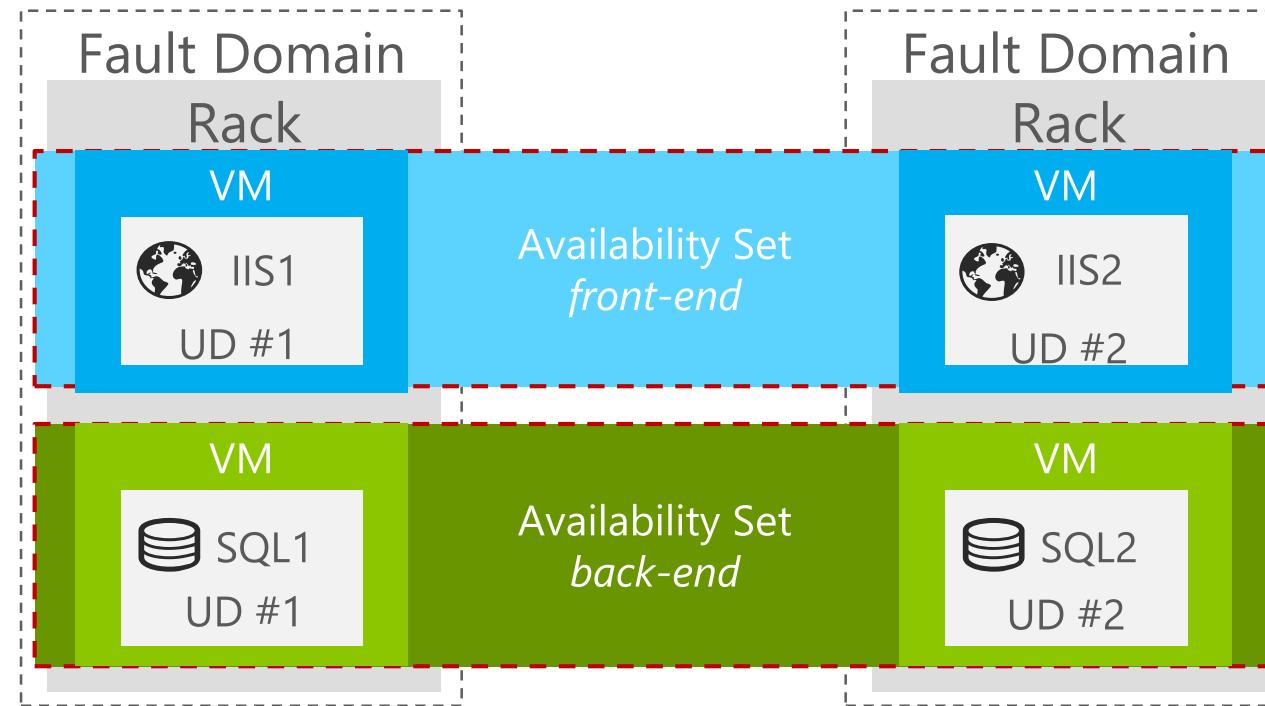
Fault Domains

- Represent groups of resources anticipated to fail together, i.e. same rack, same server
- 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
- IaaS V2 – 3 fault domains by default

Update Domains

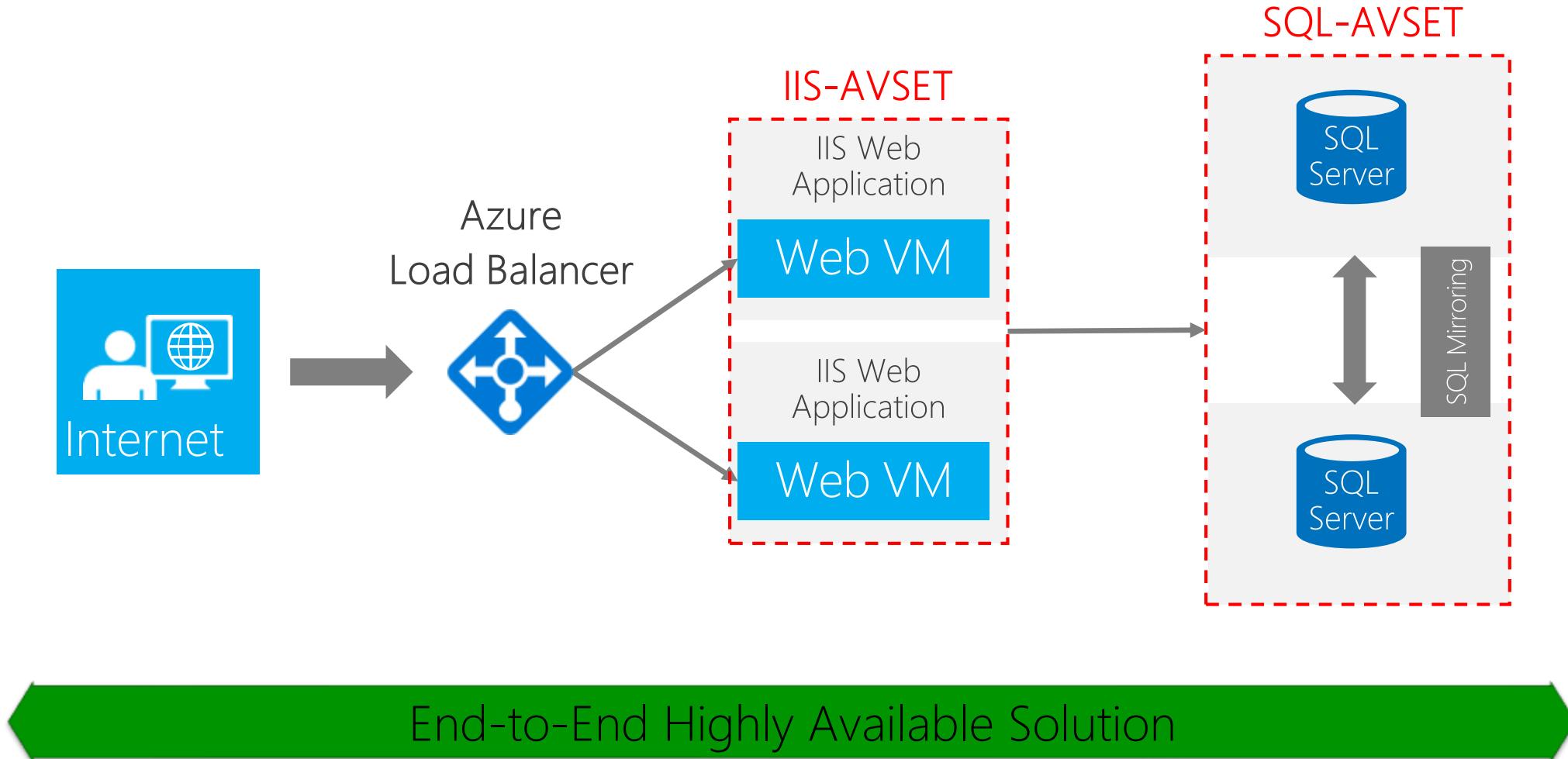
- Represents groups of resources that will be updated together
- Host OS updates honor service update domains
- Specified in service definition
- IaaS v1 – Default of five (up to 5)
- IaaS v2 – more than 5 update domains

Application tiers into separate Availability Sets



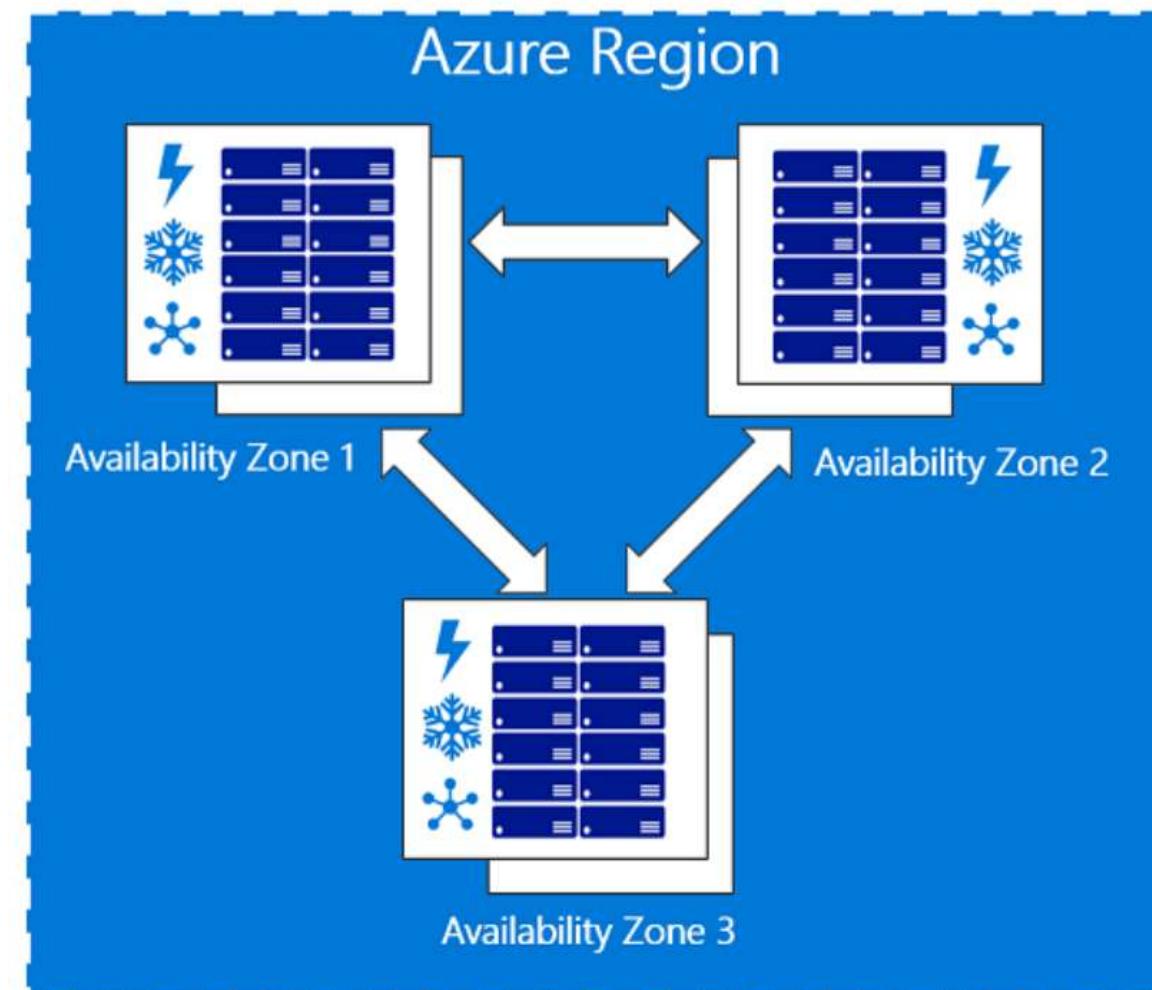
Update domains are honored by host OS updates

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
- Can be used as an alternate to Availability Sets
- ~1.2 ms latency between datacenters



Supported Availability Zones Services

- Linux Virtual Machines
- Windows Virtual Machines
- Virtual Machine Scale Sets
- Managed Disks
- Load Balancer
- Public IP address
- Zone-Redundant Storage
- SQL Database

Demo: Create an Availability Set in Azure Portal





Virtual Machines Disks

Microsoft Services



VM disk layout – Windows OS

OS Disk

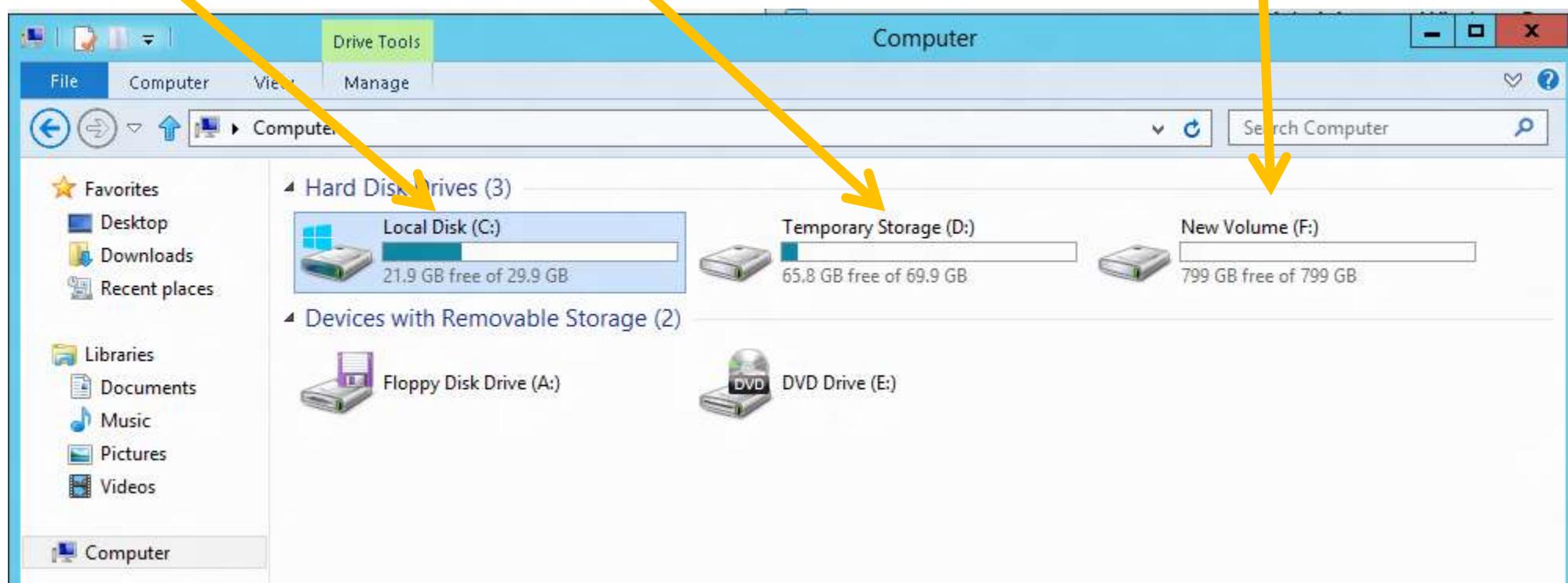
- Persistent
- SATA
- **Drive C:**

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
- 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	1023 GB	1023 GB
Imaging Capable	Yes	No
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	Not Supported
Data Disks	Supported	Supported	Default
Temporary Disk	Not stored in Microsoft Azure Storage Blob Service		

Types of Disks and Performance

Performance		Types	
Standard	Premium	Unmanaged disks	Managed disks
Backed by HDDs Cost-effective storage Suitable for dev/test, non-critical, infrequent access Geo-replication options	Backed by SSDs High-performance and low-latency disk support Suitable for I/O-intensive workloads or mission critical production environment	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)



Virtual Machines Image Mobility

Microsoft Services



Introduction to Disks and Images

OS Images

- Microsoft
- Partner
- User



- Base OS image for new VMs
- Sysprep/Generalized/Read-only
- Created by uploading or by capture

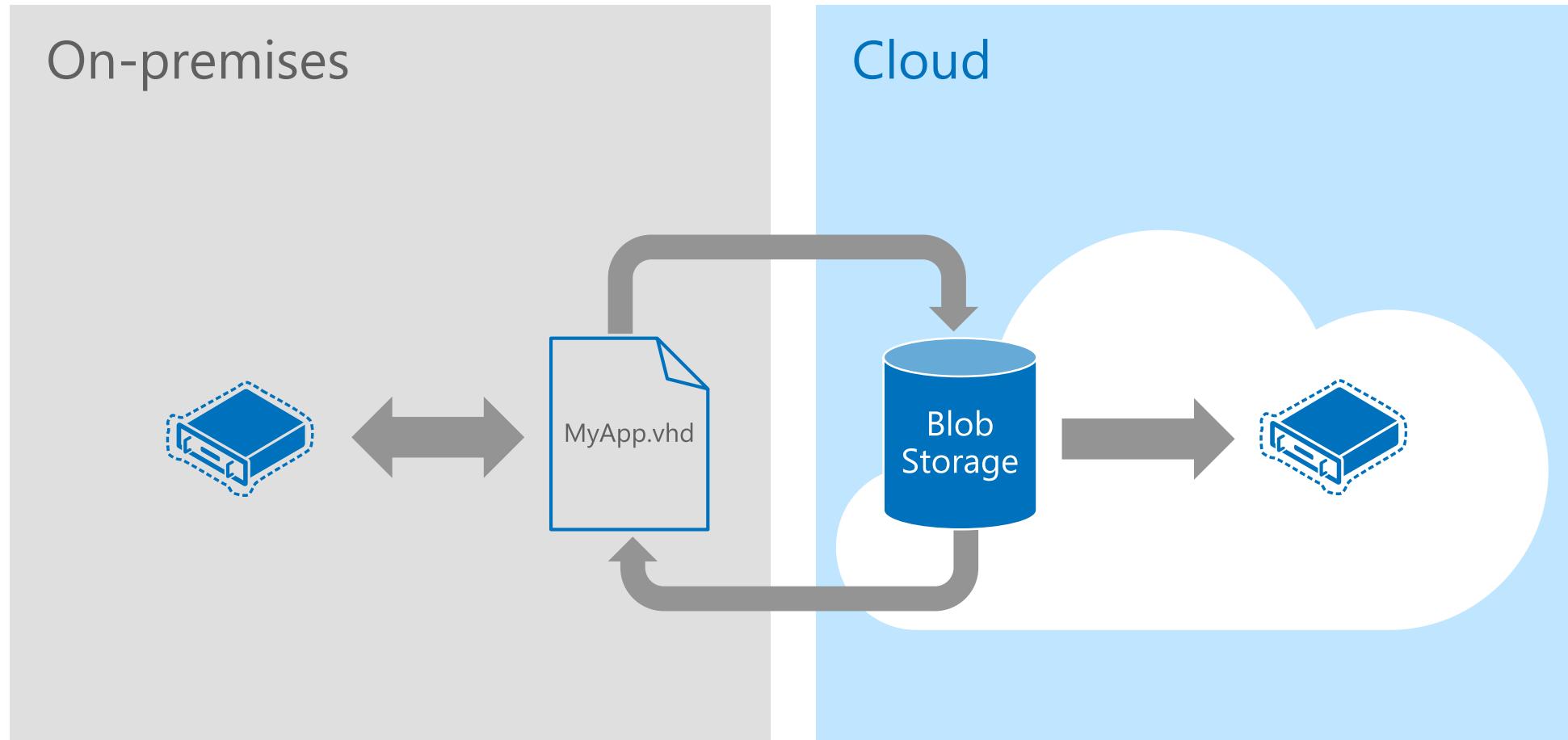
Disks

- OS Disks
- Data Disks

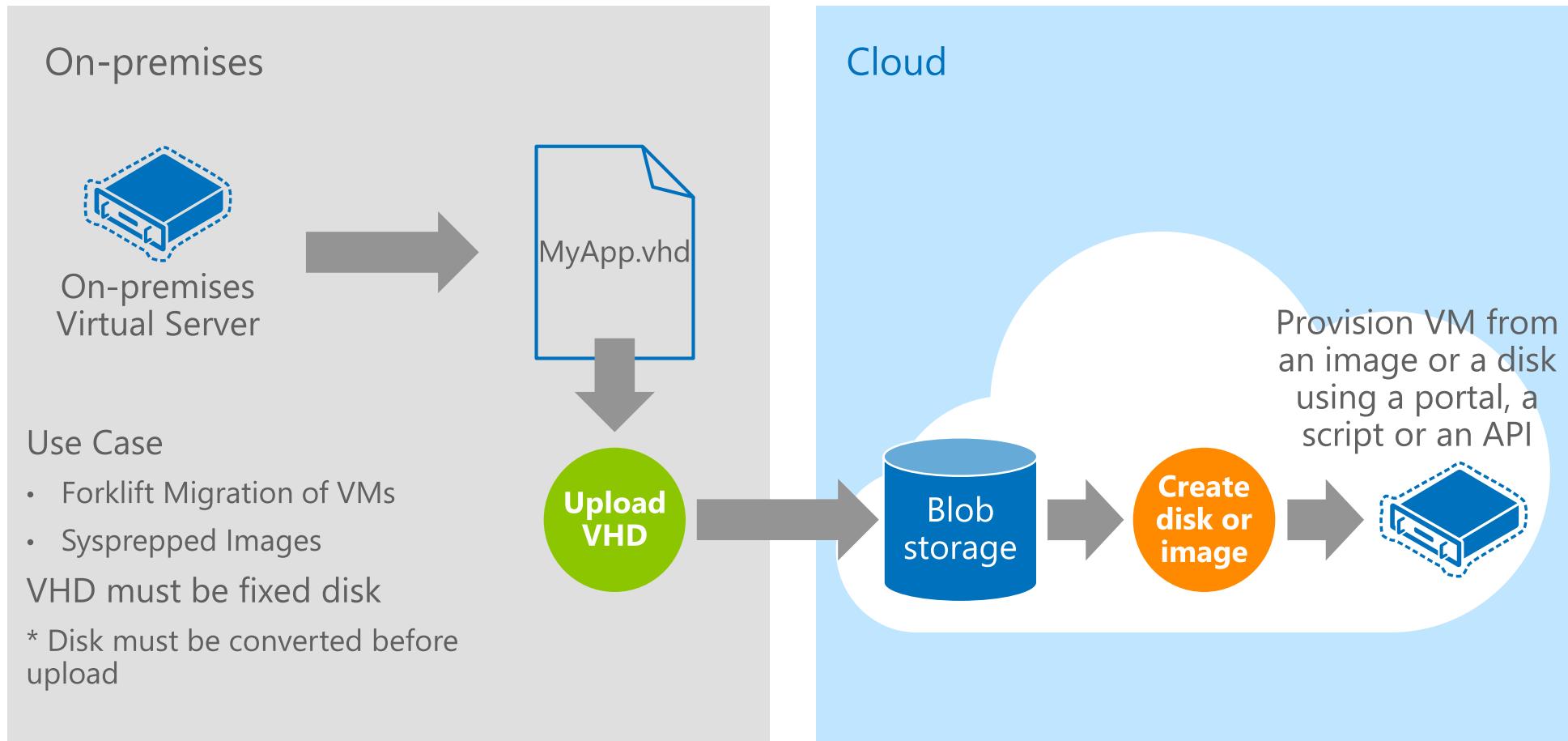


- Writable disks for VMs
- Created during VM creation or during upload of existing Virtual Hard Disks (VHDs)

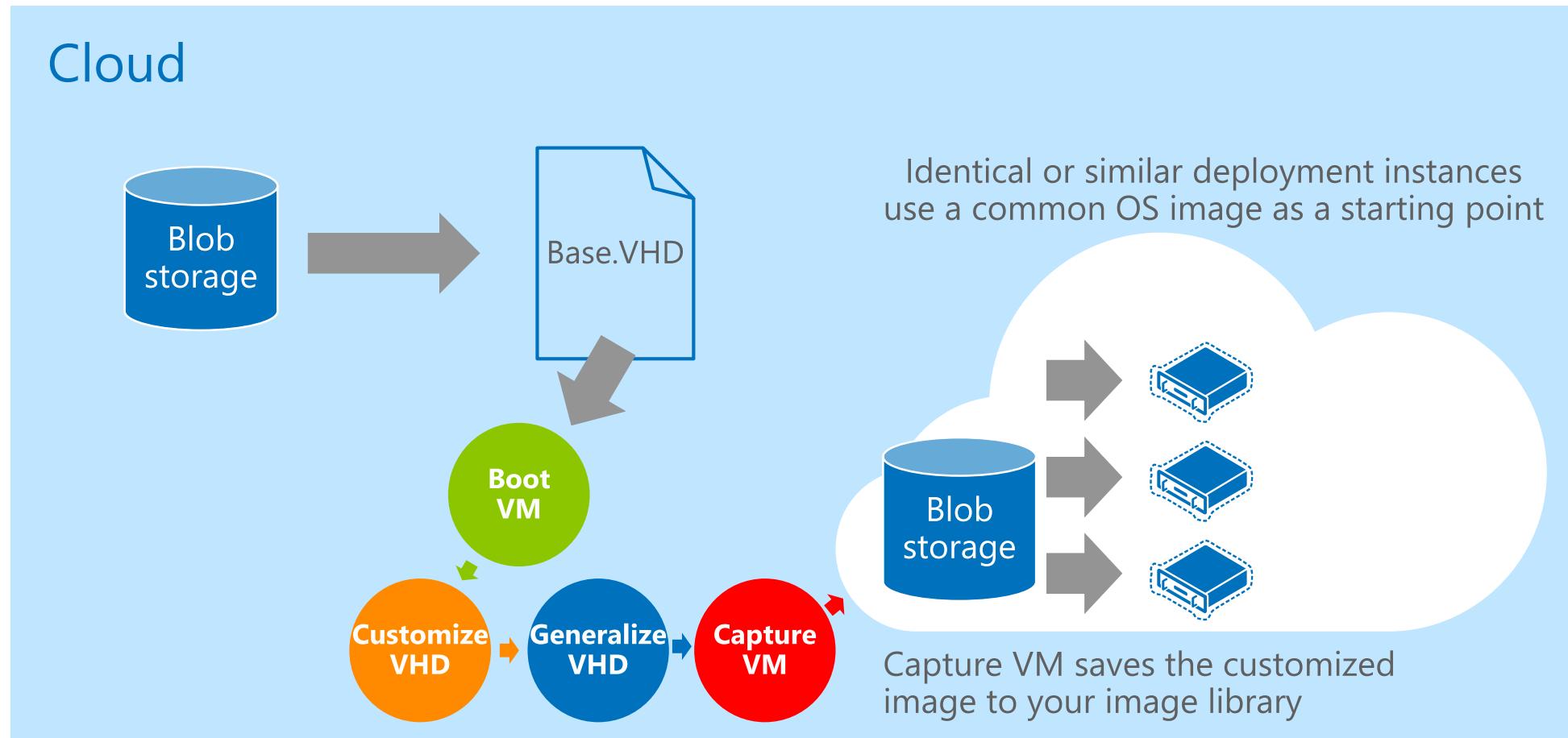
Image Mobility



Bring Your Own Server/VHD

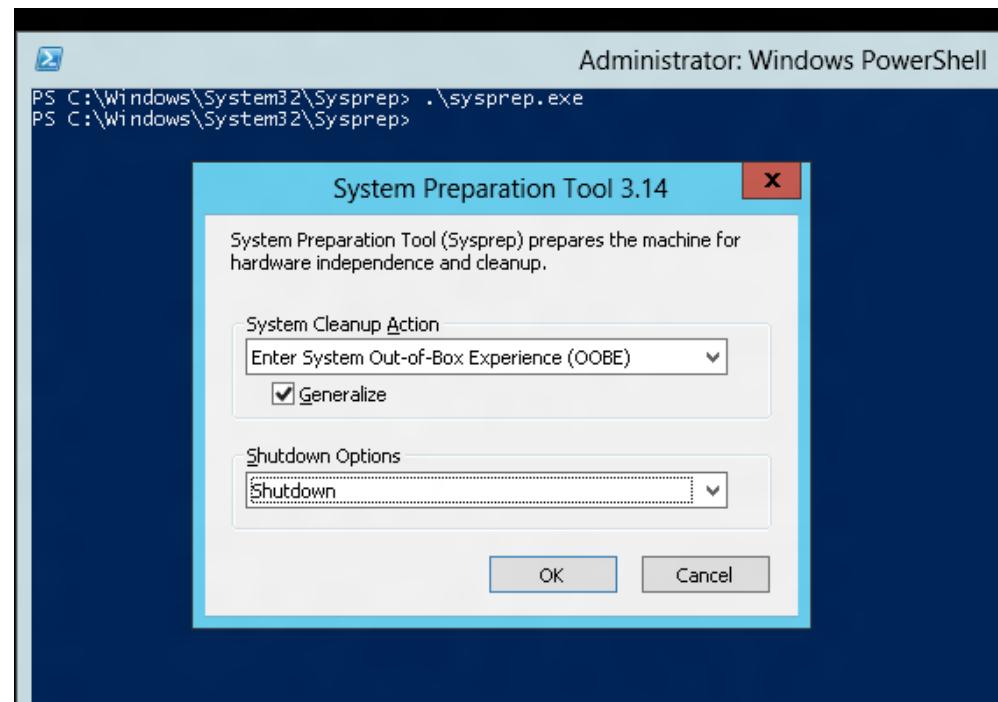


Imaging VMs in the Cloud



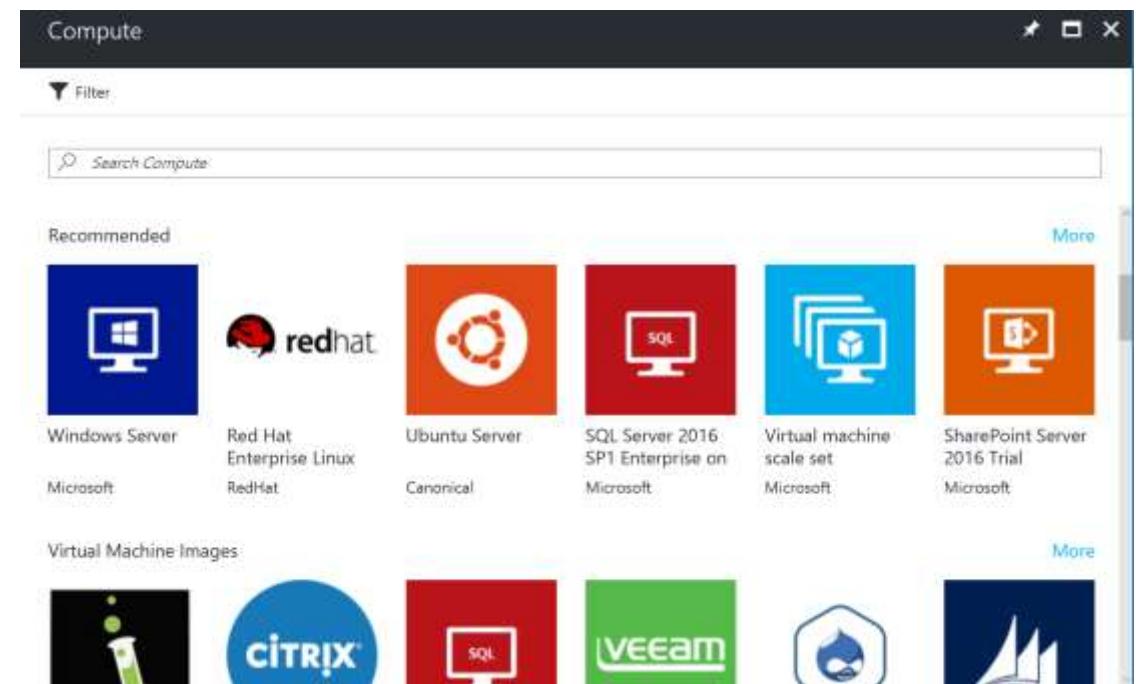
Tips on Bring Your Own (BYO) Generalized Images

- 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



Marketplace VM Images

- Allows you to create VMs based on Microsoft or Partners Images
- Images available depend on each location
- Images are organized in the following categories:
 - Publisher
 - Offer
 - SKU



Azure Hybrid Use Benefit (HUB)

- Prerequisite
 - Windows Server or Windows Client licenses with Software Assurance.
- Benefit
 - Use on-premises licenses on Windows Virtual Machines running on Azure.
- How to use
 - *With an Enterprise Agreement subscription:* deploy VMs from specific Marketplace images that are pre-configured with Azure HUB.
 - *Without an Enterprise Agreement subscription:* upload a custom VM and deploy using a Resource Manager template or Azure PowerShell.

The screenshot shows a search interface with a dark blue header containing the word "Everything". Below the header is a "Filter" button with a funnel icon. A search bar contains the text "[HUB] Windows". The main area is titled "Results" and has a column header "NAME". Five items are listed, each with a small blue square icon containing a white server symbol:

- [HUB] Windows Server 2016 Datacenter
- [HUB] Windows 10 Enterprise Preview
- [HUB] Windows Server 2012 Datacenter
- [HUB] Windows Server 2012 R2 Datacenter
- [HUB] Windows Server 2008 R2 SP1



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
- Requires Port 8443 outbound

Prerequisites

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



Virtual Machine Extensions

Use cases

- Apply PowerShell Desired State configurations to a virtual machine by using the DSC extension for Windows.
- Configure virtual machine monitoring by using the Microsoft Monitoring Agent VM extension.
- Configure an Azure virtual machine by using Chef extension.



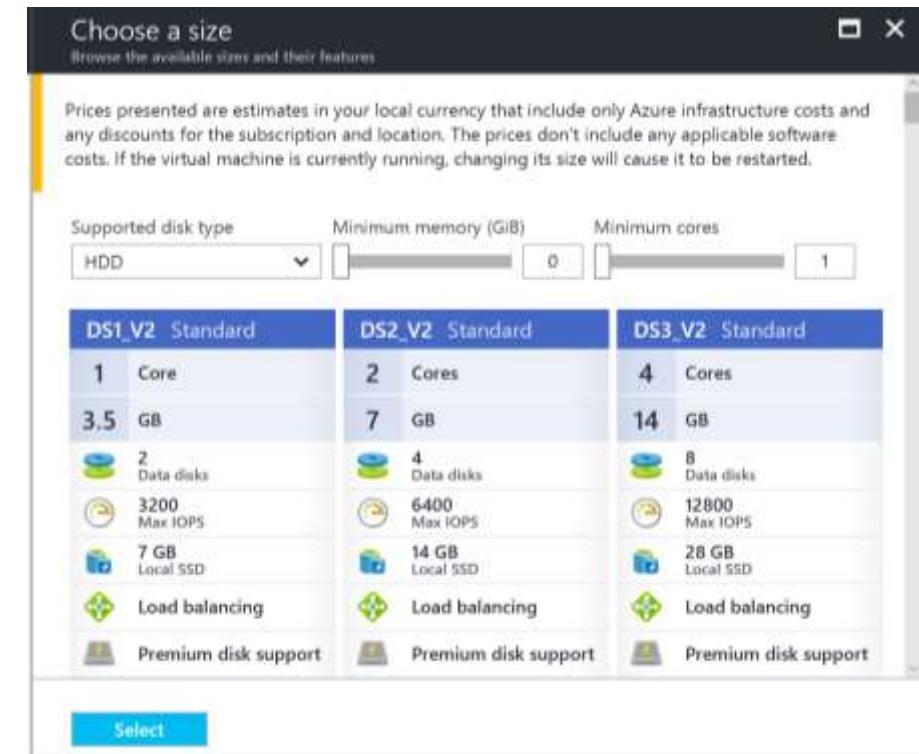
Virtual Machine Management

Microsoft Services



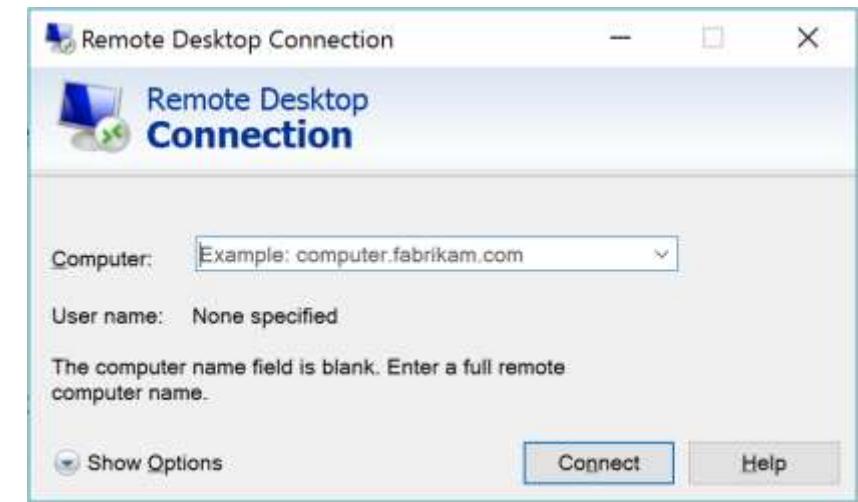
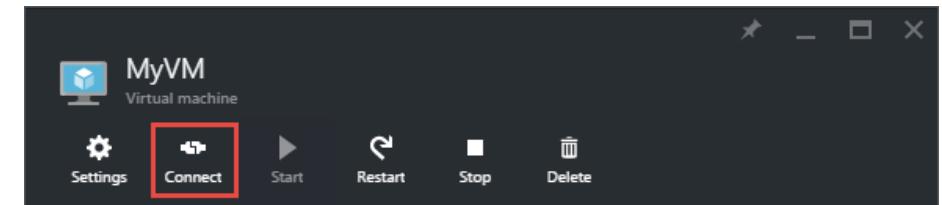
Resize a Virtual Machine

- After creation, a VM can be scaled up or down by changing its size.
- If the new size is not available on the hardware cluster that is hosting the VM, it must be deallocated first.
 - Don't forget: deallocating the VM releases any dynamic IP addresses assigned to the VM. The OS and data disks are not affected.
- To list the VM sizes that are available on the hardware cluster where the VM is hosted run the following command:
 - **Get-AzureRmVMSize -ResourceGroupName <resourceGroupName> -VMName <vmName>**



Connect to a Virtual Machine

- To connect to a running Windows VM use a Remote Desktop (RDP) session.
- From the Portal:
 - Use the Connect button to connect using a Public IP Address
- From your local machine:
 - Windows: Use Remote Desktop Connection application
 - Mac: Remote Desktop Client for Mac, e.g. [Microsoft Remote Desktop](#)





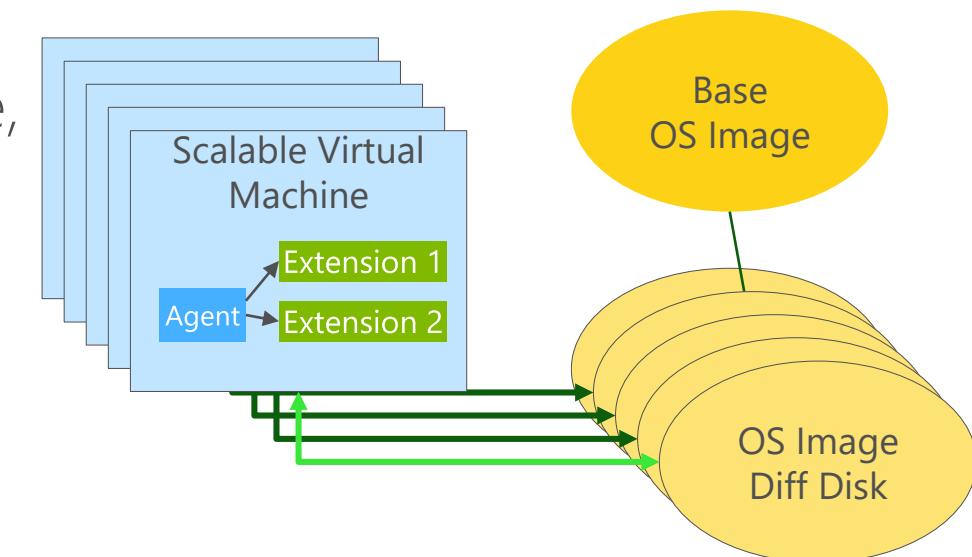
Virtual Machines Scale Sets

Microsoft Services



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





Virtual Machine Accelerated Networking

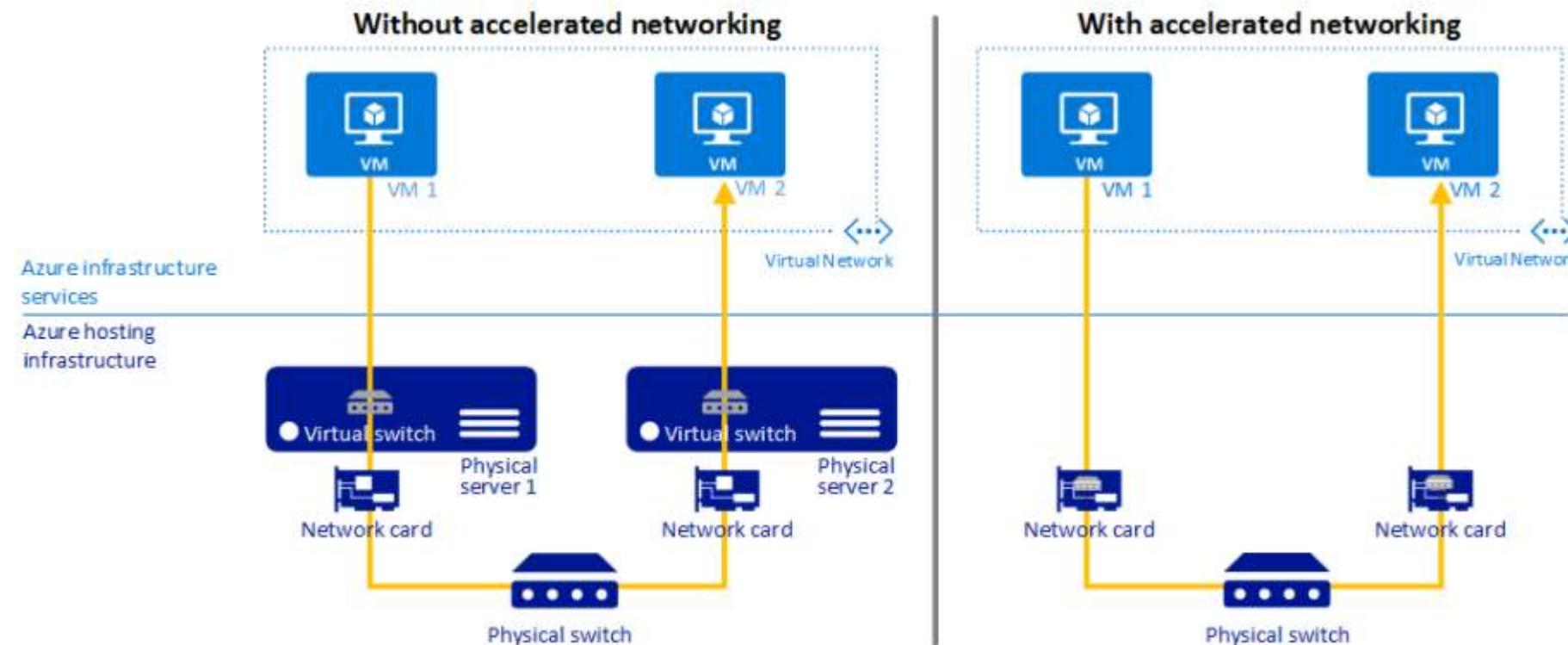
Microsoft Services



Virtual Machine with 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 only be attached to a VM when the VM is created and cannot be attached to an existing VM.
- Requires VM instances of 8 or more cores.
- Can only be enabled for a new NIC and not for an existing NIC.

Virtual Machine with Accelerated Networking

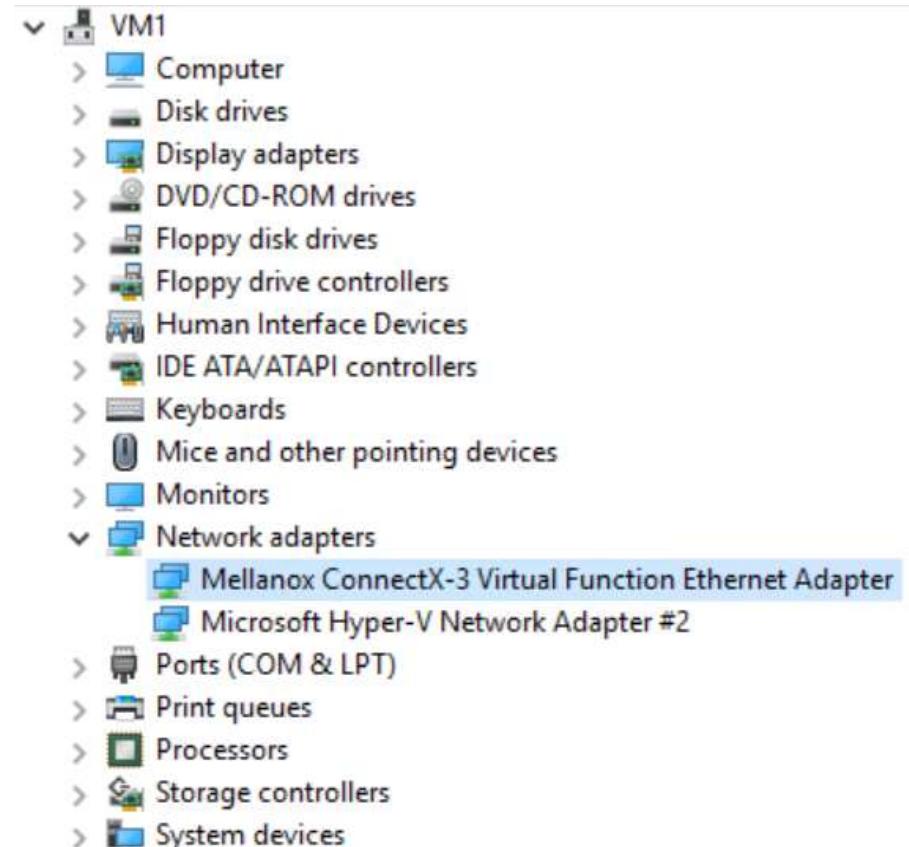


- Up to 25Gbps of throughput and reduces network latency by up to 10 times.

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.

Accelerated networking 





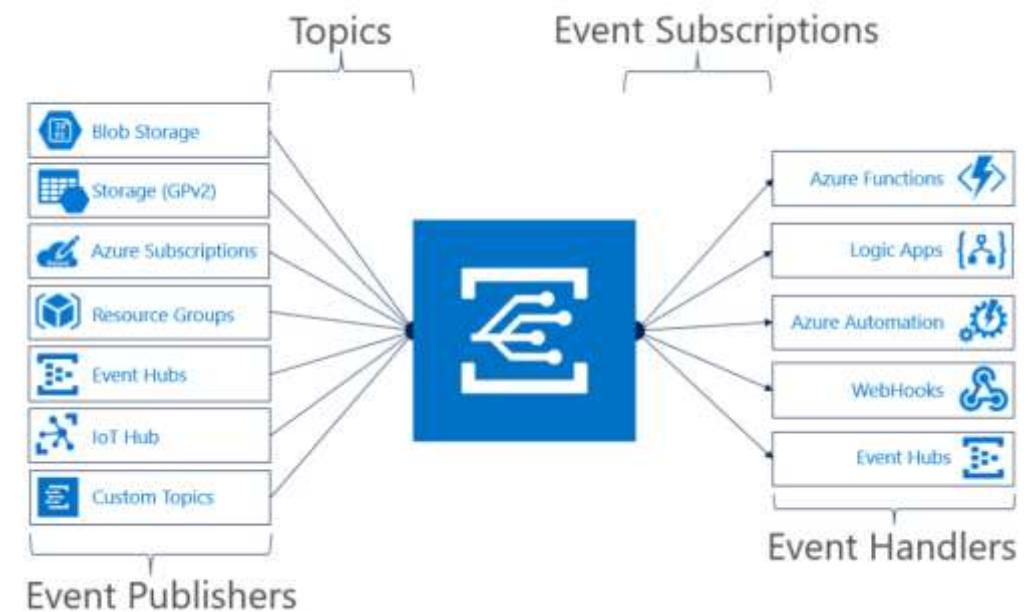
Azure Event Grid

Microsoft Services



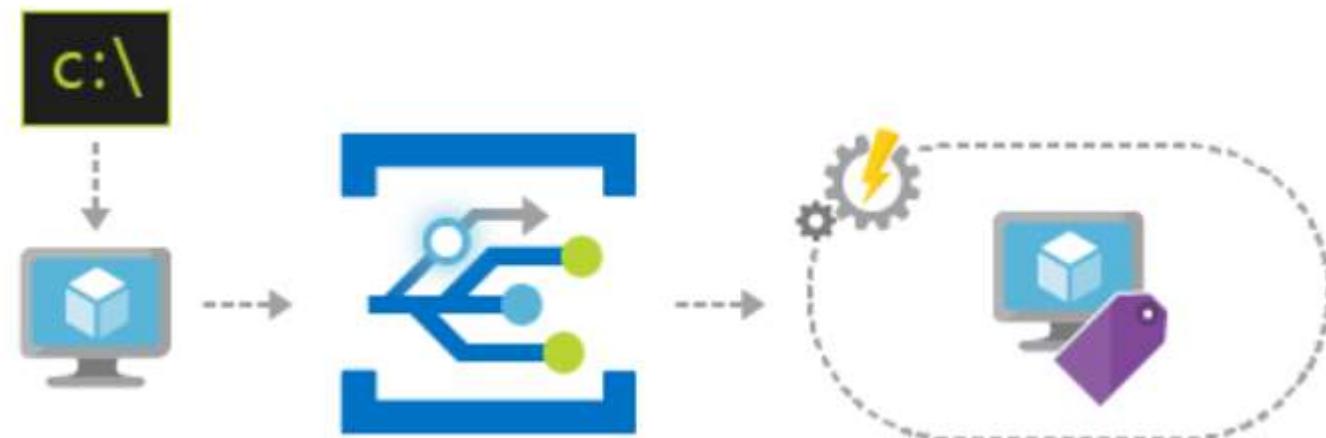
Azure Event Grid

- Azure Event Grid allows you to trigger some task when an event is logged e.g. send an email to the Azure Administrator when an event for a new VM creation is logged
- Select the Azure resource you would like to get events from and specify the event handler or WebHook endpoint to send the events to



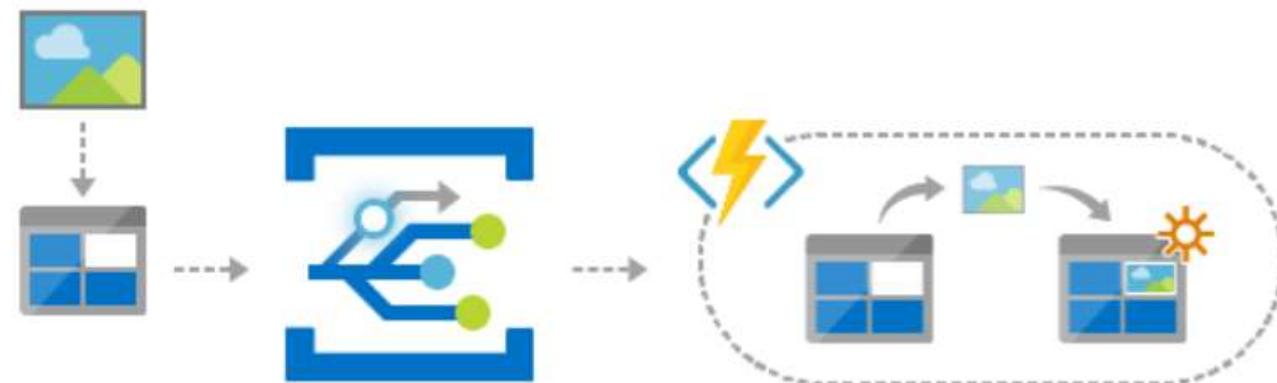
Azure Event Grid Benefits – Ops Automation

- Event Grid allows you to speed automation and simplify policy enforcement e.g. Event Grid can notify Azure Automation when a virtual machine is created, or a SQL Database is spun up
- These events can be used to automatically check that service configurations are compliant, put metadata into operations tools, tag virtual machines, or file work items



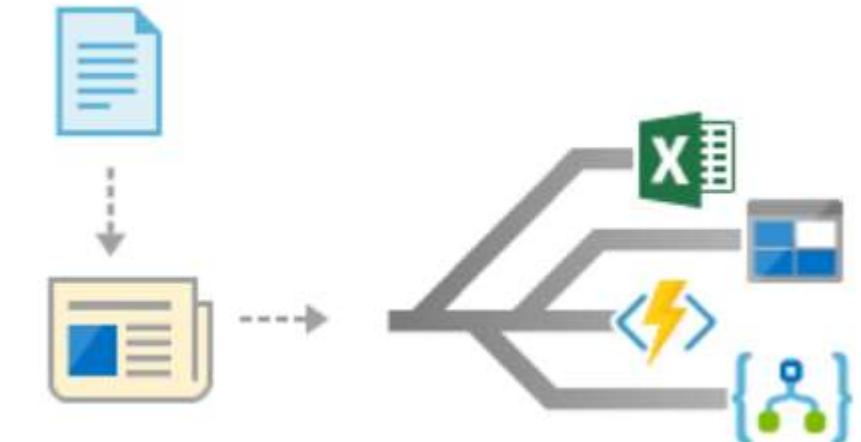
Azure Event Grid Benefits – Serverless Application Architectures

- Event Grid connects data sources and event handlers e.g. use Event Grid to instantly trigger a serverless function to run image analysis each time a new photo is added to a blob storage container



Azure Event Grid Benefits - Application Integration

- Event Grid connects your application with other services e.g. create a custom task to send your applications event data to Event Grid, and take advantage of its reliable delivery, advanced routing, and direct integration with Azure
- Use Event Grid with Logic Apps to process data anywhere, without writing code



Azure Event Grid Publishers (Event Senders)

- At present, the following Azure services have built-in publisher support for event grid:
 - Azure Subscriptions (management operations)
 - Custom Topics
 - Event Hubs
 - IoT Hub
 - Resource Groups (management operations)
 - Storage Blob
 - Storage General-purpose v2 (GPv2)

Azure Event Grid Handlers (Event Receivers)

- At present, the following Azure services have built-in handler support for event grid:
 - Azure Automation
 - Azure Functions
 - Event Hubs
 - Logic Apps
 - Microsoft Flow
 - WebHooks

Azure Event Grid Terminology

- Events - What happened
- Event sources/publishers - Where the event took place
- Topics - The endpoint where publishers send the events
- Event subscriptions - The endpoint or built-in mechanism to route events, sometimes to multiple handlers. Subscriptions are also used by handlers to intelligently filter incoming events
- Event handlers - The app or service reacting to the event

Azure Event Grid Billing

- Uses a pay-per-event pricing model, so you only pay for what you use
- The first 100,000 operations per month are free



Azure Advisor

Microsoft Services



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

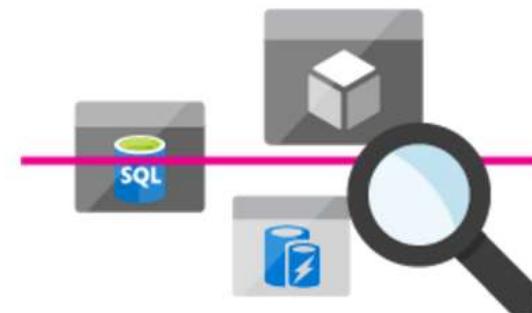
- **High Availability:** To ensure and improve the continuity of your business-critical applications.
- **Security:** To detect threats and vulnerabilities that might lead to security breaches.
- **Performance:** To improve the speed of your applications.
- **Cost:** To optimize and reduce your overall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

The screenshot shows the Microsoft Azure Advisor recommendations interface in preview mode. At the top, there are four main categories: ALL (10), HIGH AVAILABILITY (6), SECURITY (1), and PERFORMANCE (2). Below these, a summary message encourages improving availability, security, and performance. The interface includes dropdowns for Subscriptions (Microsoft Azure Internal Consumption) and Resource groups (All resource groups), and a filter for Active or snoozed recommendations (Active). A large button labeled 'Get recommendations' is visible. The main area displays a table of active recommendations, each with an Impact level (High or Medium), a Description, the Resource it applies to, and the last update time. The table lists 10 recommendations across various Azure services.

IMPACT	DESCRIPTION	RESOURCE	UPDATED AT
High	Improve the security of your Azure resources Follow Security Center recommendations	8 Recommendations	11/10/2016 10:07:28 AM
High	Your virtual machine has low usage To lower your cost, shut down or resize your virtual machine	1 Virtual machine (classic)	11/10/2016 10:07:29 AM
High	Improve the performance of your SQL Azure database Follow the recommendations from SQL DB Advisor	3 SQL databases	11/10/2016 10:07:26 AM
Medium	This availability set is not configured for fault tolerance To ensure high availability add one or more virtual machines to this availability set	1 Availability set	11/10/2016 10:07:28 AM
Medium	This availability set is not configured for fault tolerance To ensure high availability add one or more virtual machines to this availability set	1 Availability set (classic)	11/10/2016 10:07:25 AM
Medium	Improve the performance and reliability of your App Service Follow the recommendations from App Service Advisor	1 App service	11/10/2016 10:07:28 AM
Medium	Improve the reliability of your virtual machine disks Upgrade to Premium Disks	2 Virtual machines	11/10/2016 10:07:28 AM
Medium	This virtual machine is not configured for fault tolerance For virtual machine redundancy, use availability sets	1 Virtual machine (classic)	11/10/2016 10:07:25 AM
Medium	This virtual machine is not configured for fault tolerance For virtual machine redundancy, use availability sets	1 Virtual machine	11/10/2016 10:07:28 AM
Medium	Improve the reliability of your virtual machine disks Upgrade to Premium Disks	2 Virtual machines (classic)	11/10/2016 10:07:28 AM

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 Advisor





Lab: Introduction to Azure Virtual Machines

Microsoft Services



