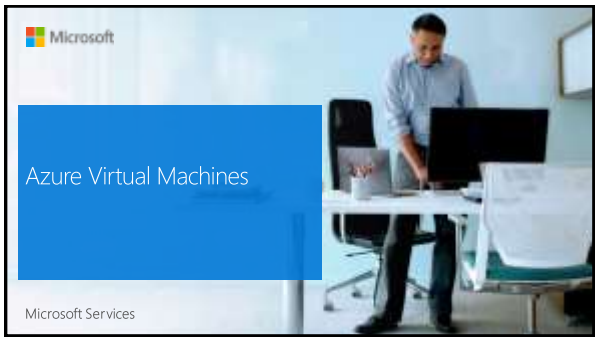


Agenda

- 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)

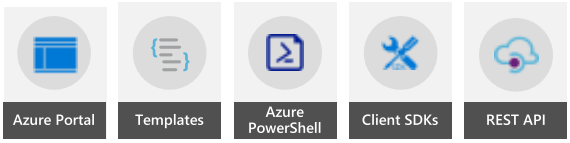
Azure Virtual Machines Workloads

Development & Test	Running applications in the cloud
Quickly provision and un-provision entire environments	Custom applications Customer Relationship Management (CRM) Content Management Server (CMS) Enterprise Resource Planning (ERP) Business Intelligence (BI)
Hybrid applications	**Disaster recovery**
Applications that span your data center and the cloud	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



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.

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-minute 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.

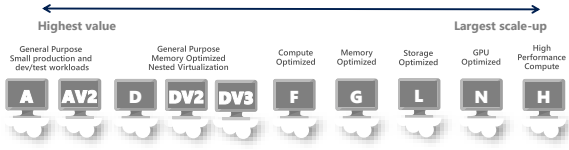
Demo: Create a Virtual Machine in Azure Portal based on a Marketplace image

Microsoft

Virtual Machines Sizes

Microsoft Services

Series and Scale-up options



A-Series and Av2-Series
General Purpose

A-Series Basic	A-Series Standard	Av2-Series
Best for dev & test and entry-level workloads Earliest generation Variety of hardware types and processors Only supports HDD		
No load balancing No auto-scaling	Full capabilities Load Balancing Autoscaling	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	Dv2-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	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

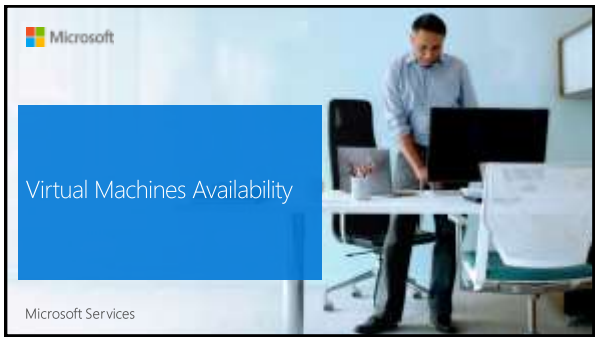
NC-Series	NV-Series
Optimized to run GPU-Accelerated Workloads Include NVIDIA's GPU cards, optimized for different scenarios and use cases.	
The NC sizes are more optimized for compute-intensive and network-intensive applications and algorithms, including CUDA and OpenCL-based applications and simulations.	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 K80 card	NVIDIA's Tesla M60 GPU card and NVIDIA GRID
Supported operating systems Windows Server 2016, Windows Server 2012 R2 Ubuntu 16.04 LTS	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.



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

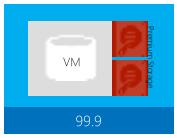
Best practices for high availability

Configure multiple virtual machines in an availability set for redundancy

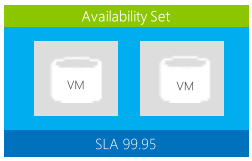
Configure each application tier into separate availability sets

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%.



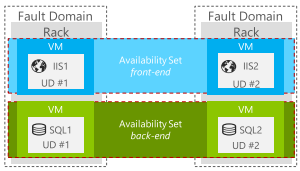
For all **Virtual Machines** that have **two or more instances** deployed in the same **Availability Set**, we guarantee you will have Virtual Machine Connectivity to at least one instance at least 99.95% of the time.

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

Fault and Update Domains

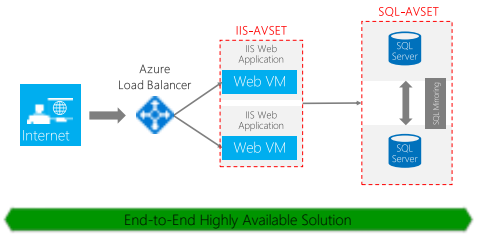
Fault Domains	Update Domains
• Represent groups of resources anticipated to fail together, i.e. same rack, same server • Fabric spreads instances across fault at least two fault domains • The number of fault domains is controlled by the Azure Fabric • Anticipated to fail together: share power source and network switch • IaaS V2 – 3 fault domains by default	• 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



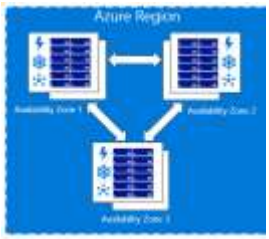
Update domains are honored by host OS updates

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 Availablility 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

Microsoft

Virtual Machines Disks

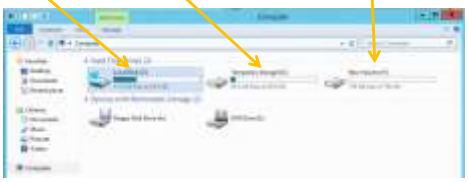
Microsoft Services

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

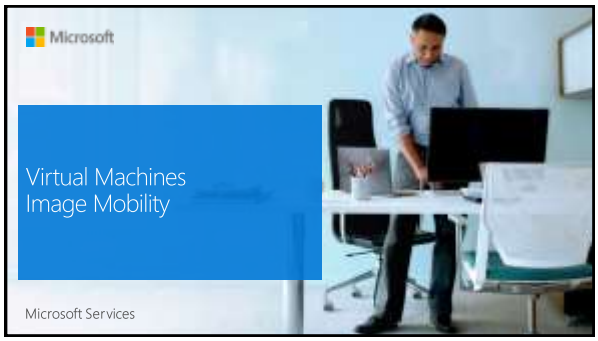
Supported Cache Modes:

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	
Standard	Premium
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

Types	
Unmanaged disks	Managed disks
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)



Introduction to Disks and Images

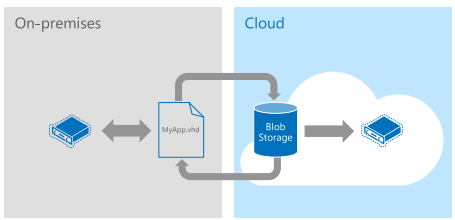
OS Images
- Microsoft
- Partner
- User

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

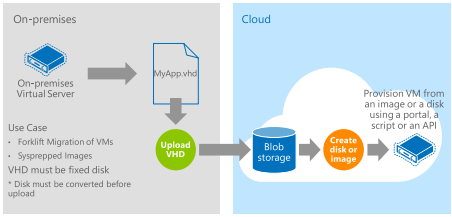
Disks
- OS Disks
- Data Disks

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

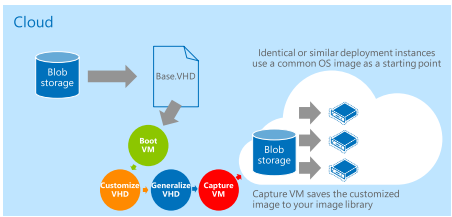
Image Mobility



Bring Your Own Server/VHD



Imaging VMs in the Cloud



Tips on Bring Your Own (BYO) Generalized Images

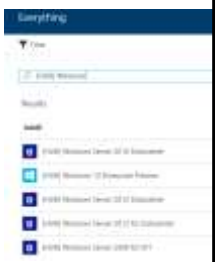
- Sysprep and *Generalize* is expected
- Do not put **unattend.xml** on the disk
- Do not install virtual machine Integration Components
- Install the Azure VM Agent
- Enable RDP

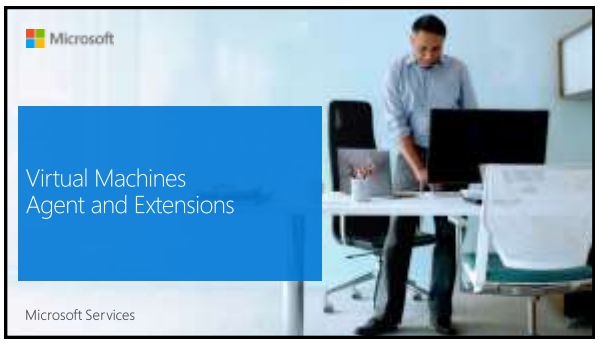
Marketplace VM Images

- 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.





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

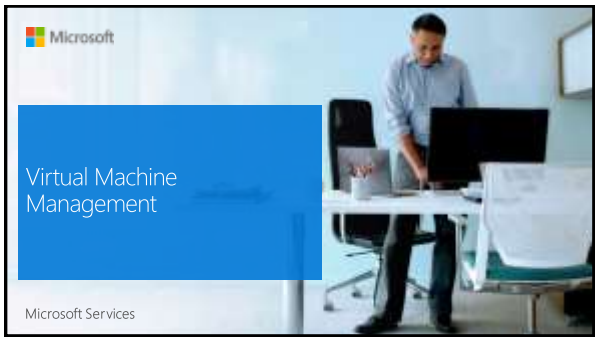
Prerequisites

- 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.



Resize a Virtual Machine

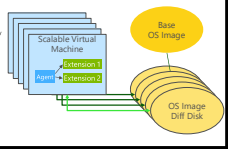
- After creation, a VM can be scaled up or down by changing its size.
- If the new size is not available on the hardware cluster that is hosting the VM, it must be deallocated first.
  - Don't forget: deallocating the VM releases any dynamic IP addresses assigned to the VM. The OS and data disks are 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 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

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.

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

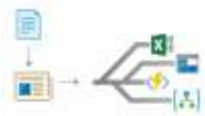
- Event Grid allows you to speed automation and simplify policy enforcement e.g. Event Grid can notify Azure Automation when a virtual machine is created, or a SQL Database is spun up
- These events can be used to automatically check that service configurations are compliant, put metadata into operations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

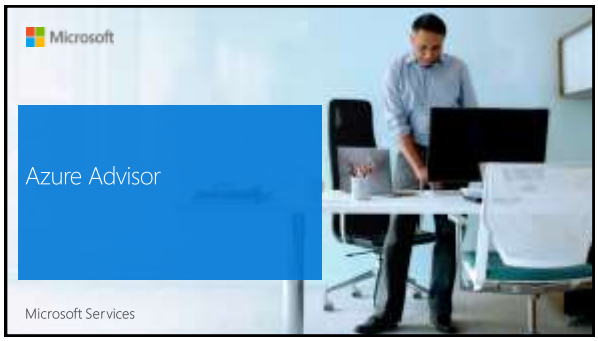
- At present, the following Azure services have built-in handler support for event grid:
  - Azure Automation
  - Azure Functions
  - Event Hubs
  - Logic Apps
  - Microsoft Flow
  - WebHooks

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

- 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 Advisor

Microsoft

Lab: Introduction to Azure Virtual Machines

Microsoft Services


Microsoft
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