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Microsoft

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interAct making the Data Center work — Ingram Micro Value Division

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DAY 1

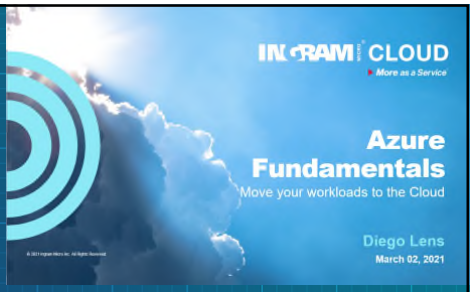
09h15 - Start

09h15 - 17h00 Session with Lunch break

DAY 2

09h15 - Start

09h15 - 17h00 Session with Lunch break



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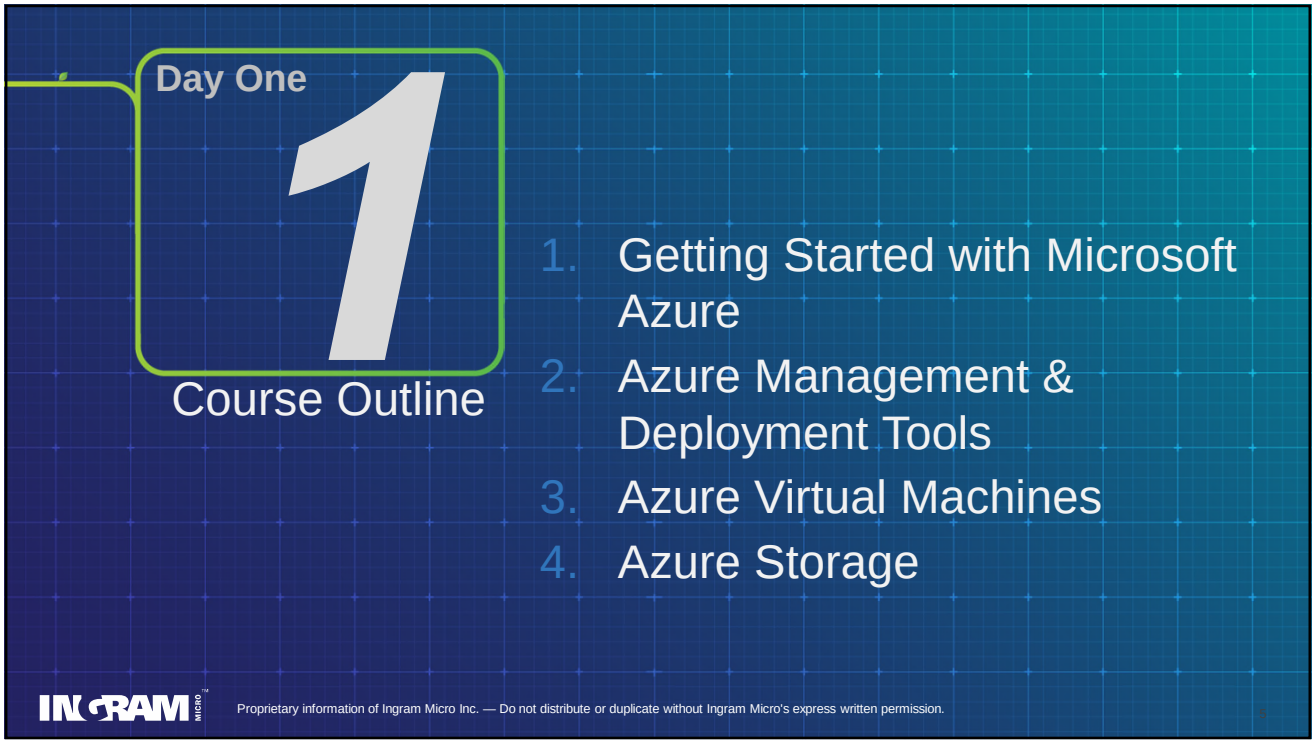

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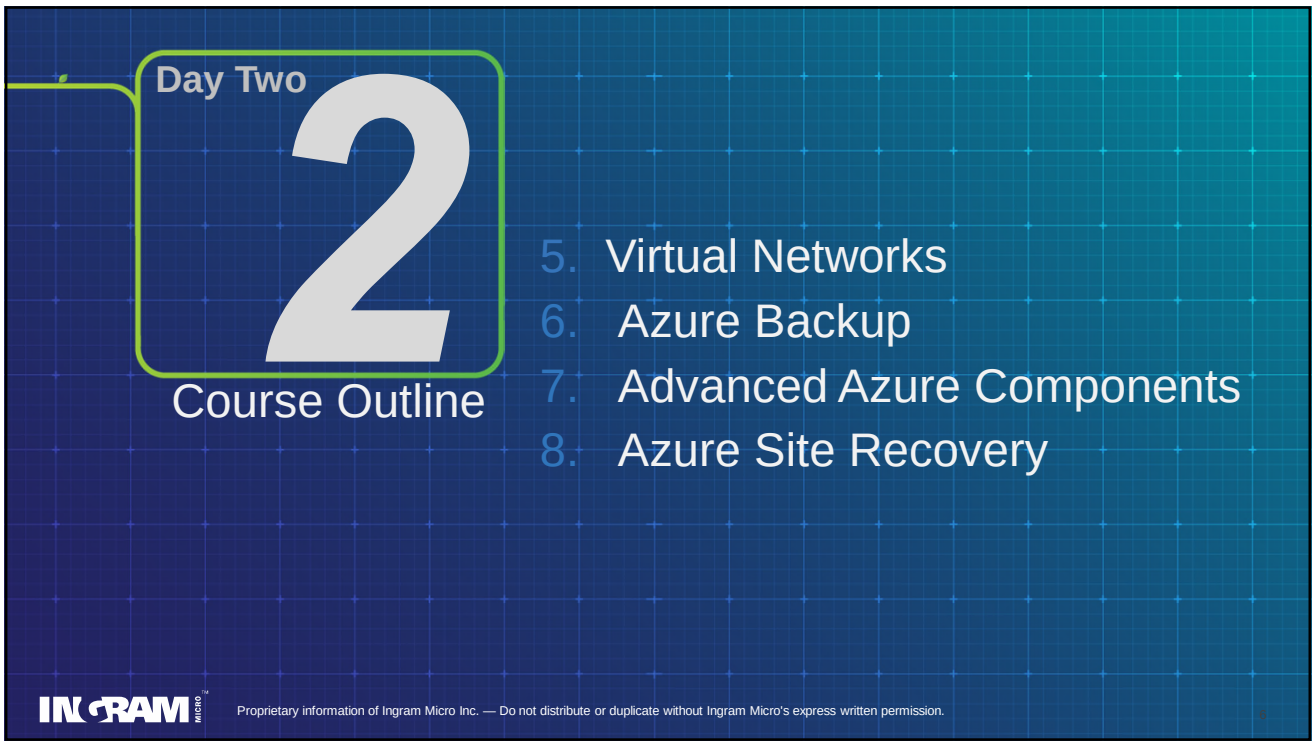

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Module 0

Introduction

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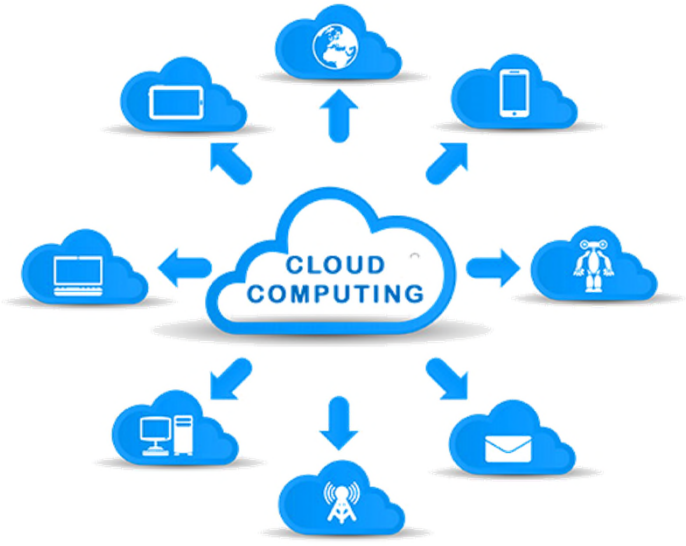
Digital Transformation



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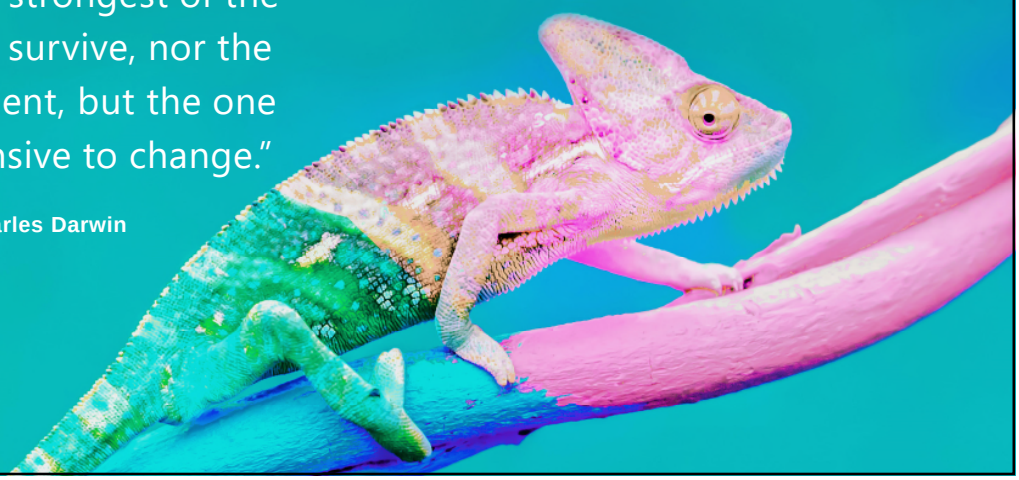
If you want to stay current and keep your business growing, you'll have to adapt.

"It is not the strongest of the species that survive, nor the most intelligent, but the one most responsive to change."

– Charles Darwin



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Growth Solutions

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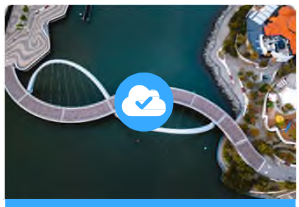
More as a Service

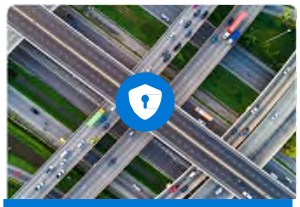


Modern Cloud Platforms

Transform Into the New Norm

Go boldly into the future with innovative infrastructure and platform solutions built for driving profitability and growth through key app modernization, data & insights, and cloud strategies.

- **App Modernization**
  DevOps, Containers, Microservices
  + Infrastructure
- **Data & Insights**
  DB (PaaS), Analytics, Warehousing, AI/ML
  + Infrastructure



Seamless Security

Build your Business with True Peace of Mind

Move forward towards a bright business future with total asset and data protection including seamless sign-on, endpoint security, identity security, and complete security operations management.

- **Endpoint**
  Modern Endpoint, MDR/XDR, Server Security
- **Identity**
  Authentication, Identity & Access Management
- **Security operations**
  Vulnerability Mng, Tier 2 SOC Analytics, SIEM

Connected Workplace

Together We Achieve More

Work together, work smarter and stay productive, from anywhere with our comprehensive suite of collaboration apps, digital experiences, and virtual desktops, designed to help you do more.

- **Collaboration Apps**
  Productivity Suits, conferencing
- **Virtual Desktops**
  Remote Work, Desktop Virtualization, OS
- **Employee Experience**
  Workflow insights, resources, learning

Business Performance

Work at the Speed of Modern Business

Build a fine-tuned business engine to power your performance with our tailor-made technological approach to equip your teams with CRM, ERP software, and imaginative workforce automation.

- **CRM**
  Customer Relationship Management
- **ERP**
  Enterprise Resource Planning
- **Workforce Automation**
  No/low Code, Power Automate

http://bit.ly/ingramcloud https://ingram.cloudchampion.nl https://ingram.cloudchampion.be

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Ingram Micro Cloud Enablement 2023

Enablement
http://bit.ly/ingramcloud

Cloud Champion
https://ingram.cloudchampion.be
https://ingram.cloudchampion.nl

Newsletter
http://bit.ly/imc-email

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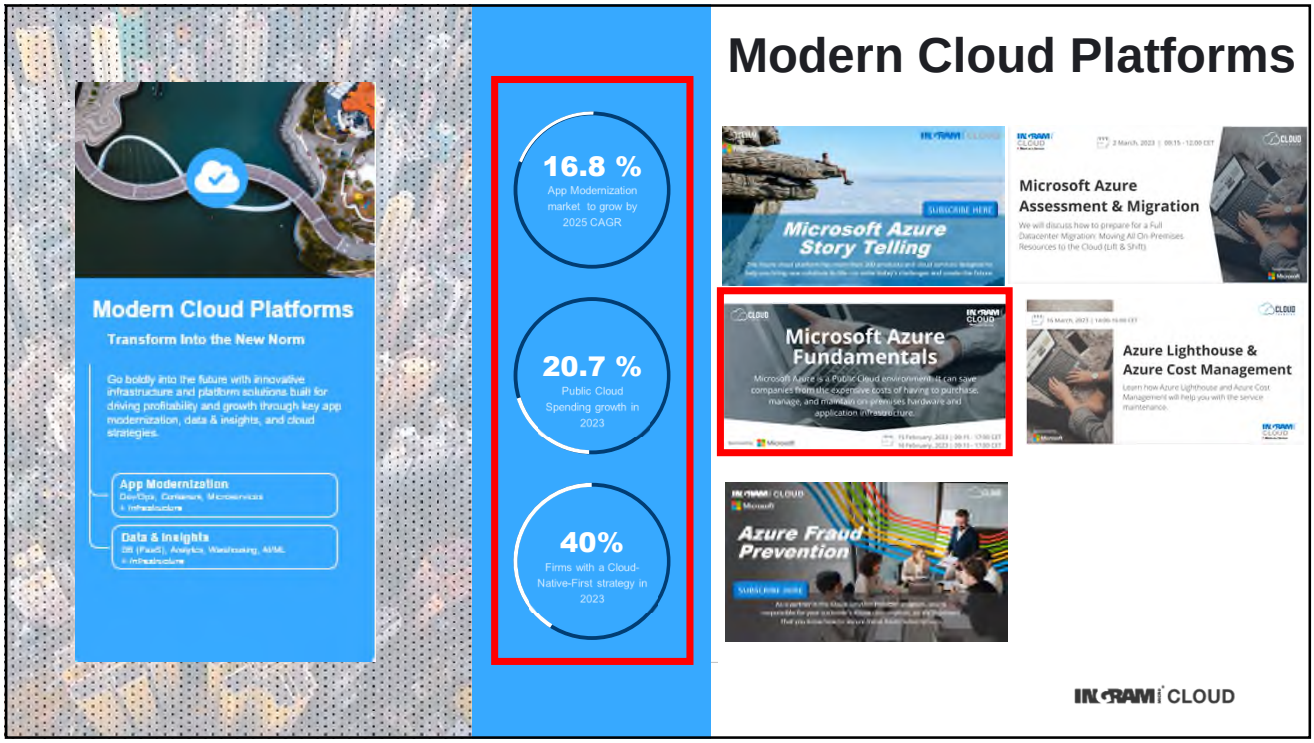

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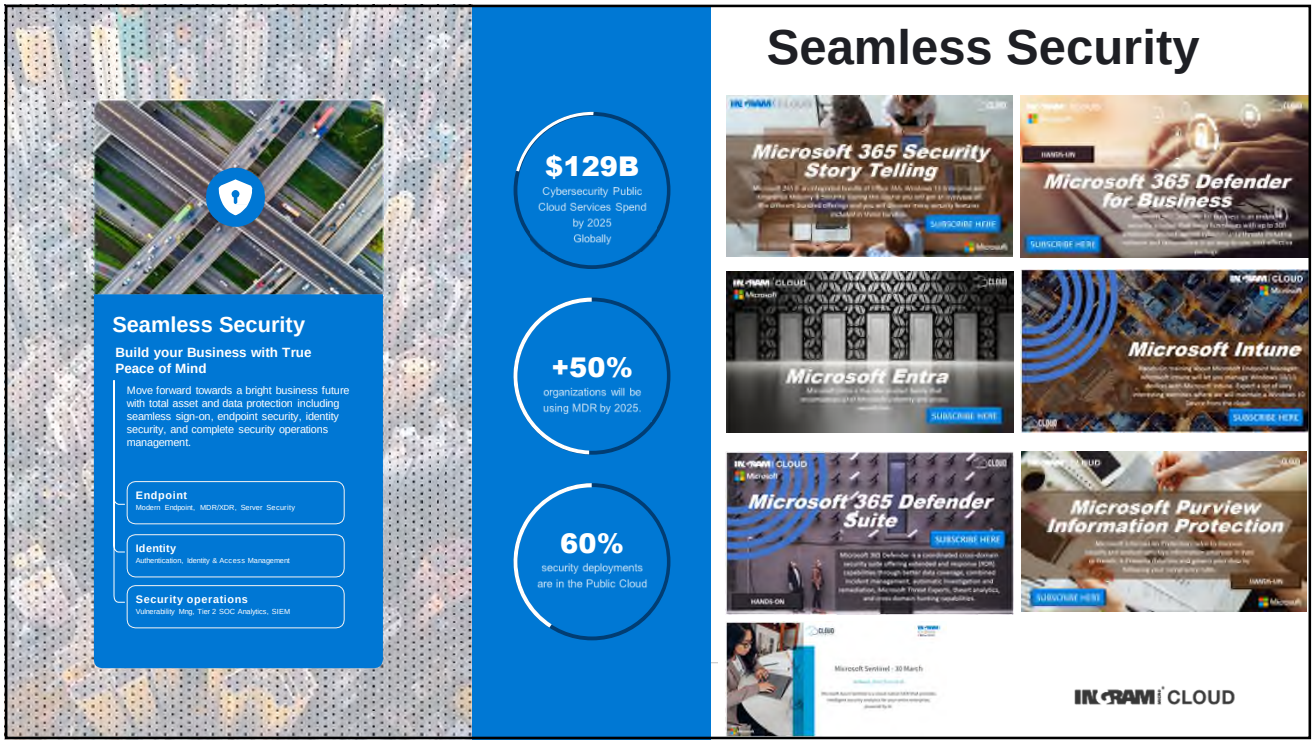

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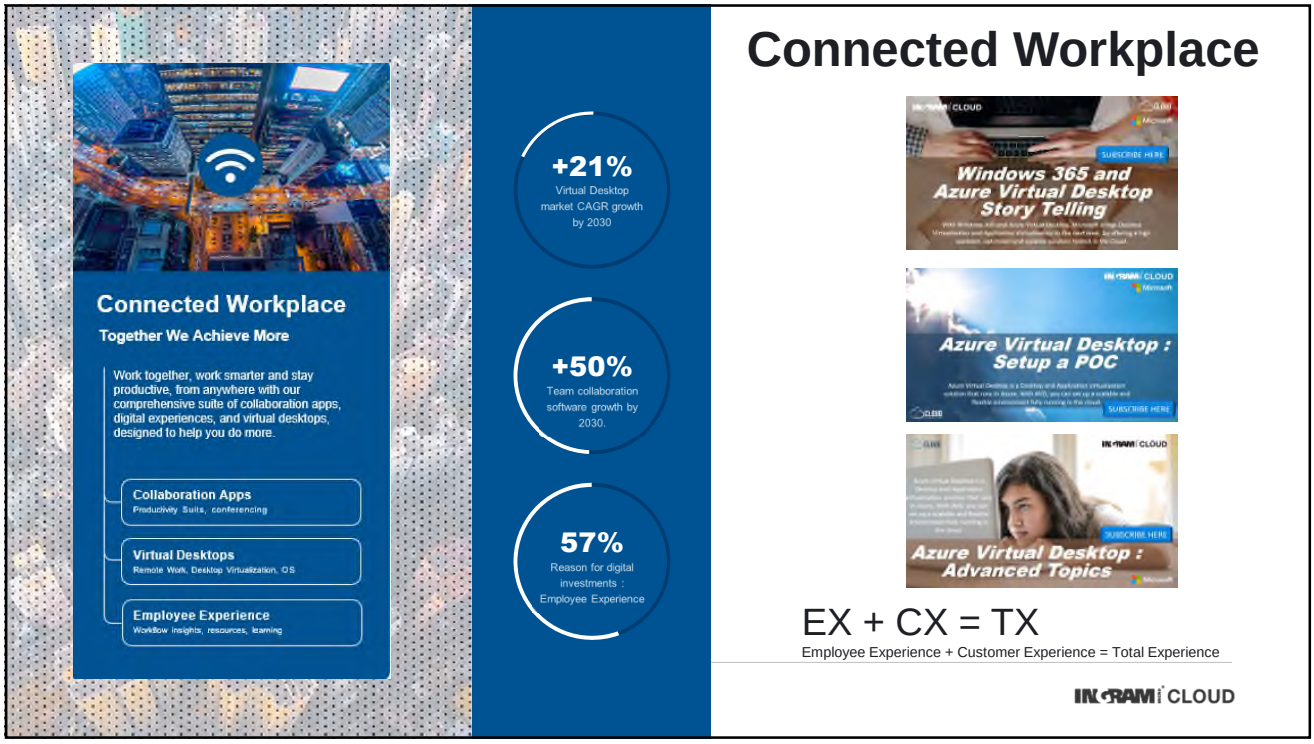

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Business Performance

We want to help modernize and transform your business. With a focus on facilitating your team's needs, we are taking a tailor-made technological approach to personalize what strategies work best for you.

CRM:
CRM technology directly aligns with our growth mindset – at the end of the day, the goal of CRM is to foster and sustain existing and future customer relationships. Through this technology, you can generate multichannel marketing campaigns, nurture sales-ready leads and align sales and marketing with planning and tracking tools that integrate with existing apps and services.

ERP:
In the evolving digital landscape, it is imperative to stay up to date with the latest technologies to move forward. An ERP software suite can help manage day-to-day business processes that push beyond just financial data – discover how you can accelerate your business, grow your customer base and increase your profit margins with ERP.

Workflow Automation:
Workflow Automation is your go-to resource for building custom apps that connect to your existing data and systems, without the need for code. Through low-code platforms, you can build solutions that support workflow automation, AI, secure data access, seamless data analysis and visualization capabilities

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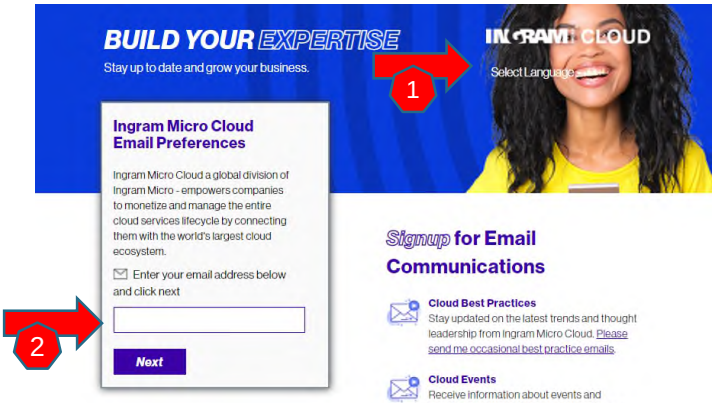
Stay up to date : Subscribe for Email

Stay updated

- Latest trends
- Latest trainings
- Events
- Tradeshows



Subscribe : http://bit.ly/imc-email

Enablement
http://bit.ly/ingramcloud

Cloud Champion
https://ingram.cloudchampion.be
https://ingram.cloudchampion.nl

Questions
cloud@ingrammicro.be
cloud@ingrammicro.nl

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Benefits of Using Cloud

- High Availability
- Scalability & elasticity
- Agility / Flexibility
- Fault Tolerance & Disaster Recovery
- Capital expenditures versus operations expenditures (Capex – Opex)
- Consumption/Subscription Based Model
- Every Day new capabilities

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Every Day new capabilities

- **https://azure.microsoft.com/en-us/updates/**
- **Every day new capabilities announced for Azure**

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Website you should know !

- Ingram Micro Cloud Marketplace
  - https://be.cloud.im https://nl.cloud.im
- Ingram Micro Cloud Champion Portal
  - https://ingram.cloudchampion.be
  - https://ingram.cloudchampion.nl
- Microsoft Cloud Journeys
  - http://bit.ly/ingramcloud

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Microsoft Azure

Microsoft

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Azure Datacenter

- Physical Buildings
- Located all over the globe
- House a Group of networked Computer Servers

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Azure Availability Zones

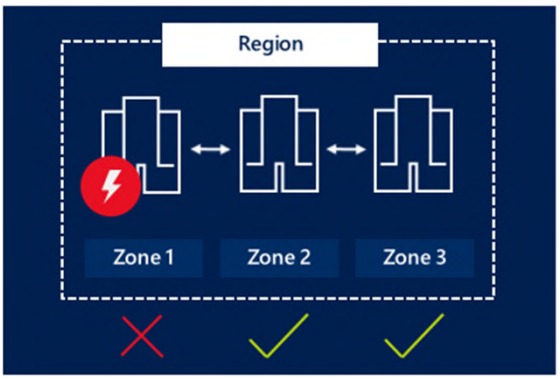
Unique Physical Locations within an Azure region

Offer High Availability to protect Applications and Data from Datacenter Failers

Each zone is made up one or more datacenters

Independent Power, Cooling, Networking

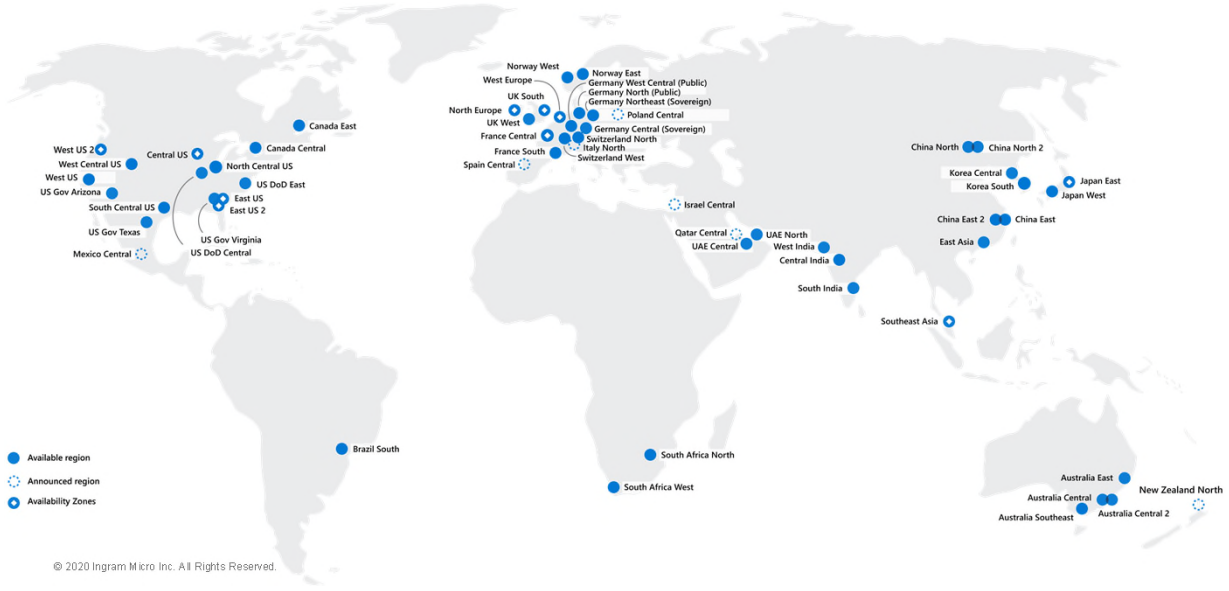
Zone Redundant Services



Azure Regions

- Today 60+ Azure Regions around the world
- A Set of Availability Zones
- Deployed in latency-defined perimeter
- Connected through dedicated low-latency network
- Own Service Availability an Pricing

Azure Regions worldwide



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Azure Region Pairs

Azure Regions are paired together for disaster recovery purposes

Relationship between two Azure Regions

Each Azure region is always paired with another region in the same Geography

Geography, such as US, Europe, Asia

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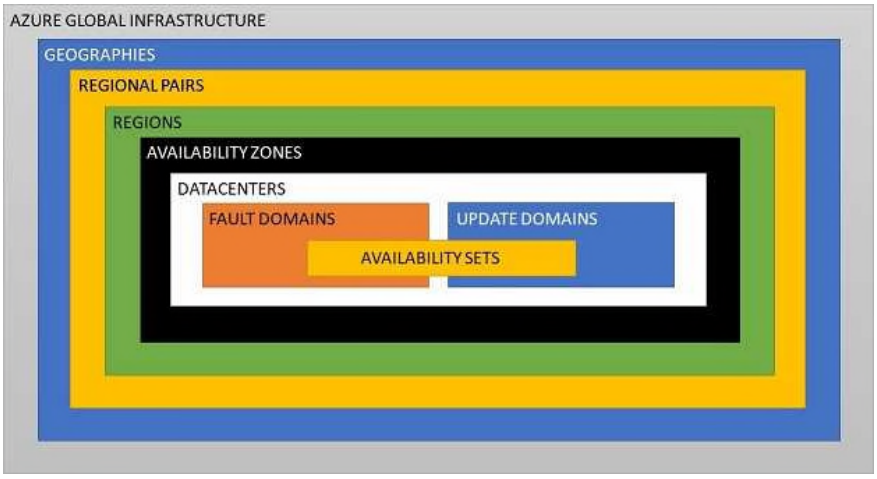
The Bigger Picture



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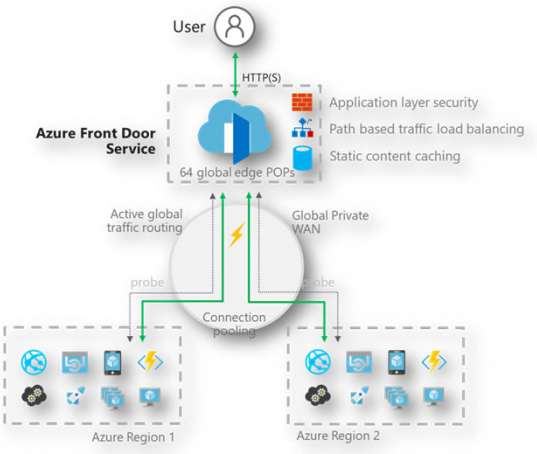
Azure Point of Presence (PoPs)

Azure Access Point

Physical location where traffic can enter the Microsoft Global Network

Belgium has a PoP in Brussels



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IaaS, PaaS, SaaS

Microsoft

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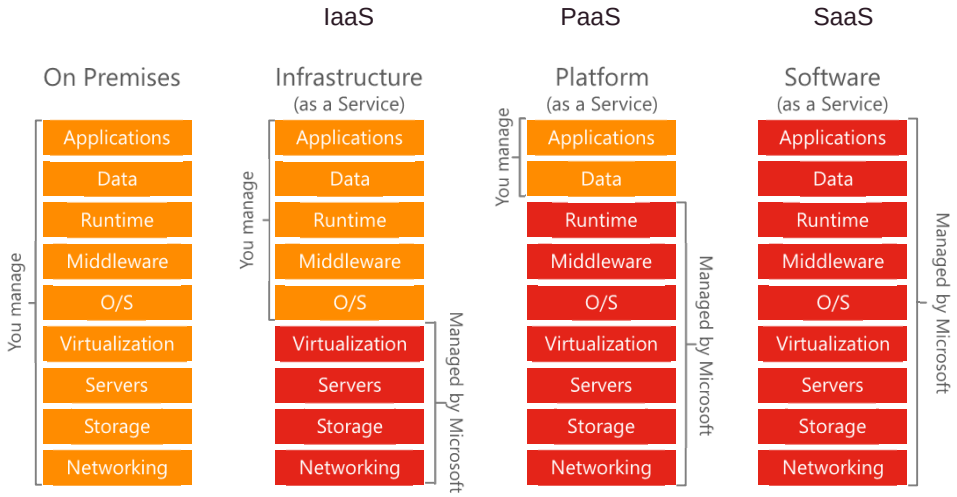
Cloud Service Delivery Models



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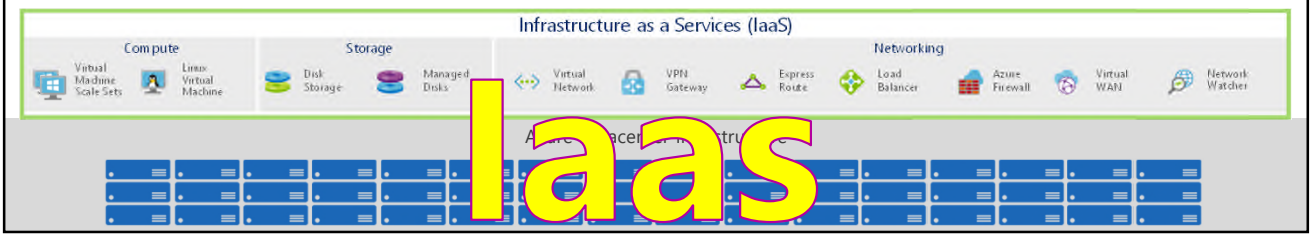
IaaS resources in Azure



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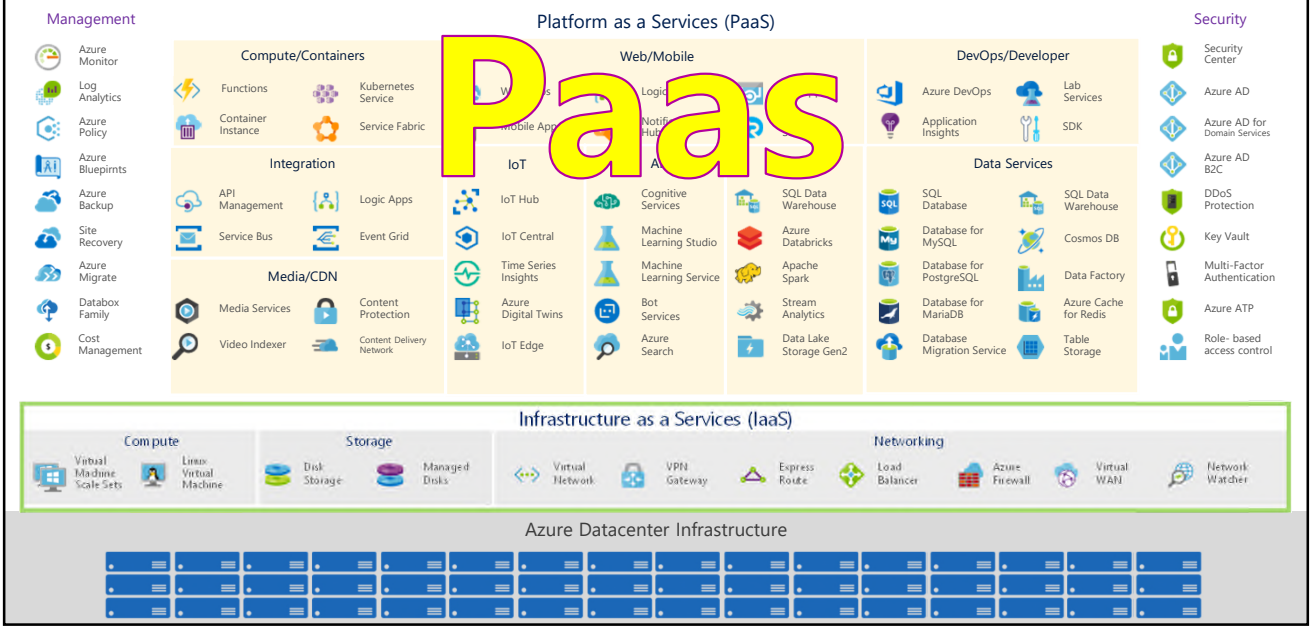
PaaS resources in Azure



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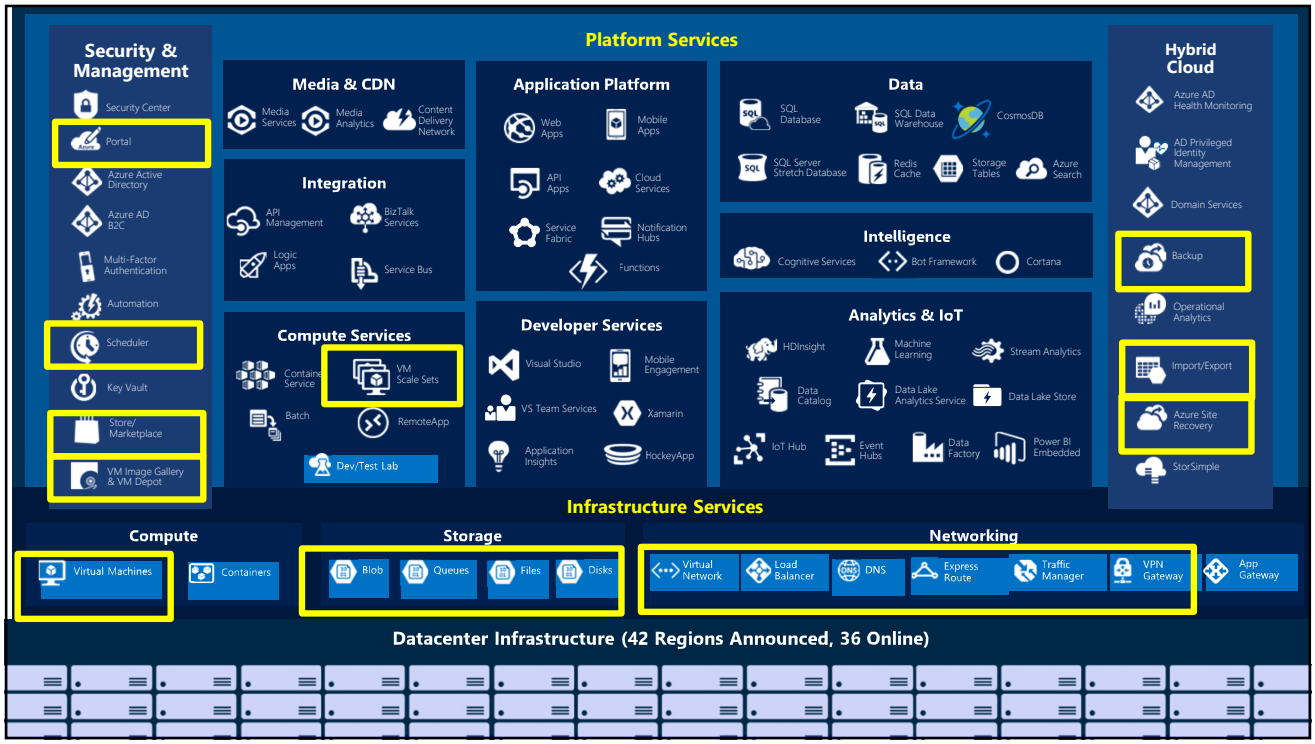

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Azure Vocabulary

Microsoft

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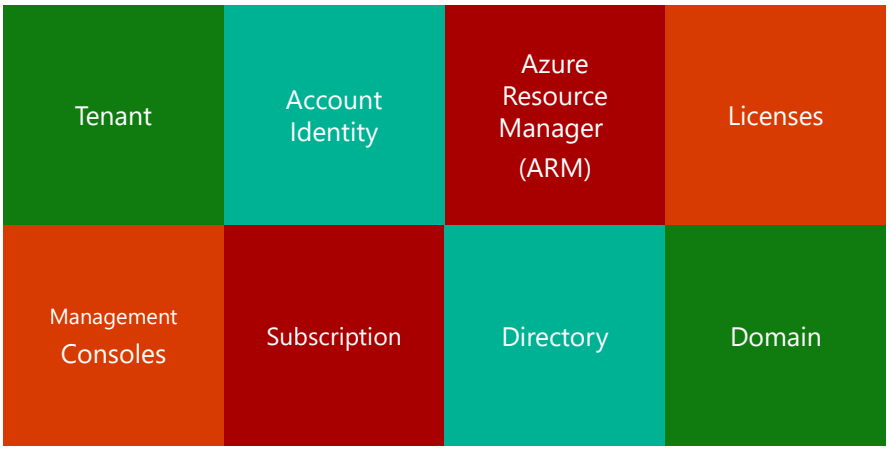
Vocabulary



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Azure Tenant

Tenant  company

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Azure Tenant

Tenant  **company.onmicrosoft.com**

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Azure Tenant Domain Name

Tenant  **company.onmicrosoft.com**

- Unique Name
  - Tenant did exist already (Office 365 / Dynamics)
  - Created with Ingram Micro Cloud Marketplace
  - Free Azure Tenant : https://azure.microsoft.com/en-us/free/
- You cannot change the Tenant name

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Azure Active Directory

Tenant

company.onmicrosoft.com

Azure
Active
Directory

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Azure Active Directory

- Created in a specific Region, verified in this location :
  - https://admin.microsoft.com
    > Settings > Org settings > Organizational Profile > Data Location

- Name
  - https://portal.azure.com
    > Top right corner
- Name Change
  - https:// admin.microsoft.com
    > Settings > Org Settings > Organizational Profile > Organization Information
- Azure Active Directory ID

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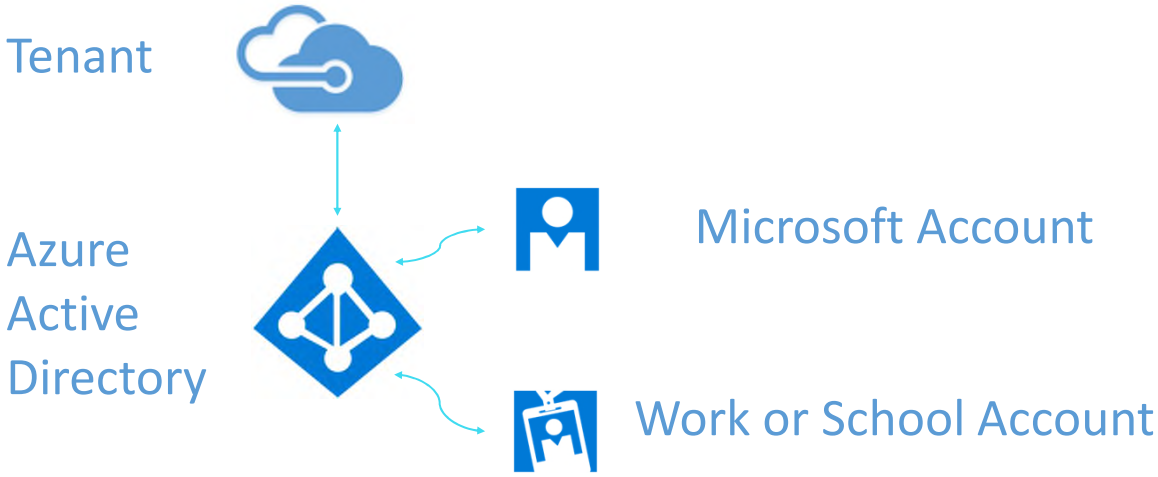
Azure AD Authentication



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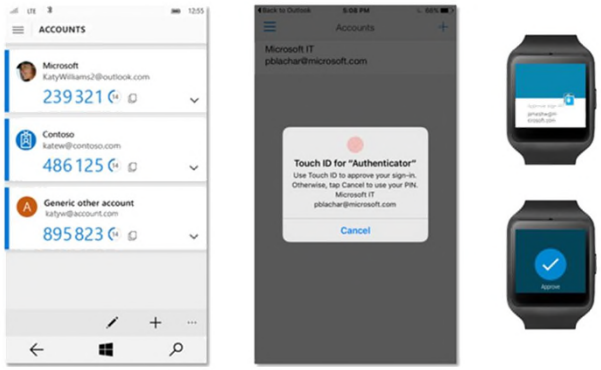
MFA – Multi-factor Authentication

More than 99.9% of these identity-related attacks are stopped by using multi-factor authentication (MFA) and blocking legacy authentication.

Enabling MFA is simple, and you can use the Microsoft Authenticator App on your mobile device. It is especially critical to enable it on privileged accounts, such as Global Admin, User Access Admin, Owner, Contributor, etc. **We recommend enabling it on ALL accounts!**

Microsoft Mobile Phone Authenticator App | Microsoft Security



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Tenant Domain Name(s)

Tenant

company.onmicrosoft.com

Azure Active Directory

ingrammicro.com
ingrammicro.be
ingrammicro.eu
interact.be

Custom Domain Names
(unique in Azure)

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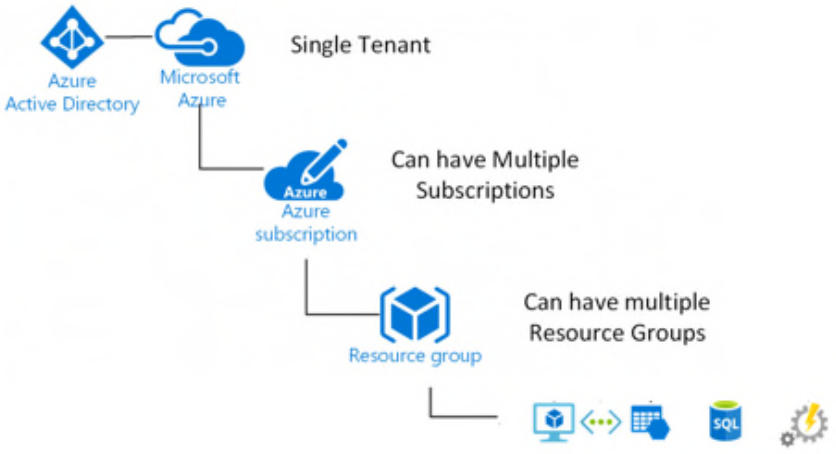
General Azure Security



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Azure Subscription (after July, 21 2021)

NCE	CSP	EA	Open	Direct
✓ Pay-as-you-Go ✓ IMC Marketplace ✓ Aq. through partners ✓ Partner Added Value ✓ RI's IMC Enabled ✓ Incentive Programs + ✓ Azure Plan ✓ Azure Cost Management ✓ Azure Lighthouse ✓ Calendar Month Bill	✓ [illegible] ✓ [illegible] ✓ Aq[illegible] ✓ Part[illegible] ✓ M[illegible] ✓ [illegible]	✓ Classic +ARM Deployment ✓ Annual Financial Commitment	✓ Pre-Consumption SKU's ✓ Classic Deployments	✓ Credit Card Linked ✓ Pay-as-you-Go ✓ ARM Deployments ✓ No Support ✓ No Partner Insights ✓ No Discount ✓ No Incentives

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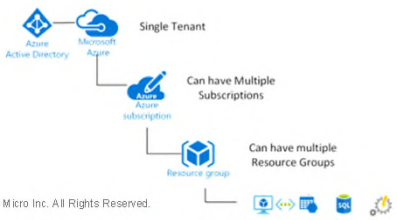
Resources and Resource Groups

- Resource
  - A manageable item available through Azure. VMs, web apps, databases, etc.
- Resource group
  - A container that holds related resources
  - You decide how to allocate resources to Resource Groups



Azure Resource

Azure Resource Group

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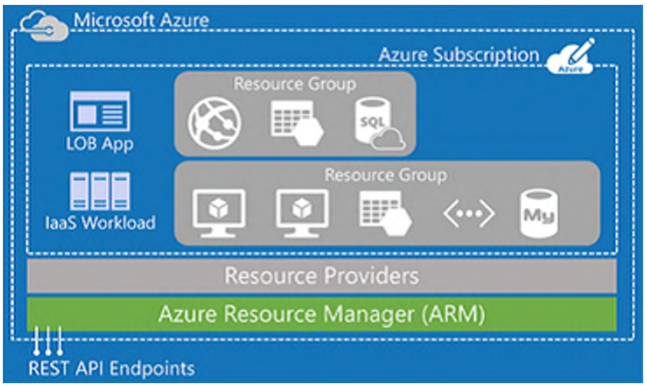
Azure Resource Manager (ARM)

- Referred as Control Planes
- Works with Resource Groups
- Template-driven (JSON)
- Faster Compared to PowerShell
- User Rights (RBAC)
- Resource Tags
- multi-region
- https://portal.azure.com



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Legacy Azure platform : ASM

- Referred as Classic
- Deprecated
- Sequentially Resource Creation
- Not Compatible with ARM
- VMs created in ASM should be migrated to ARM by 1 September 2023 !

https://azure.microsoft.com/en-us/updates/classicvmretirment/

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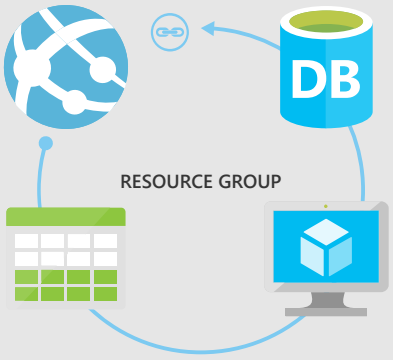

Resource Group

- container for multiple resources
- resources exist in one resource group
- resource groups can span regions
- resource groups can span services

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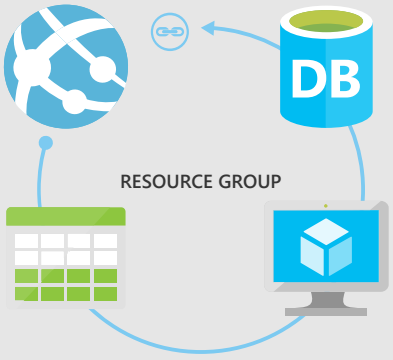

Deployment

- tracks template execution (JSON)
- created within a resource group
- allows nested deployments

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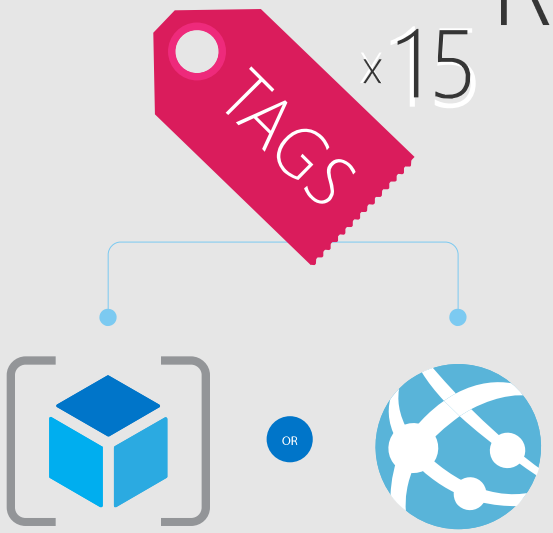
Resource Tags



- Name-value pairs assigned to resources or resource groups
- Subscription-wide taxonomy
- Each resource can have up to 15 tags

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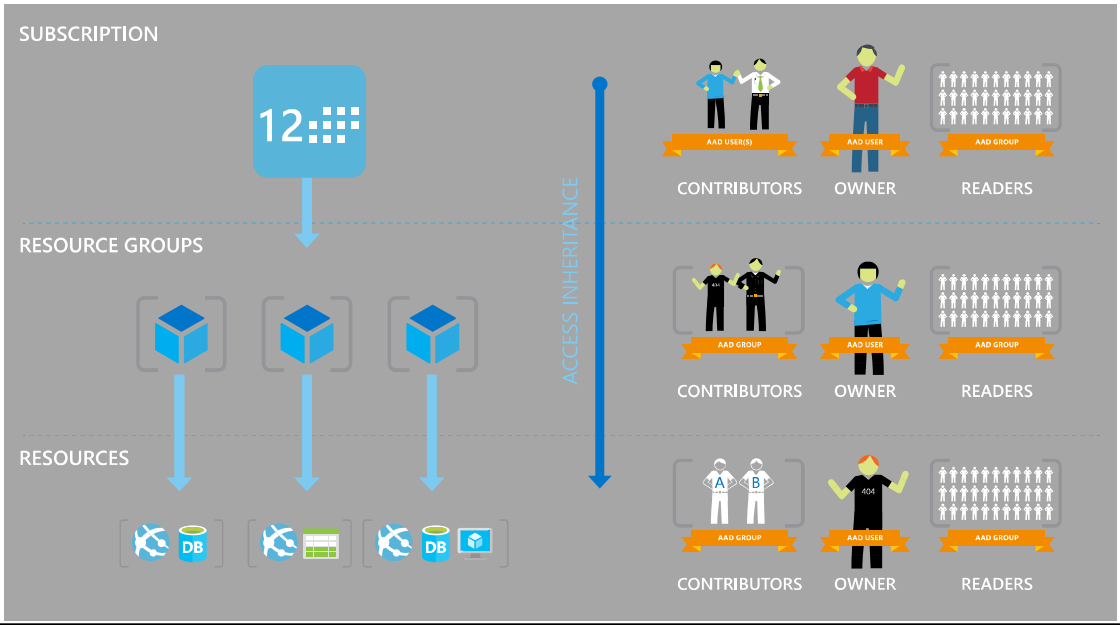
Role Based Access Control (RBAC)



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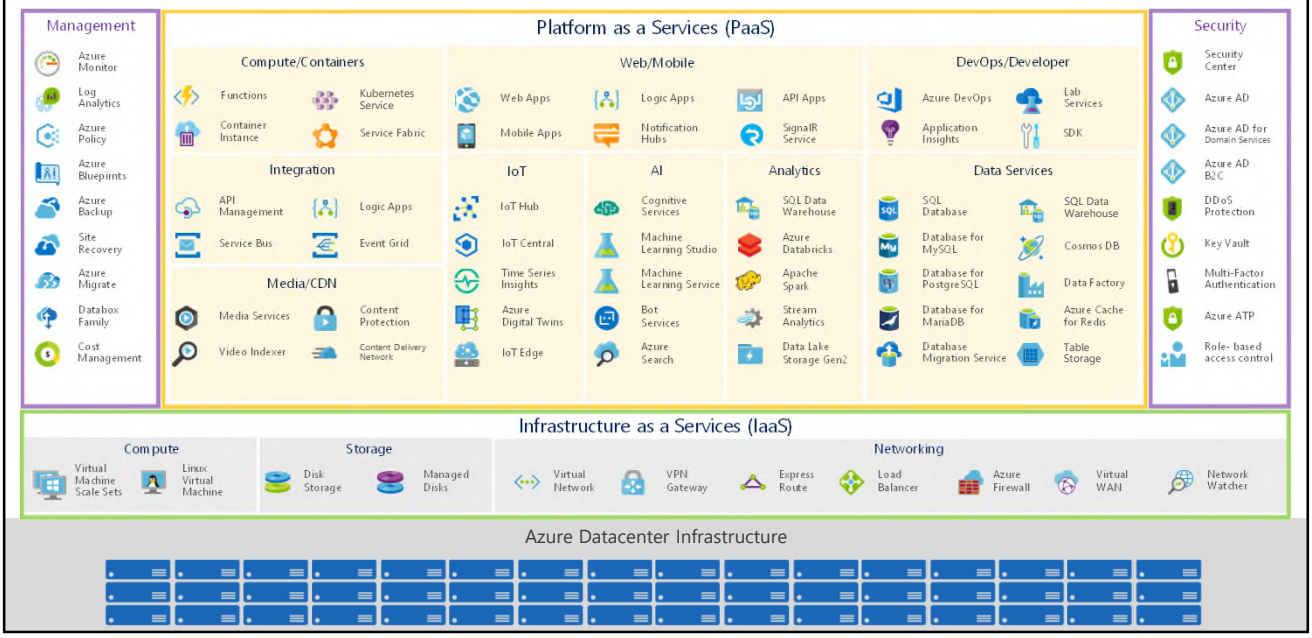
All Resources in Azure



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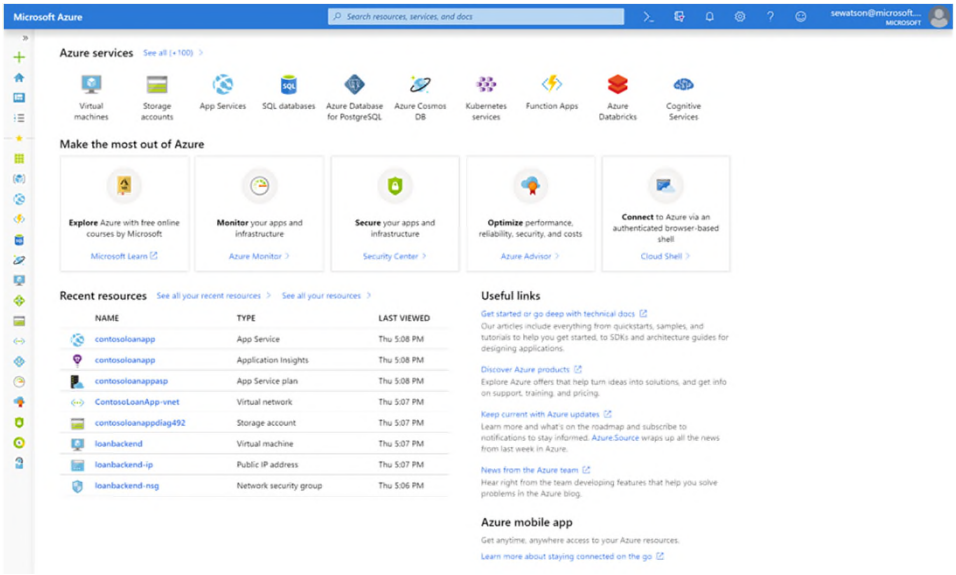
Azure Portal : portal.azure.com



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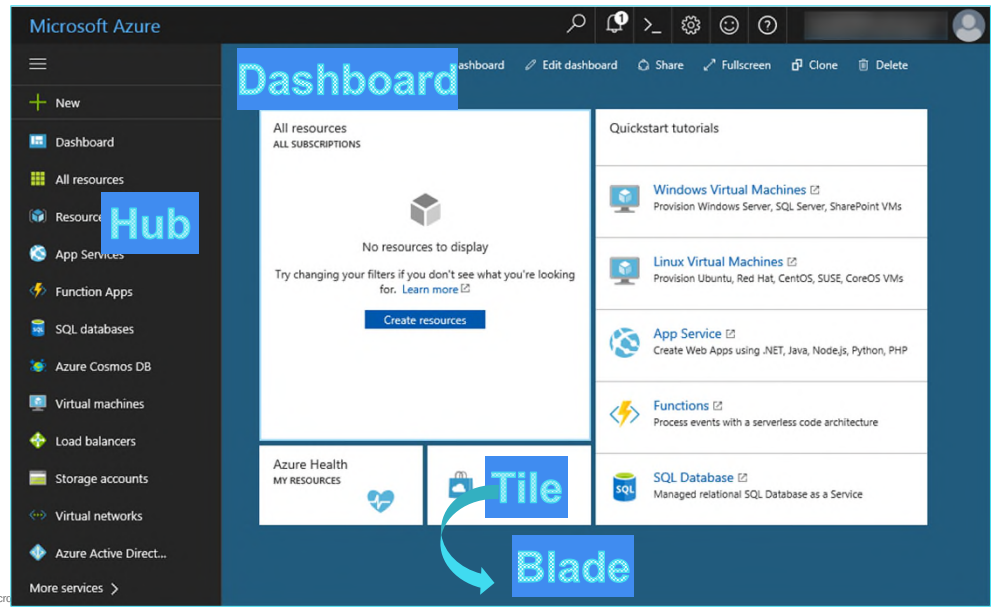
Azure Dashboard



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Demo: Azure Portal

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Lab 1:
Getting Started With Microsoft Azure

(ingram azure fundamentals)

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Azure Management Tools

Microsoft

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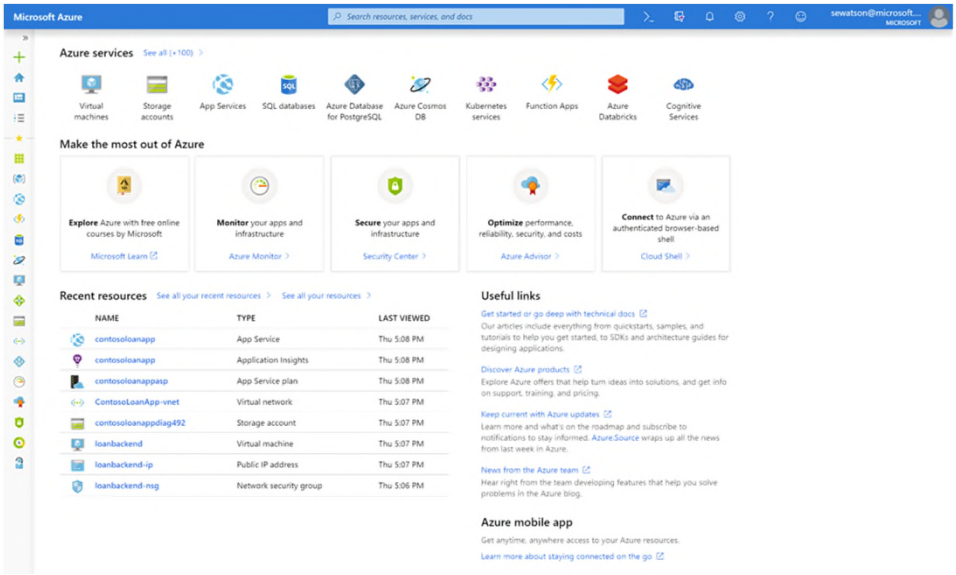
Azure Portal : portal.azure.com



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Choose the right Azure command-line tool

- Managing and Administering Azure Resources from the command line

- Azure PowerShell
- Azure CLI
- Azure Cloud Shell

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PowerShell Az Module

- Starting December 2018, the Azure PowerShell Az module is in general release
- Shorter Commands
- Improved stability
- Cross-Platform Support

- Recommended : Uninstall AzureRM module
- Install Azure Az Module

```
PowerShell

Install-Module -Name Az -AllowClobber
```


https://docs.microsoft.com/en-us/powershell/azure/install-az-ps?view=azps-1.2.0

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AzureRM : Legacy Azure PowerShell Module

- https://docs.microsoft.com/en-us/powershell/azure/install-azurerm-ps?view=azurermps-5.4.0

PowerShell Copy

```
# Install the Azure Resource Manager modules from the PowerShell Gallery
Install-Module -Name AzureRM -AllowClobber
```

PowerShell Copy

```
Get-Module AzureRM -ListAvailable | Select-Object -Property Name,Version,Path
```

PowerShell Copy

```
Import-Module -Name AzureRM
```

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Azure CLI (Open Source)

- Command-line tool along-side Azure PowerShell
- Focused on Mac/Linux/BASH/cmd.exe
- Simple to automate
- Easy to learn

- CLI 1.0 written with Node.js
- CLI 2.0 written in Python

- offer better cross-platform capabilities

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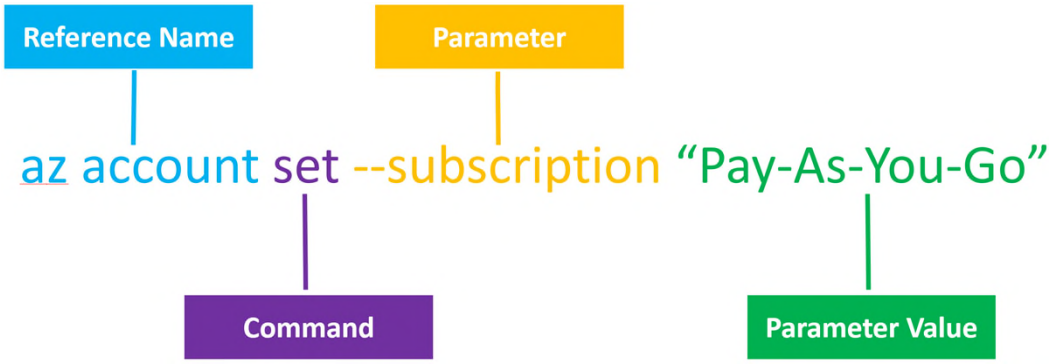
Azure CLI Syntax



https://learn.microsoft.com/en-us/cli/azure/reference-index?view=azure-cli-latest

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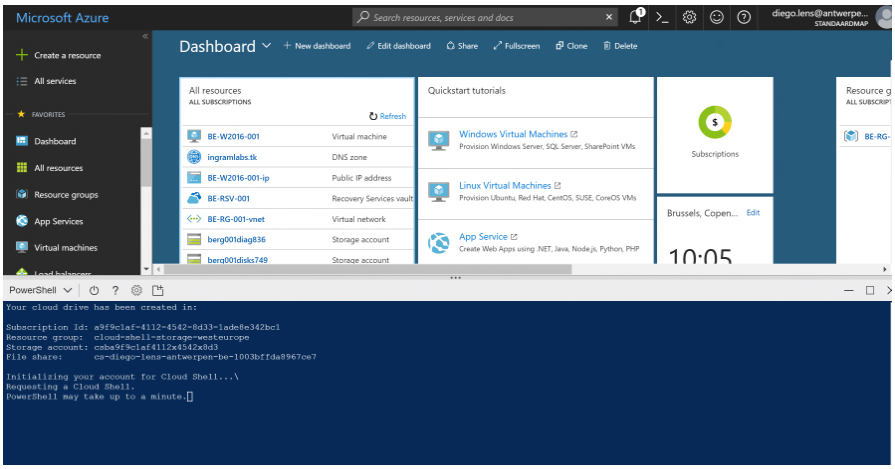
Azure Cloud Shell



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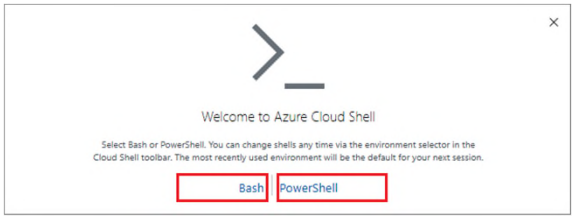
Azure Cloud Shell requirements

- Requires an Azure File Share
- While Enabling Azure Cloud Shell, Azure will create :
  - Resource Group
  - Storage Account
  - File Share
- Called : Clouddrive
- Azure Cloud Shell in **Cloud Shell Only** mode :
  - https://shell.azure.com



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Azure Deployment Tools

Microsoft

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Choose the right Azure deployment tool

Implement **Infrastructure as Code (IaC)**

IaC Tooling for Azure includes :

- Azure Resource Manager Templates (ARM Templates)
- Azure Bicep
- Azure Terraform

https://techcommunity.microsoft.com/t5/azure-events/azure-deployments-ama/ec-p/3560291#M342

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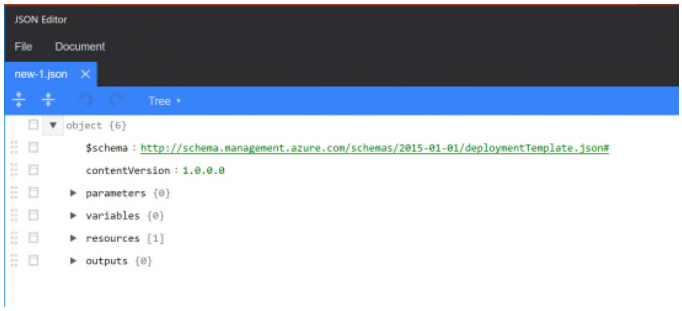
Azure Resource Manager Templates

- Expressed in JSON format
- Use a JSON Editor
- Create your First Template :
- https://docs.microsoft.com/en-us/azure/azure-resource-manager/resource-manager-create-first-template?



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Basic ARM Template Structure

```
{
  "$schema": ""
  "contentVersion": "",
  "parameters": {},
  "variables": {},
  "resources": [],
  "outputs": {}
 }
```

Provide values during deployment

Define reusable values

Specify Resources to deploy

Return values from the deployed resources

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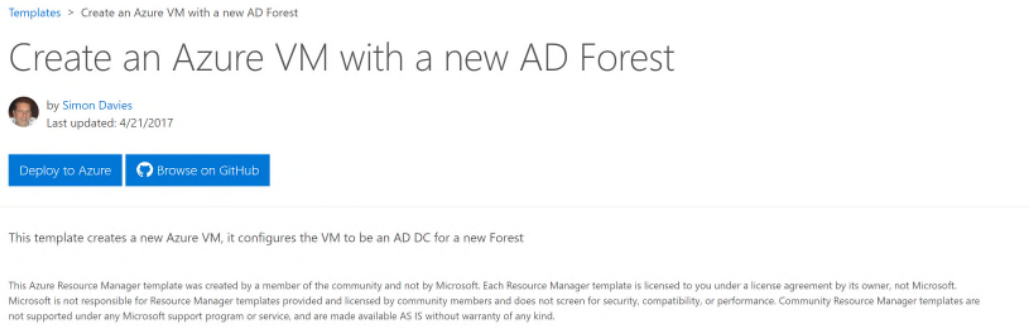
Azure QuickStart Templates

https://azure.microsoft.com/en-us/resources/templates/



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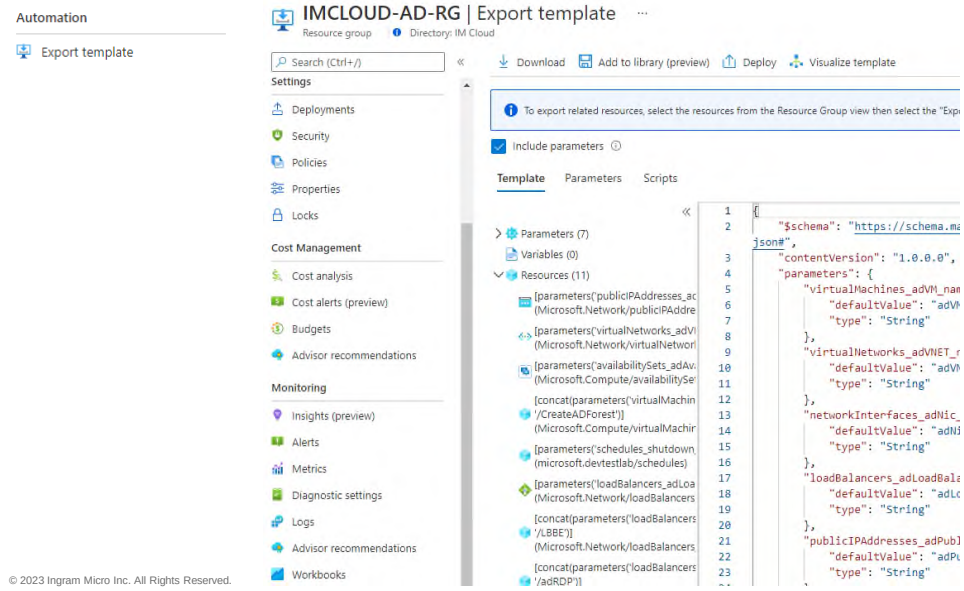
Export an ARM Template



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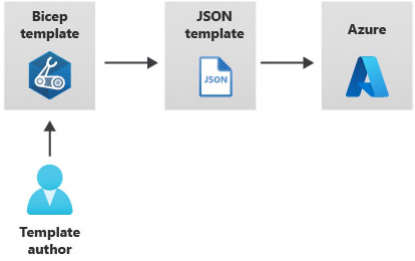
Azure Bicep

- New effort to define Azure-native language for Infrastructore as Code (IaC)
- Azure Bicep is Open-Source
- Azure Bicep will transpile into an ARM-JSON template
- Provides abstract layer and reduces pain of working with JSON



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Comparing Bicep and JSON

```
param location string = resourceGroup().location
param storageAccountName string = 'toylaunch${uniqueString(resourceGroup().id)}'

resource storageAccount 'Microsoft.Storage/storageAccounts@2019-06-01' = {
  name: storageAccountName
  location: location
  sku: {
    name: 'Standard_LRS'
  }
  kind: 'StorageV2'
  properties: {
    accessTier: 'Hot'
  }
}
```

Bicep

```
{
  "$schema": "https://schema.management.azure.com/schemas/2019-04-01/deploymentTemplate.json#",
  "contentVersion": "1.0.0.0",
  "metadata": {
    "_generator": {
      "name": "bicep",
      "version": "0.3.255.40792",
      "templateHash": "2629167571522382857"
    }
  },
  "parameters": {
    "location": {
      "type": "string",
      "defaultValue": "[resourceGroup().location]"
    },
    "storageAccountName": {
      "type": "string",
      "defaultValue": "[format('toylaunch{0}', uniqueString(resourceGroup().id))]"
    }
  },
  "functions": [],
  "resources": [
    {
      "type": "Microsoft.Storage/storageAccounts",
      "apiVersion": "2019-06-01",
      "name": "[parameters('storageAccountName')]",
      "location": "[parameters('location')]",
      "sku": {
        "name": "Standard_LRS"
      },
      "kind": "StorageV2",
      "properties": {
        "accessTier": "Hot"
      }
    }
  ]
}
```

ARM Template

https://learn.microsoft.com/en-us/training/paths/fundamentals-bicep

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Azure Terraform

- Hashicorp Terraform is an Infrastructore as Code (IaC) tool for provisioning and managing cloud infrastructure
- Manage infrastructure across multiple cloud providers
  - Azure
  - AWS
  - GCP
  - …
- Uses Hashicorp Configuration Language (HCL)

HashiCorp Terraform

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Demo:
Azure Management Tools

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Lab 2:
Azure Management Tools

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Module 3

Azure Virtual Machines

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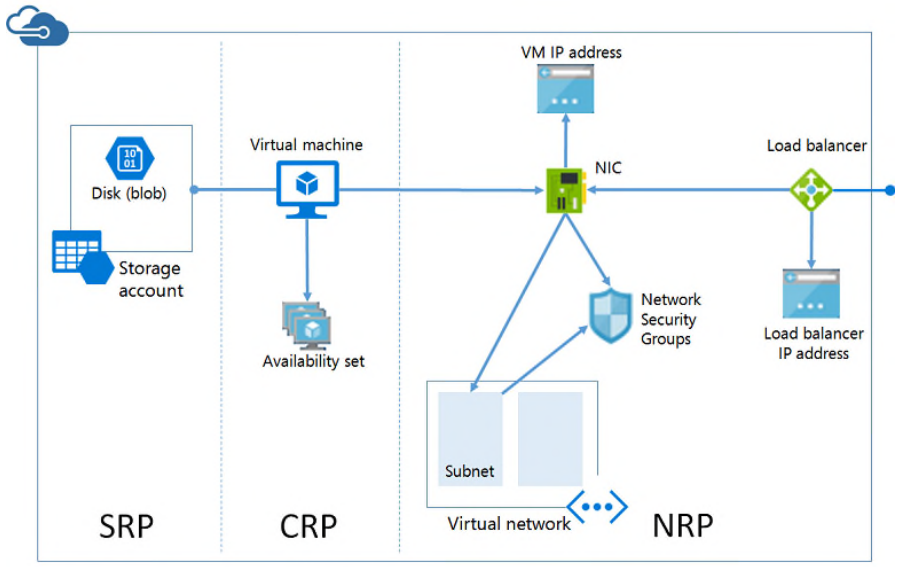
Azure Virtual Machine Resources



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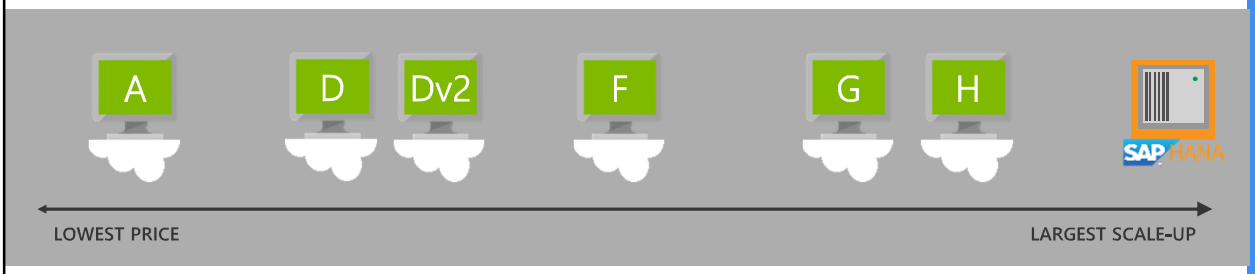
Azure Virtual Machines in 2016



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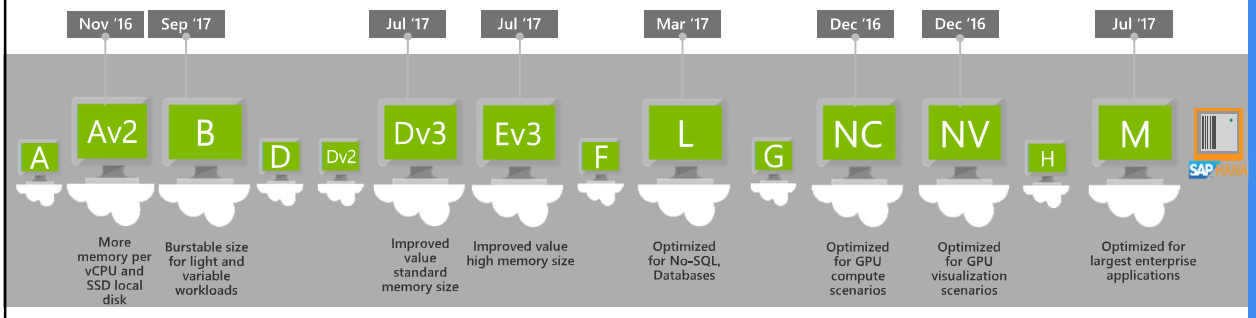
Azure Virtual Machines in 2017



Doubling the compute offerings since last Ignite!

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https://docs.microsoft.com/en-us/azure/virtual-machines/linux/sizes

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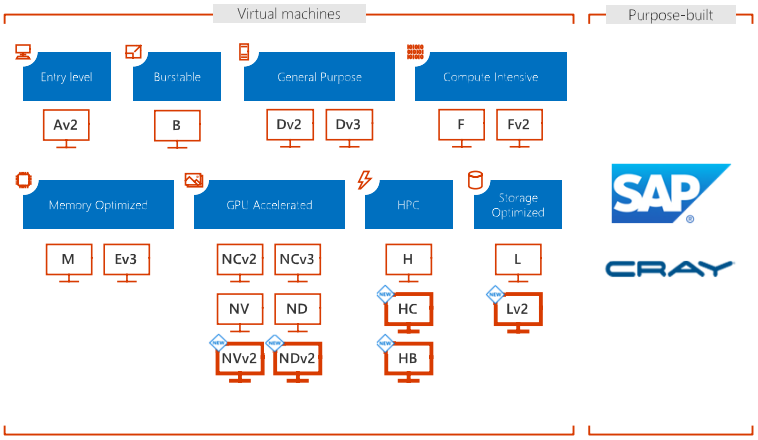
Azure Virtual Machines in 2018



What's new and on the roadmap?

- NVv2 for graphic intensive applications in Preview
- NDv2 accelerate machine training and HPC New Ev3 and Esv3
- Lv2 VMs currently in limited public preview.
- H-series VMs coming soon:
- HC for computationally intensive workloads
- HB for memory bandwidth driven workloads

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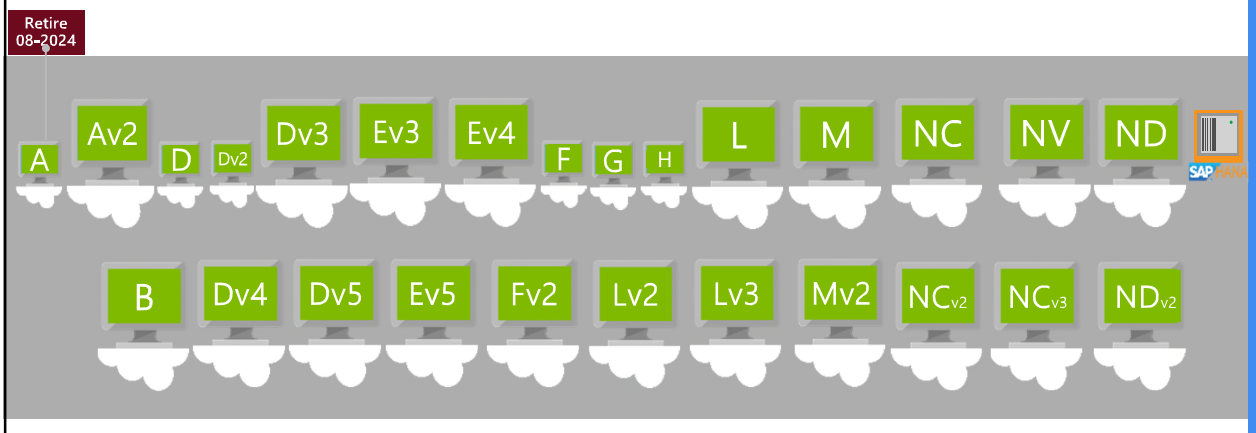
Azure Virtual Machines in 2023



https://azure.microsoft.com/en-us/pricing/details/virtual-machines/series/

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Select the Right Virtual Machine

Microsoft

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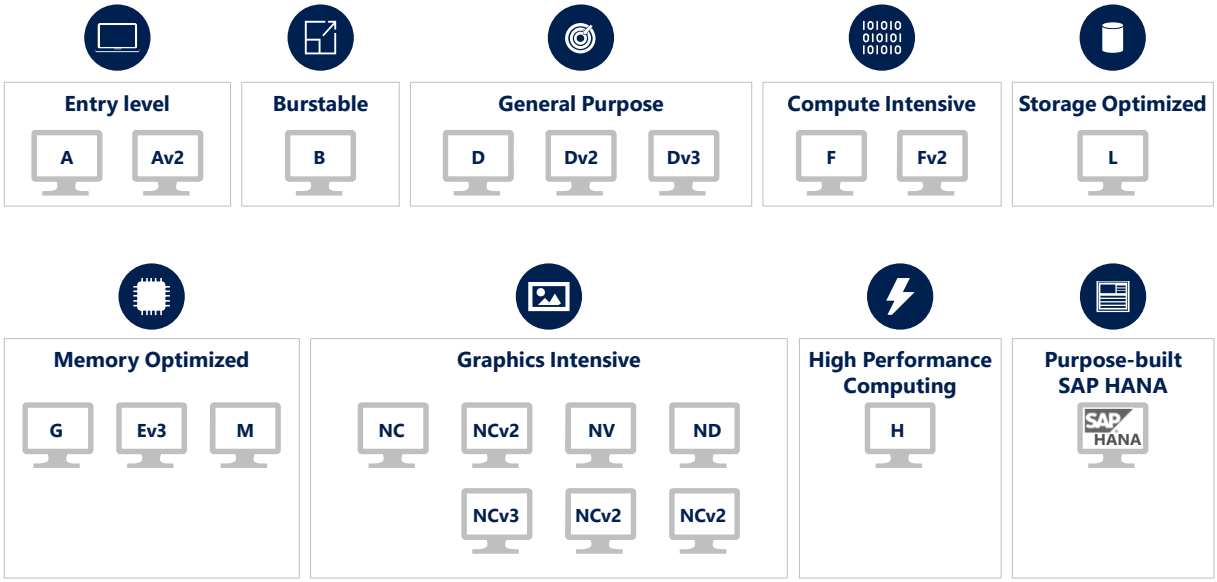
Compute Options for all Types of Apps



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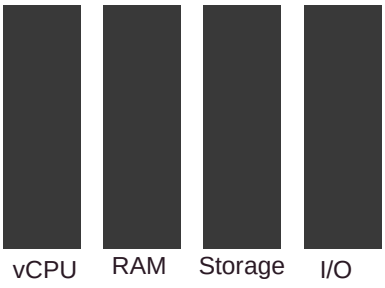
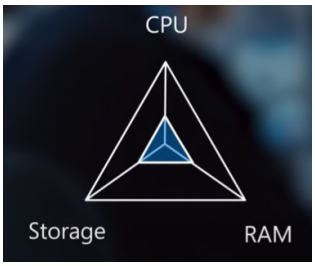
D-Series : General Purpose





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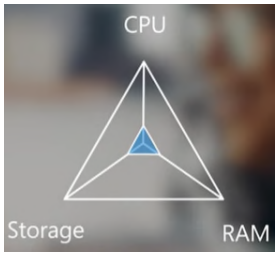
A-Series : Entry Level



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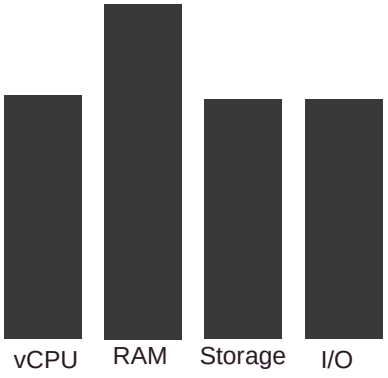
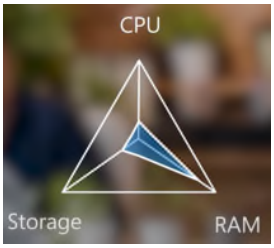
E-Series : Memory Optimized





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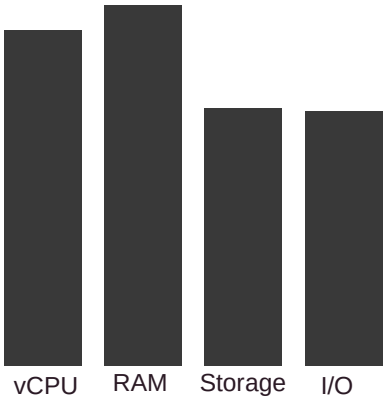
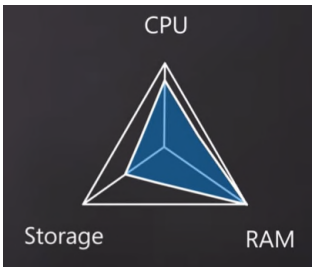
M-Series : Memory + CPU Optimized





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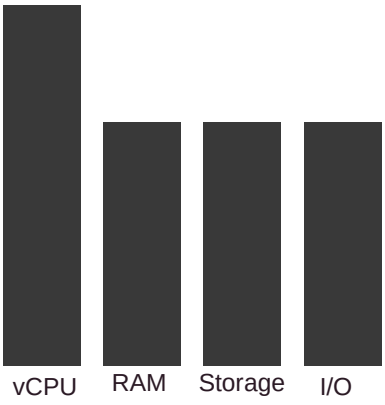
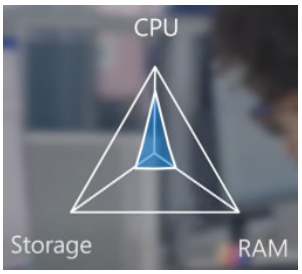
F-Series : CPU Optimized





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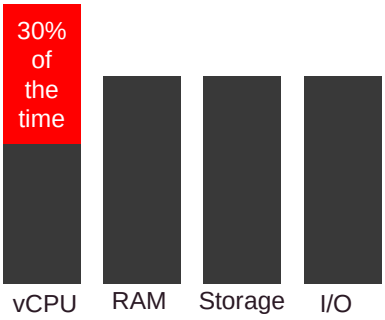
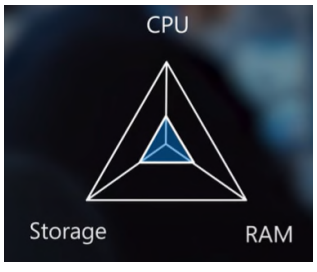
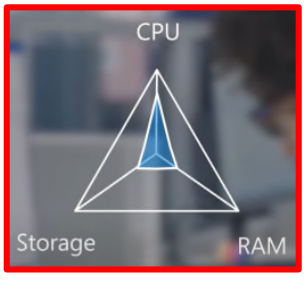
B-Series : Burst



30% of the time





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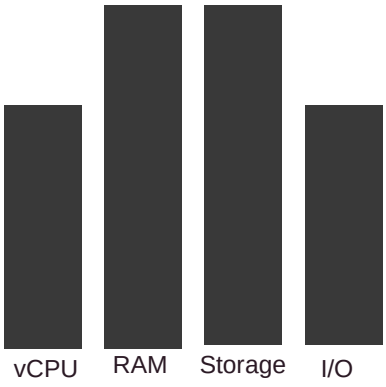
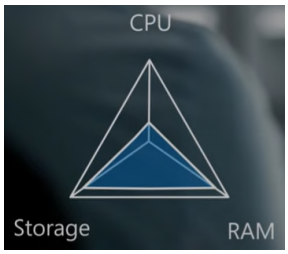
L-Series : Storage + RAM Optimized





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Azure VM Size Naming

<Family>[Sub-family]<#>[m][r][s]...[_v#]

Family series indicates target workload.

Optional **sub-family** further differentiates workloads (e.g. NC for GPU Compute; NV for GPU Visualization)
ND fo Deep Learning

Number of vCPUs in the VM

One or more **additive features**:

d	=	Disk, local are present
h	=	Hibernation capable
i	=	Isolated
l	=	Low memory
m	=	Memory intensive
n	=	NVMe
t	=	Tiny memory
r	=	RDMA
s	=	Premium Storage capable
a	=	AMD Based Processor

Version # of family, incremented with 10%+ performance improvements

https://docs.microsoft.com/en-us/azure/virtual-machines/vm-naming-conventions

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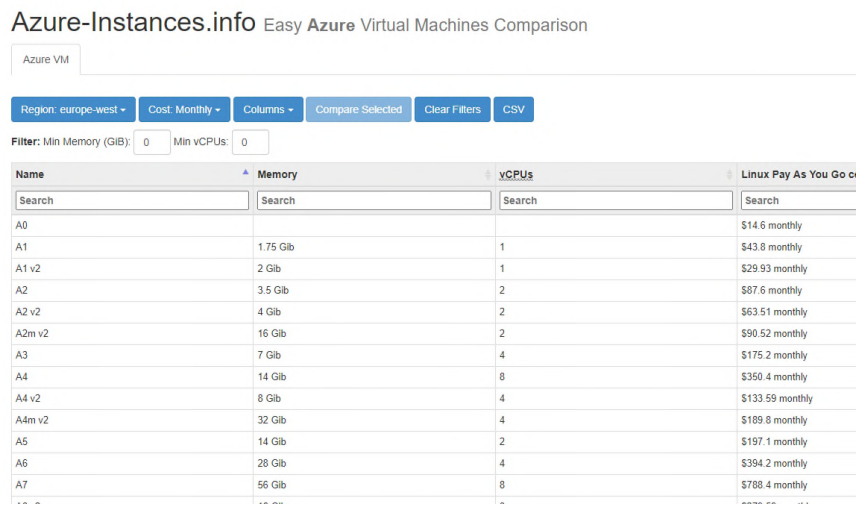
Compare the Virtual Machines

https://azure-instances.info/



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Azure Billing

- Priced on a per-hour basis
- Billed on a per-minute basis

- VM Status
  - Running (billable)
  - Stopped (Deallocated) (not billable)
  - Stopped (*) (billable !)

(*) The VM is stopped but still deployed to a physical host (Shutdown in VM)

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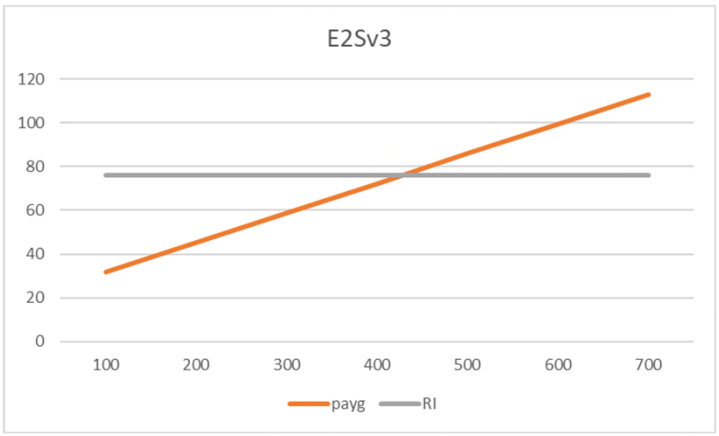
Reserved Instances versus PAYG



hrs	PAYG	RI
100	31,78	76,19
200	45,28	76,19
300	58,78	76,19
400	72,28	76,19
500	85,78	76,19
600	99,28	76,19
700	112,78	76,19
800	126,28	76,19

(1 month = 730 hours)

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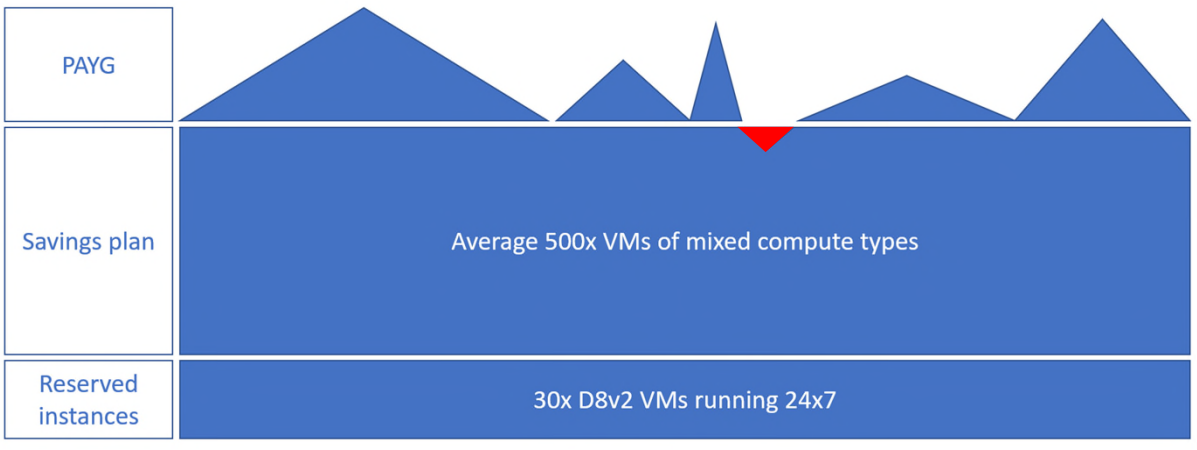
Azure Savings Plan

NEW



https://learn.microsoft.com/en-us/answers/questions/1082760/azure-reserved-instance-vs-azure-savings-plan-best

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Virtual Machines & Storage

Microsoft

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Select the right Storage

Managed Disks	~~Unmanaged Disks~~
Standard Storage	Premium Storage

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Unmanaged Disk retired on 20 september 2025

- Begin deprecating unmanaged disks on September 30, 2022 (for new installations)
- Functionality completely retired on September 30, 2025
- For existing installations : Plan migration

https://azure.microsoft.com/en-in/updates/azure-unmanaged-disks-will-be-retired-on-30-september-2025/

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Storage Types Compared

	Ultra disk	Premium SSD v2	Premium SSD	Standard SSD	Standard HDD
Disk type	SSD	SSD	SSD	SSD	HDD
Scenario	IO-intensive workloads such as SAP HANA, top tier databases (for example, SQL, Oracle), and other transaction-heavy workloads.	Production and performance-sensitive workloads that consistently require low latency and high IOPS and throughput	Production and performance sensitive workloads	Web servers, lightly used enterprise applications and dev/test	Backup, non-critical, infrequent access
Max disk size	65,536 gibibyte (GiB)	65,536 GiB	32,767 GiB	32,767 GiB	32,767 GiB
Max throughput	4,000 MB/s	1,200 MB/s	900 MB/s	750 MB/s	500 MB/s
Max IOPS	160,000	80,000	20,000	6,000	2,000
Usable as OS Disk?	No	No	Yes	Yes	Yes
Price 128 GB Disk	-	-	€ 20,00	€ 6,86 (*)	€ 5,43 (*)

(*) Transactions not included

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Managed / ~~Unmanaged Disks~~

Managed Disks (introduced February 2017)

Only Specify Type and Size of Storage

- Two Storage Types Available : Premium & Standard
- Sizes : P4 – P50 or S4 – S50

No Storage Account Creation needed (LUN)

Better reliability for Availability Sets

Different Storage Scale Units (Stamps)

Local Redundant Storage (LRS) & Zone Redundant Storage (ZRS)

~~Unmanaged Disks (retired September 30, 2022)~~

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Storage Remarks

- **Standard Disk : Additional Cost for Transactions**
- **Premium Disk : No Additional Transaction Cost**
- **Storage Q&A : http://aka.ms/DiskQnA**

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Virtual Network (VNet)

Microsoft

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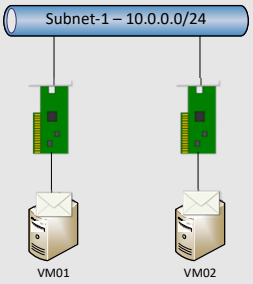
What is a virtual network (VNet) ?

- Logical Network Security Boundary
- Address Space
  - Not overlapping Address Ranges
  - Private IP Addres space (example 10.0.0.0/16)
  - Only Reachable within the Vnet
- Subnets
  - In an VNet Address Space you can have one or more Subnets
  - Example 10.0.0.0/24 and 10.0.1.0/24 and 10.0.3.0/24
  - By Default no security boundery between Subnets
  - Services in each Subnet can talk to each other



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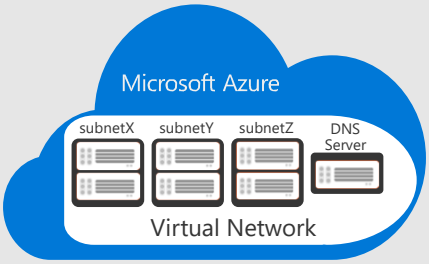
Virtual Network (VNet) and SubNet

- Logical isolation with control over the network
- Create subnets and isolate traffic with network security groups
- Support for Static IP addresses
- Support for Internal Load Balancing
- DNS options – BYO or Microsoft Azure-provided
- Extend your trust boundary – VMs on the same Network



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Create Virtual Machines

Microsoft

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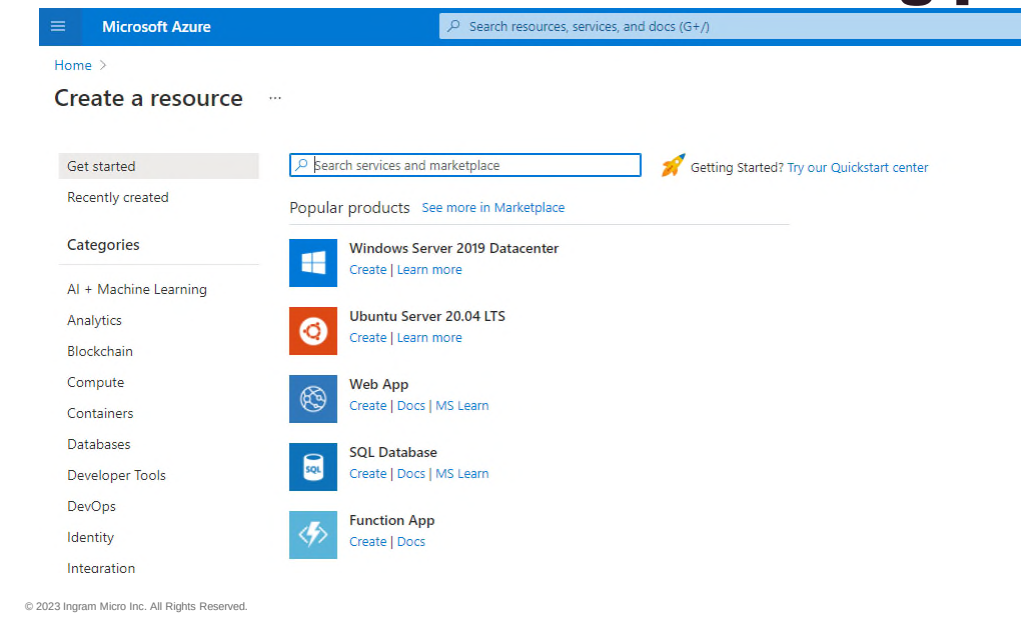
Create Virtual Machines using portal



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ARM Templates

Microsoft

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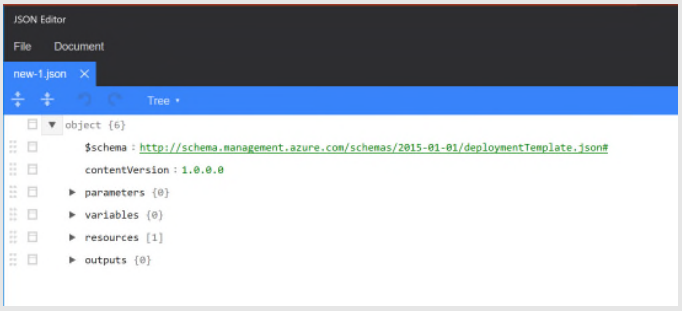
Resource Manager Templates

- Are JSON-Files
- Use a JSON Editor
- Create your First Template :
- https://docs.microsoft.com/en-us/azure/azure-resource-manager/resource-manager-create-first-template?



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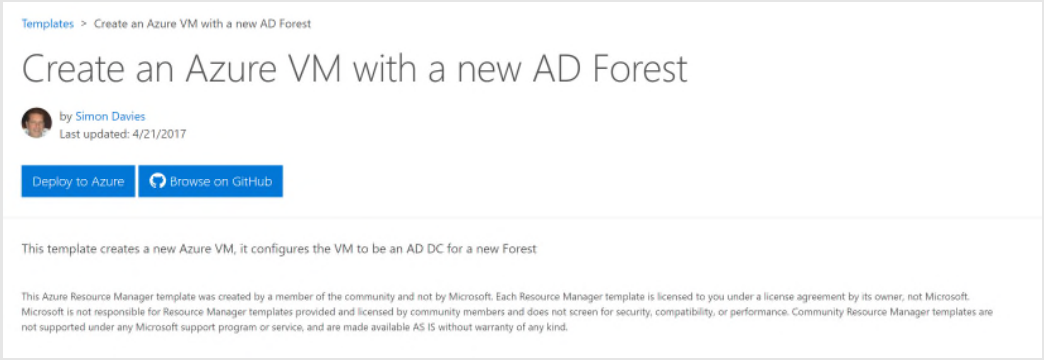
Creating VM from Azure QuickStart Template

https://azure.microsoft.com/en-us/resources/templates/



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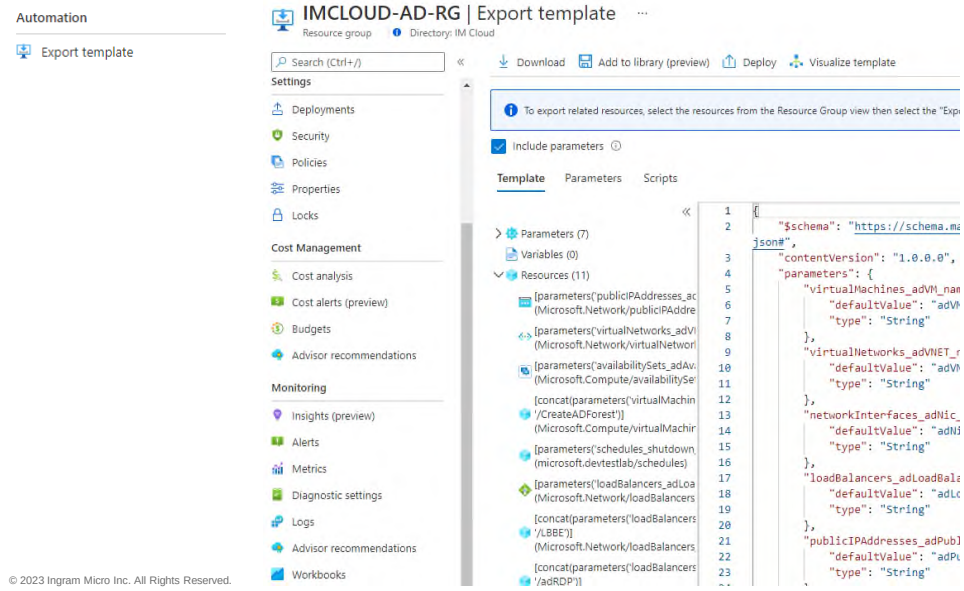
Export an ARM Template



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Additional Resources

Microsoft

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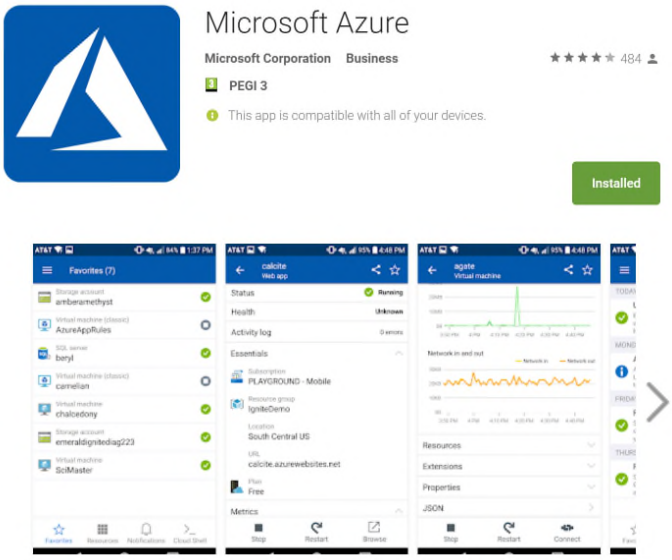
Microsoft Azure App for Android



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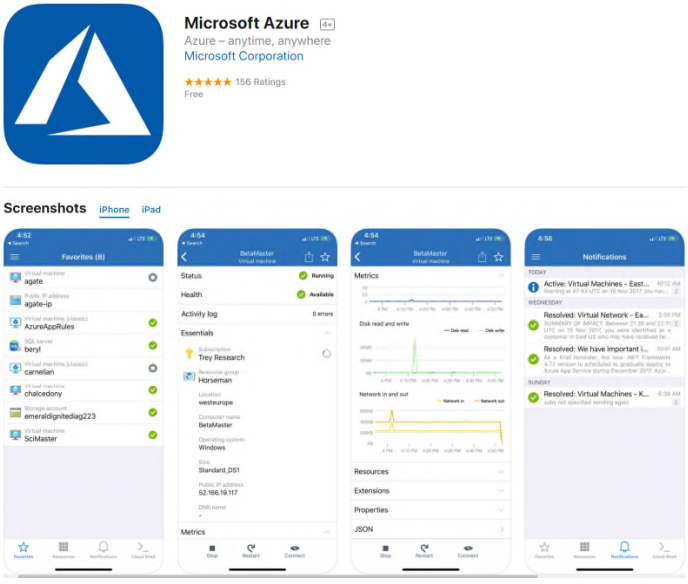
Microsoft Azure App for iPhone



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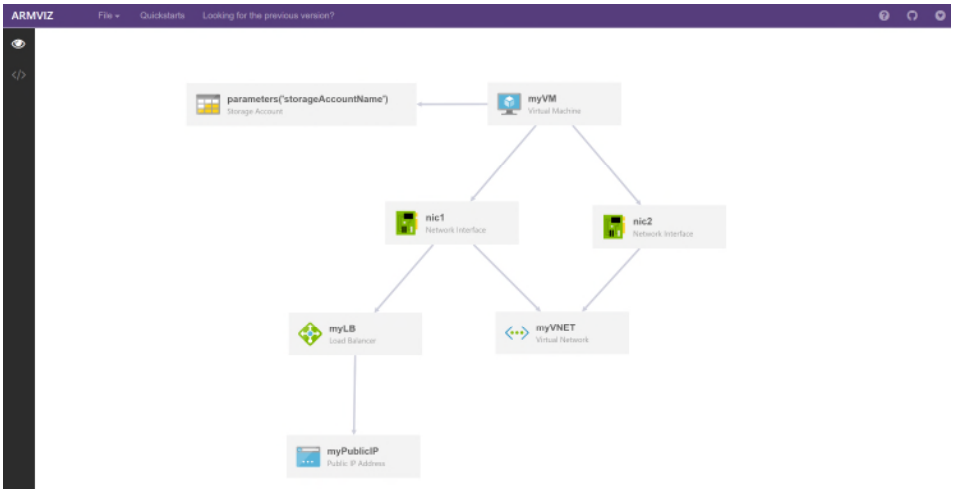
ARM Template Visualizer



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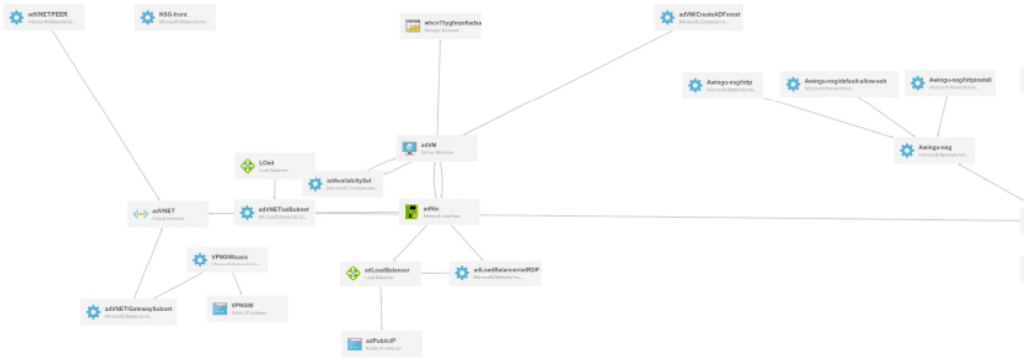
Make your configuration visual



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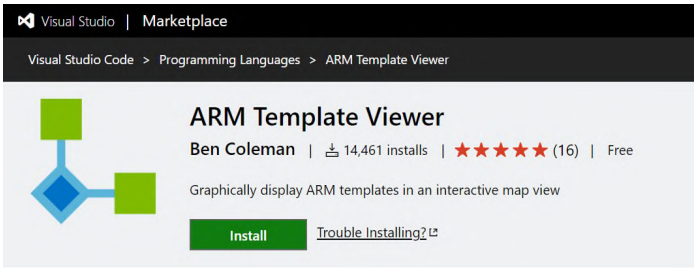
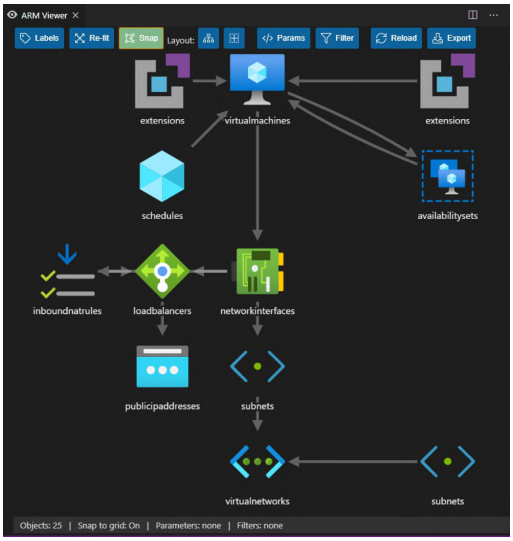
Visual Studio Code & ARM Viewer
(Extention)



https://marketplace.visualstudio.com/items?itemName=bencoleman.armview



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- Stop your Virtual Machines after the exercises !

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Demo:
Azure Virtual Machines

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Lab 3:
Azure Virtual Machines

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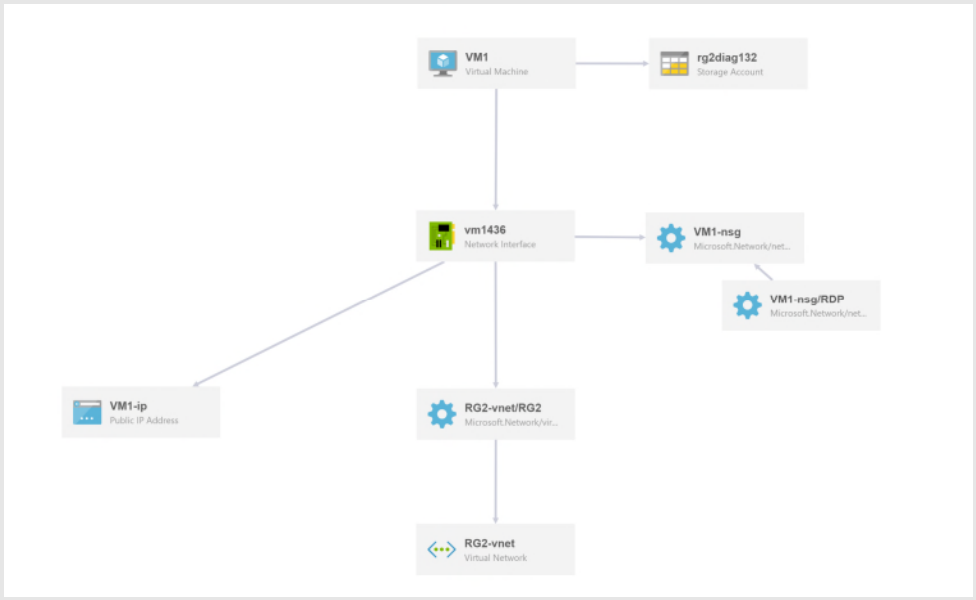
VM1



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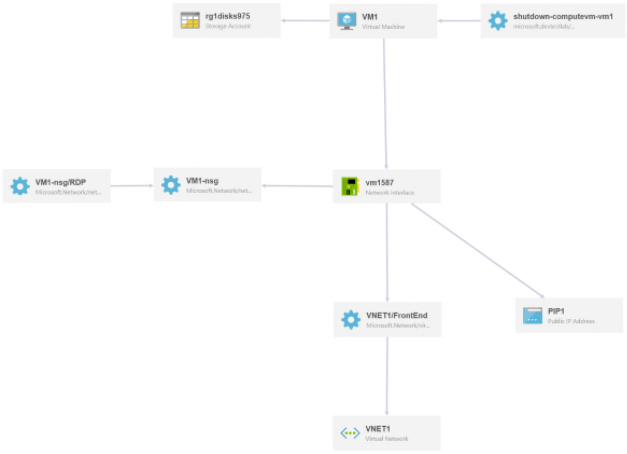
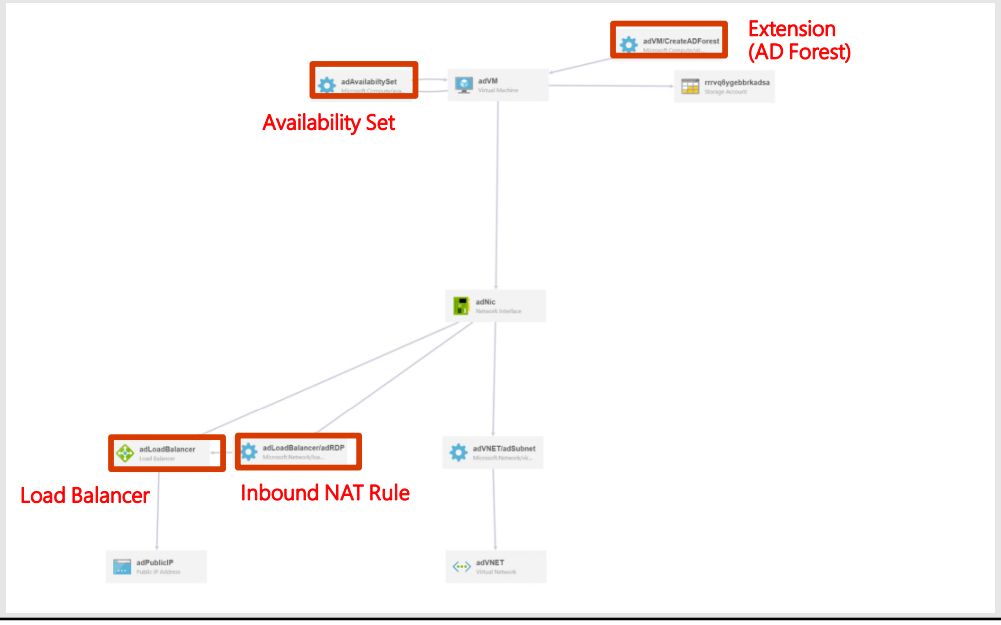
VM1



124

Active Directory Template



125

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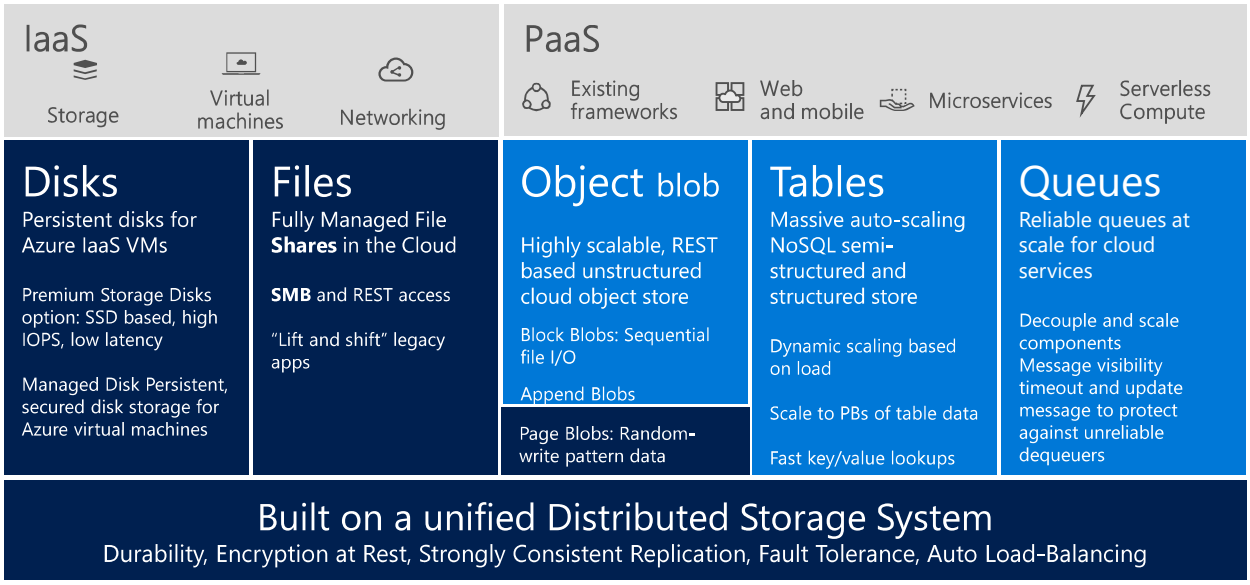
Azure Storage Services



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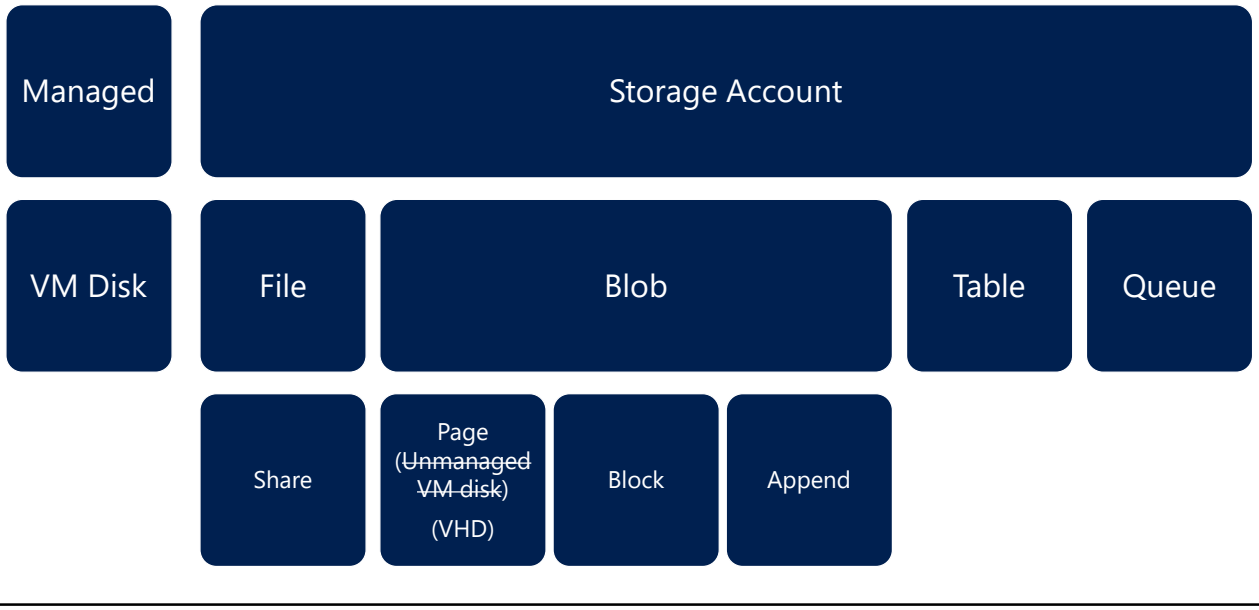
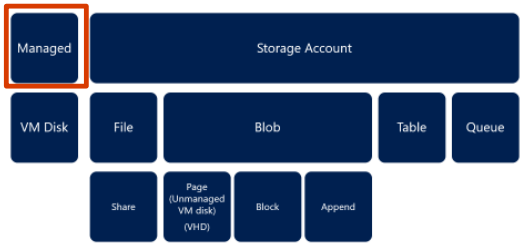
Azure Storage Overview



128

Azure Managed Storage



Microsoft

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Azure Managed Storage

	Ultra disk	Premium SSD v2	Premium SSD	Standard SSD	Standard HDD
Disk type	SSD	SSD	SSD	SSD	HDD
Scenario	IO-intensive workloads such as SAP HANA, top tier databases (for example, SQL, Oracle), and other transaction-heavy workloads.	Production and performance-sensitive workloads that consistently require low latency and high IOPS and throughput	Production and performance sensitive workloads	Web servers, lightly used enterprise applications and dev/test	Backup, non-critical, infrequent access
Max disk size	65,536 gibibyte (GiB)	65,536 GiB	32,767 GiB	32,767 GiB	32,767 GiB
Max throughput	4,000 MB/s	1,200 MB/s	900 MB/s	750 MB/s	500 MB/s
Max IOPS	160,000	80,000	20,000	6,000	2,000
Usable as OS Disk?	No	No	Yes	Yes	Yes
Price 128 GB Disk	-	-	€ 20,00	€ 6,86 (*)	€ 5,43 (*)

(*) Transactions not included

INGRAM CLOUD

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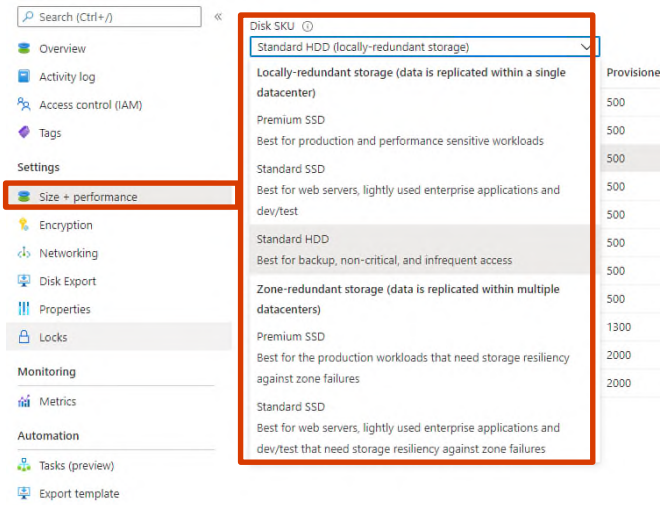
Change Disk SKU & Performance Tier (premium)

Select Settings > Disk
Click {Disk}
Select Settings > Size + performance

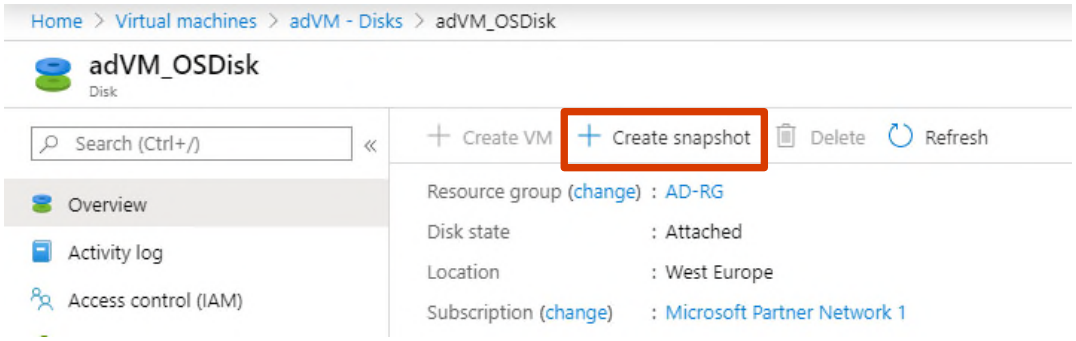


https://docs.microsoft.com/en-us/azure/virtual-machines/disks-performance-tiers-portal

131

Create a Snapshot of a Managed disk

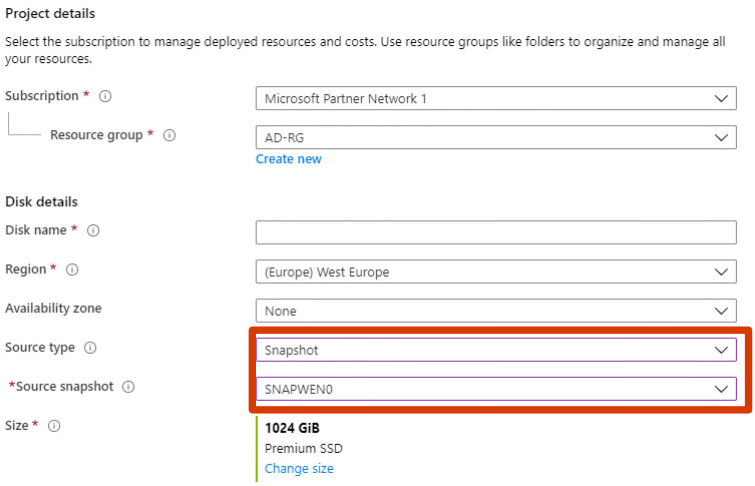
- Select the Disk
- Select + Create snapshot



132

Restore a Snapshot to a disk

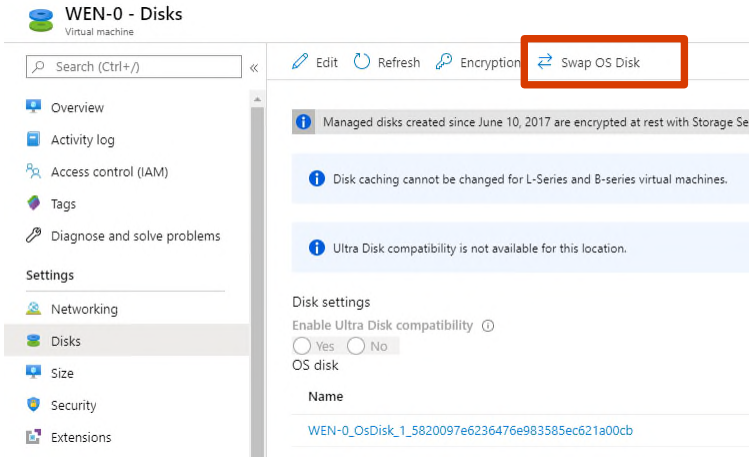
- Create a new Managed Disk
- Resource Type :
  - Snapshot
- Source Snapshot



133

Replace disk by newly created disk

- Select the VM
- Select Swap OS Disk > Select the newly created disk



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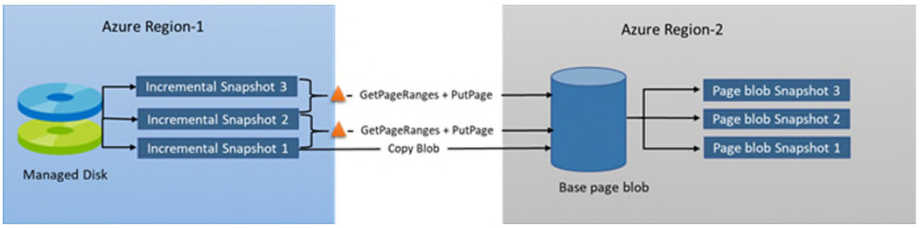
Incremental Snapshots of Managed Disks

- This feature is in preview since September 2019
- Advantage : Cost-effective Point-in-time backup
- Billed for the delta changes since last snapshot
- Stored on standard HDD (Page Blob) (ZRS)
- Only in : East US, East US2, Central US West C US, Canada



https://azure.microsoft.com/en-us/blog/introducing-cost-effective-increment-snapshots-of-azure-managed-disks-in-preview/
https://docs.microsoft.com/en-us/azure/virtual-machines/linux/disks-incremental-snapshots

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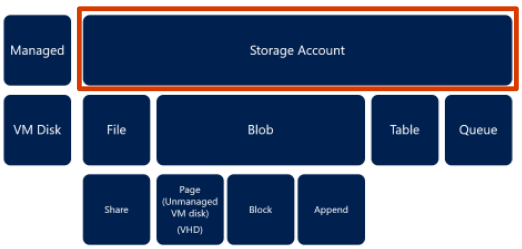
Storage Accounts



Microsoft

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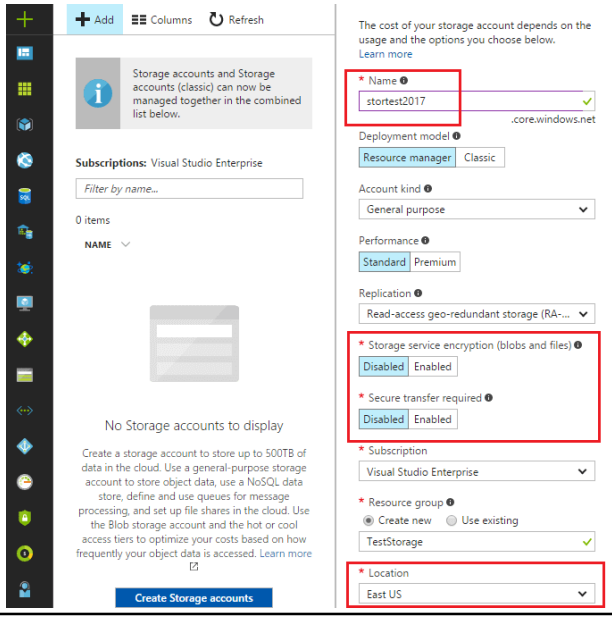
Creating a Storage Account

- Unique Name
- Account Type
- Performance
- Replication
- Location



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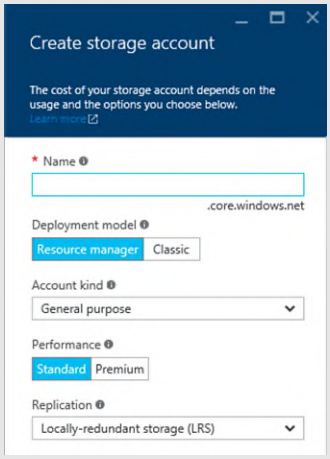
Storage Accounts

- Up to 500 TB of data per account
- Maximum of 200 storage accounts per subscription
- Three types of accounts
  - Blob storage, GPv1, GPv2
- Four types of replication
  - LRS, ZRS, GRS, and RA-GRS (Read access geo-redundant storage)
- Support optional 256-bit AES encryption for "data at rest"



Microsoft Azure

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Storage Account Types

GPv1	Blob	GPv2
General Purpose v1 Blob, File, Table, Queue Supports deploying with Classic Deployment Model	Blob Storage Account Blobs only Blob Storage Tiers	General Purpose v2 Supports all latest features Blob, File, Table, Queue

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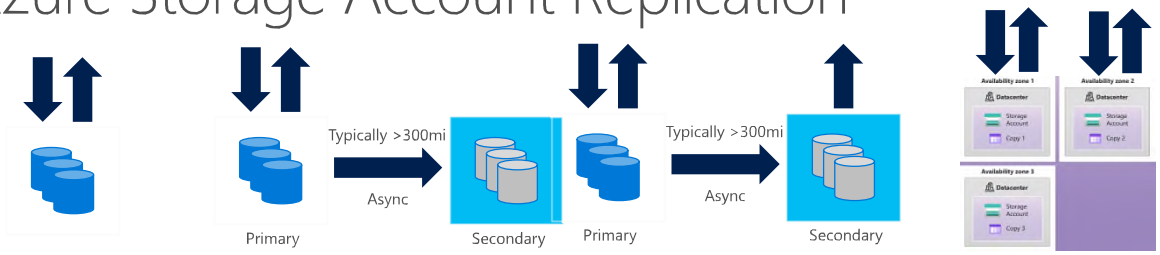
Azure Storage Account Replication



LRS

- 3 replicas, 1 region
- Protect against disk, node, rack failures
- Write is ack'd when all replicas are committed
- Superior to dual-parity RAID
- Availability : 99.9%
- 3 Disks

GRS

- 6 replicas, 2 regions (3/region)
- Protects against major regional disasters
- Asynchronous to secondary
- Availability 99.99%
- 6 Disks

RA-GRS

- GRS + Read access to secondary
- Separate secondary endpoint
- RPO delay to secondary can be queried
- Availability 99.99%
- 6 Disks

ZRS

- GRS + GRS
- Synchronously across datacenters
- Availability 99.9%
- 3 Disks/3 Datacenters

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Locally redundant storage

- Replicates your data three times within a storage scale unit (collection of racks of storage nodes) in the same region.
- A write request returns successfully only once it has been written to all three replicas
- Fault domain (FD) is a group of nodes that represent a physical unit of failure and can be considered as nodes belonging to the same physical rack.
- Upgrade domain (UD) is a group of nodes that are upgraded together during the process of a service upgrade (rollout).
- Replicas are spread across UDs and FDs within one storage scale unit

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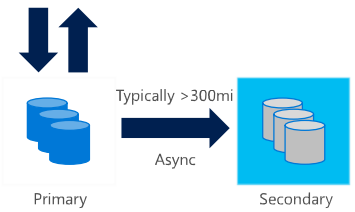
Geo redundant storage

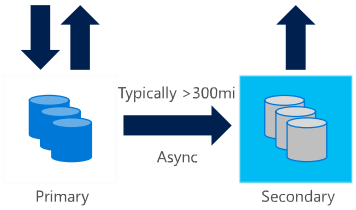
- Geo-redundant storage (GRS) replicates your data to a secondary region that is hundreds of miles away from the primary region
- Update is first committed to the primary region, where it is replicated three times.
- Update is replicated asynchronously to the secondary region, where it is also replicated three times.
- With GRS both the primary and secondary regions manage replicas across separate fault domains and upgrade domains within a storage scale unit
- The replica is not available unless Microsoft initiates failover to the secondary region.
- If an application wants to read from the secondary region the user should enable RA-GRS.
- The secondary region is pre determined based on the primary region, and cannot be changed



142

Read-access Geo-redundant storage

- Read-access geo-redundant storage (RA-GRS) provides read-only access to the data in the secondary location
- When you enable read-only access to your data in the secondary region, your data is available on a secondary endpoint, in addition to the primary endpoint for your storage account
- The access keys for your storage account are the same for both the primary and secondary endpoints.
- Your application has to manage which endpoint it is interacting with when using RA-GRS.
- RA-GRS is intended for high-availability purposes.
- 99.99 % Uptime



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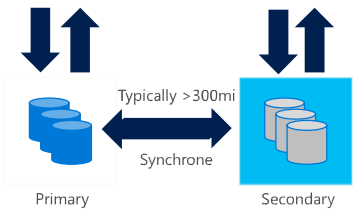
Zone redundant storage

- Zone-redundant storage (ZRS) replicates your data synchronously across datacenters within one or two regions in addition to storing three replicas
- Simplify the development of highly available applications
- ZRS provides durability for storage objects of at least 99.9999999999% over a given Year
- ZRS is currently available for preview in the following regions, with more regions coming soon:
  - US East 2
  - US Central
  - France Central



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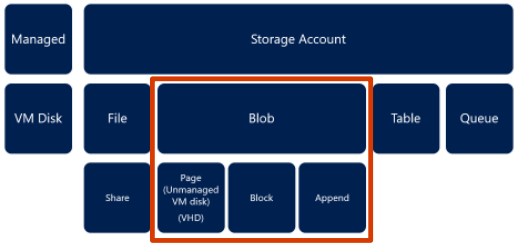
Blob Storage

Microsoft



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Blob Storage

Azure's Object Storage platform

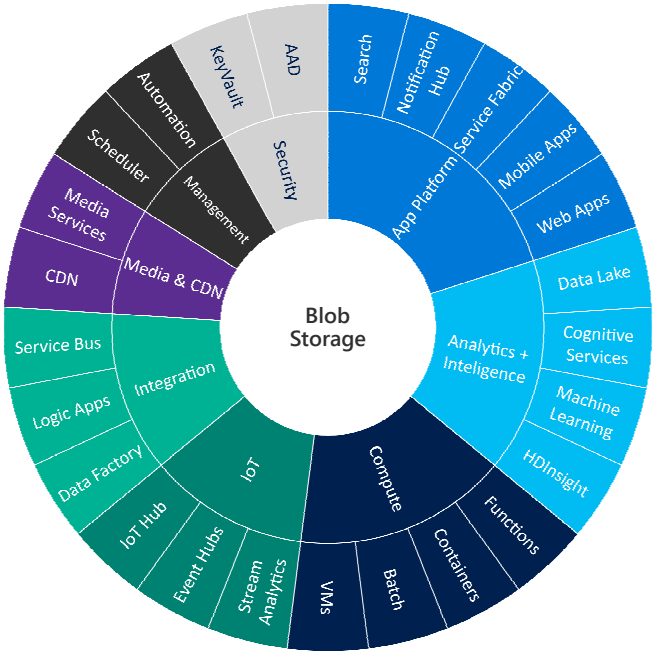
Binary Large Object (Blob)

Store and serve unstructured data

- App and Web scale data
- Backups and Archive
- Big Data from IoT, Genomics, etc.

Broad integration for Blobs across Azure services

Enables many scenarios through massive scale performance, high availability, and low cost



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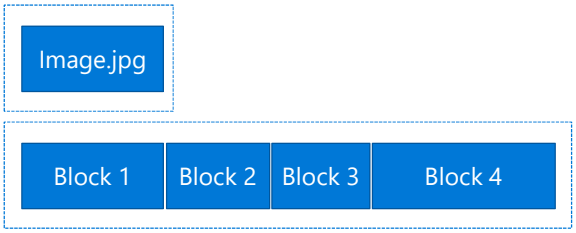
Types of Blobs

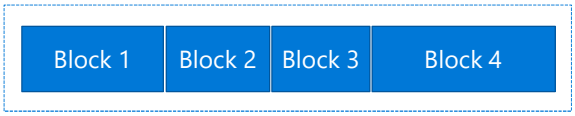
Block Blobs

Most object storage scenarios like documents, images, videos, etc.



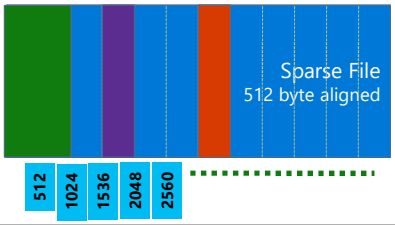
Append Blobs

Multi-writer append only scenarios
Logging, Big Data Analytics output



Page Blobs

Page aligned random reads and writes I/O
IaaS Disks, Event Hub, Block level backup



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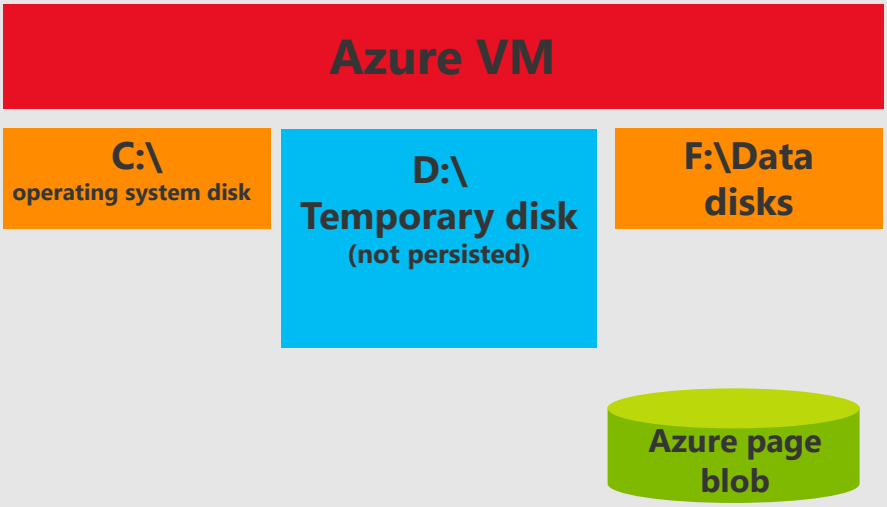
Page Blobs (Unmanaged Disks) (vhd)



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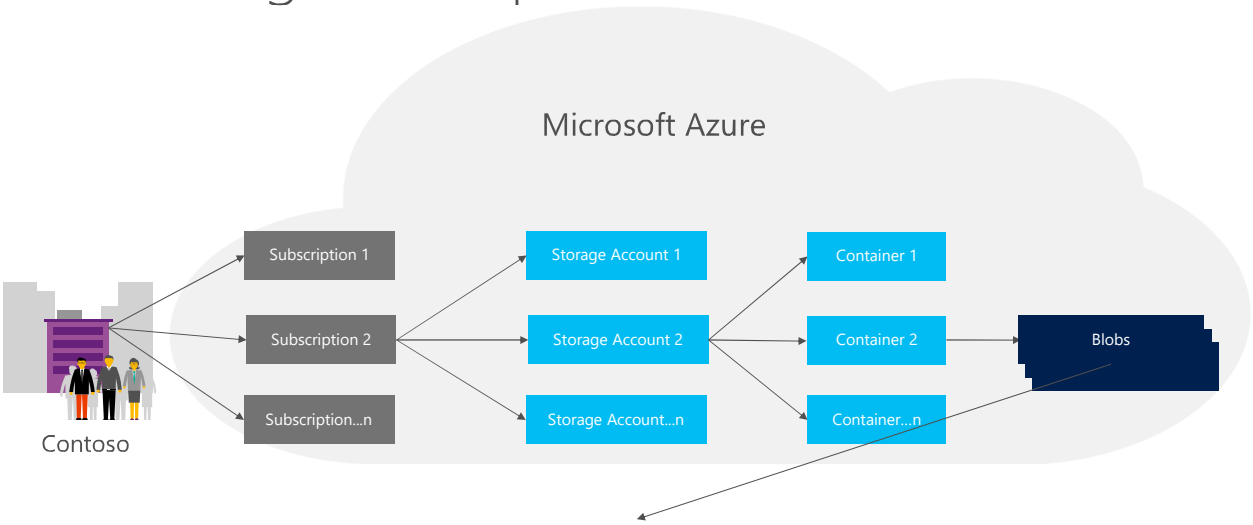
Blob Storage Concepts



https://<StorageAccount>.blob.core.windows.net/<Container>/<Blob>

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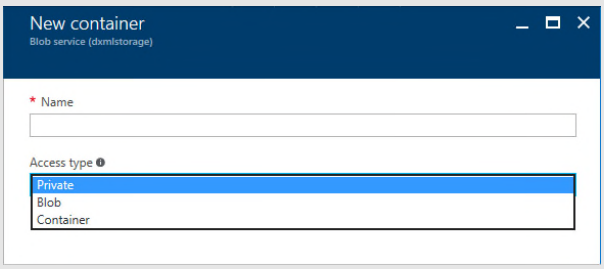
Storage Containers Access Policies

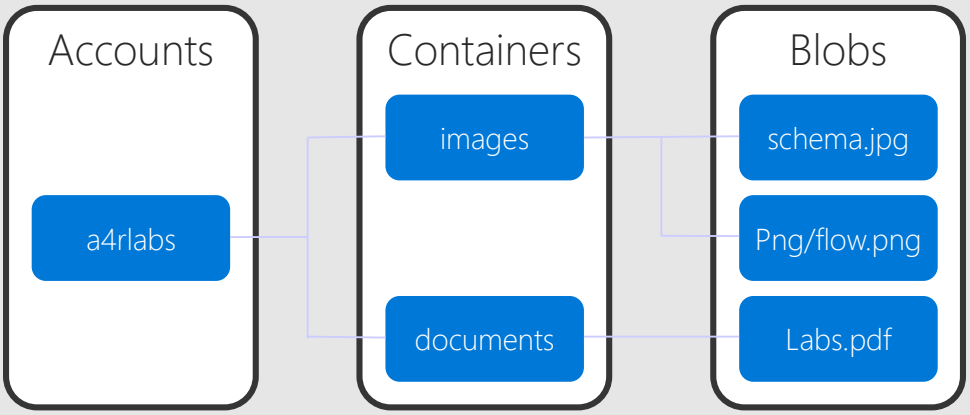
- Three access policies
  - Private – Blobs can't be read or enumerated anonymously
  - Container – Blobs can be read and enumerated anonymously
  - Blob – Blobs can be read anonymously, but cannot be enumerated



Microsoft Azure

150

Blob Storage



3 to 24 characters
0-9 and a-z
Unique within Azure

3 to 63 characters
0-9, a-z, and dashes

1 to 1,024 characters
Any characters (including slashes)
URL characters must be escaped
Max. 254 path segments

Microsoft Azure

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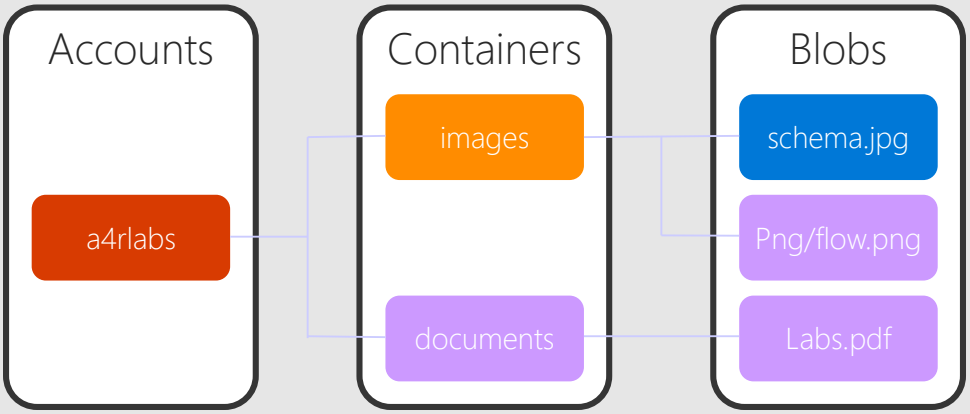
Blob URLs



https://a4rlabs.blob.core.windows.net/images/schema.jpg

Microsoft Azure

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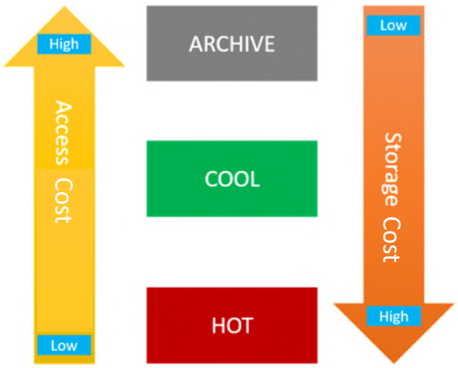
Block Blob Storage Access Tiering

- You may only tier your object storage data to hot, cool, or archive in Blob Storage or General Purpose v2 (GPv2)
- Do the setting in the **Access Tier** attribute

- Hot Access Tier
  - Data in Active Use
- Cool Access Tier
  - Short Term Backup
- Archive Access Tier
  - remain in the archive tier for at least 180 days
    - (ONLY AVAILABLE ON BLOB Level)



Azure

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Comparison Storage Tiers

The following table shows a comparison of the hot, cool, and archive storage tiers.

	Hot storage tier	Cool storage tier	Archive storage tier
Availability	99.9%	99%	N/A
Availability (RA-GRS reads)	99.99%	99.9%	N/A
Usage charges	Higher storage costs, lower access and transaction costs	Lower storage costs, higher access and transaction costs	Lowest storage costs, highest access and transaction costs
Minimum object size	N/A	N/A	N/A
Minimum storage duration	N/A	30 days (GPv2 only)	180 days
Latency (Time to first byte)	milliseconds	milliseconds	< 15 hrs
Scalability and performance targets	Same as general-purpose storage accounts	Same as general-purpose storage accounts	Same as general-purpose storage accounts

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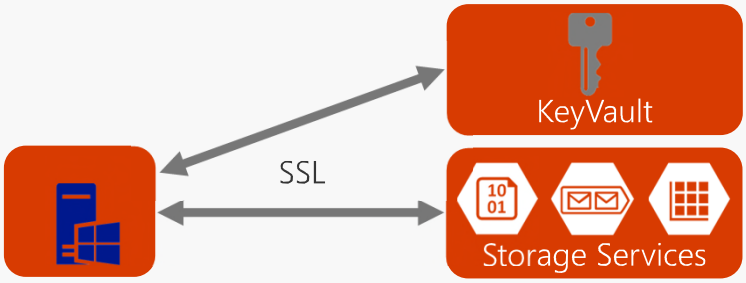
Encryption at Rest

Blob Storage Service Encryption

- Blob Storage Service automatically encrypts your data
- SSL used to secure data sent to Storage Service
- Microsoft manages all key management practices including compliance
- What's next: "Bring your own key" for server side encryption at rest



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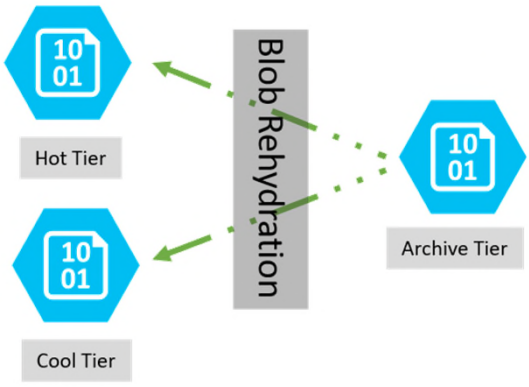
Azure Blob Rehydration

- Bring Azure Storage from Archive Tier to :
  - Hot Tier
  - Cool Tier
- Takes several hours (up to 15 hours)



Azure

INGRAM MICRO

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Versioning

Snapshots

Read only copy of a blob at a point in time
Same name as blob with a datetime stamp

Can be read, copied/restored or deleted

CopyBlob to make a write-able new blob from a snapshot
CopyBlob to restore a snapshot over the current version
Snapshots are not copied with a normal CopyBlob operation
Blob Deletion requires deletion of all snapshots

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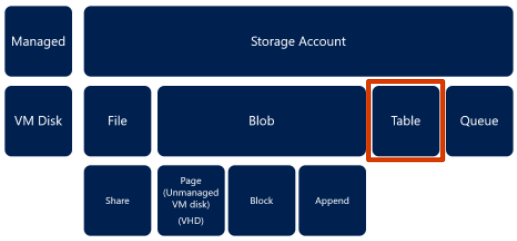
Table Storage



Microsoft

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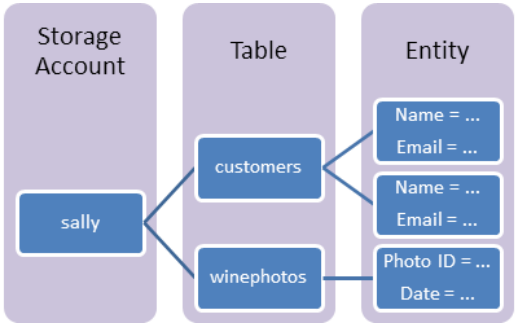
What is Table Storage ?

- Large amounts of Structured Data
- NoSQL datastore
- Structured Non-relational Data
- No schema needed
- Accessing data using the OData protocol and LINQ queries



http://<storage account>.table.core.windows.net/<table>

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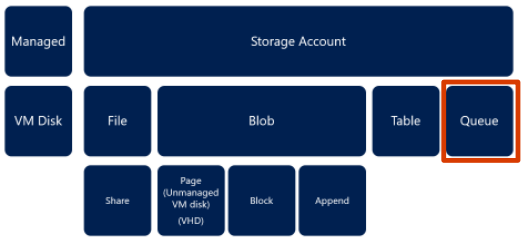
Queue Storage

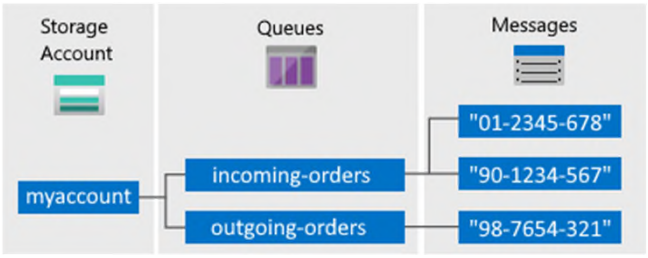


Microsoft

160

What is Queue Storage ?

- Large numbers of messages
- A queue message can be up to 64 KB in size
- Protocol http & https



https://<storage account>.queue.core.windows.net/<queue>

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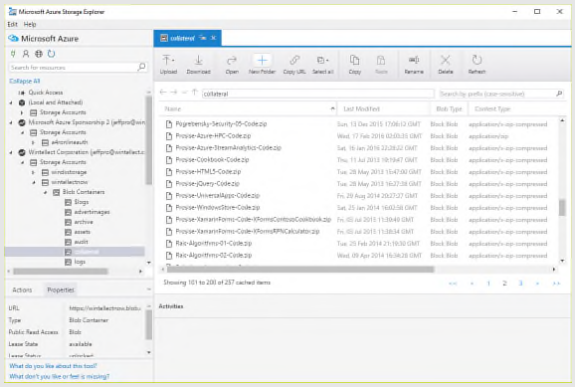
Azure Storage Explorer

- Free cross-platform tool for managing Azure Storage
- http://storageexplorer.com/



Microsoft Azure

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Accessing Storage Accounts

Microsoft

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Storage Account Access Keys & SAS Tokens

a) Storage Account Access Keys

- Your storage account is assigned two private access keys on creation that are used for authentication
- Can be rotated but application access needs to be modified (except for VMs)

b) For limited access use Shared Access Signature (SAS)

- A shared access signature (SAS) is a token that can be appended to a URL that enables delegated access to a storage resource
- Anyone who possesses the token can access the resource it points to with the permissions it specifies, for the period of time that it is valid

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Request Authorization Options - Compared

Individual Request Signing

- Possession of access key authorizes *all* operations
- To revoke access to client, key must be regenerated
- Authorization in header

SAS Tokens

- SAS tokens can grant limited, specific privileges
- SAS tokens have explicit expiration, and can be revoked (stored policy)
- Authorization in URL
- Requires custom token issuer service

- Appropriate only for secure, trusted application deployments

- Best for most scenarios
- Enables bypass of middle tier

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Account SAS Example

`https://myaccount.blob.core.windows.net/mycontainer/myblob?sv=2015-04-05&ss=b&srt=o&sp=r&se=2016-09-30T23:57:53Z&st=2016-09-14T15:57:53Z&spr=https&sig=BWLBIFazbsn96gJl2I0wKjkRRBaH9qvtF5qtsluulPk%3D`

Parameter	Description
sv=2015-04-05	SAS protocol version
ss=b	Services allowed
srt=o	Resource types allowed
sp=r	Permissions granted
st=2016-09-14T15:57:53Z	Start (valid from date/time)
se=2016-09-30T23:57:53Z	Expiration (valid until date/time)
spr=https	Allowed protocols (https or https,http)
sig=BWLBIFd8gl38avg…	Signature

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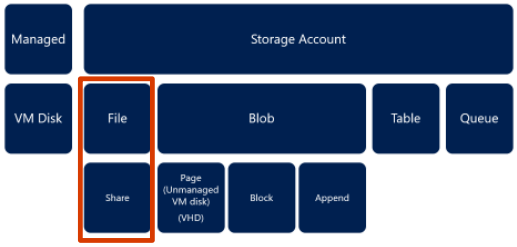
Azure Files



Microsoft

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Azure Files: Capabilities

What is Azure Files?

- Fully Managed Cloud File Storage for use with IaaS and On Premises instances

Multiple protocols & Operating Systems

- SMB 2.1, 3.0, and REST
- Mount from both Windows & Linux

Globally accessible

- Accessible from both On Premises and IaaS instances

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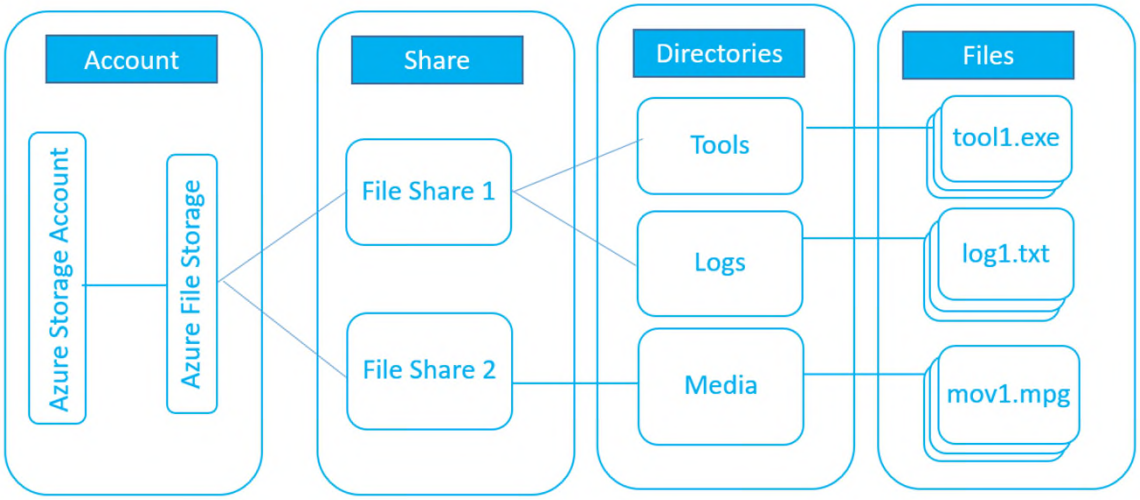
Azure Files : SMB Share



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Azure Files vs. Disks vs. Blobs

	Azure Files	Azure Disks	Azure Blobs
Scenario	**Life & Shift applications which leverage native file system**	**Persistent disks to Azure Virtual Machines**	**Massively scale out object storage**
Protocol	**SMB 2.1/3.0, REST**	**VHD, REST**	**REST**
Accessibility	**SMB – Worldwide (requires Port 445) REST – Worldwide**	**VHD – Azure Data Center REST (Page Blob) – Worldwide**	**REST –Worldwide**
Durability	LRS, GRS	LRS, GRS, RA-GRS (for Page Blob)	LRS, GRS, RA-GRS
Object Size	Up to 1 TB file	Up to 1 TB Disks (Can stripe up to 64 disks on G VM)	Up to 1 TB/Blob
Max IOPS (8K)	1000	5000 (Premium) 500 (Standard)	500 request/sec
Throughput	Up to 60 MB/s per share	Up to 200 MB/s per disks (Premium) Up to 60 MB/s per disk (Standard)	Up to 60 MB/sec per blob

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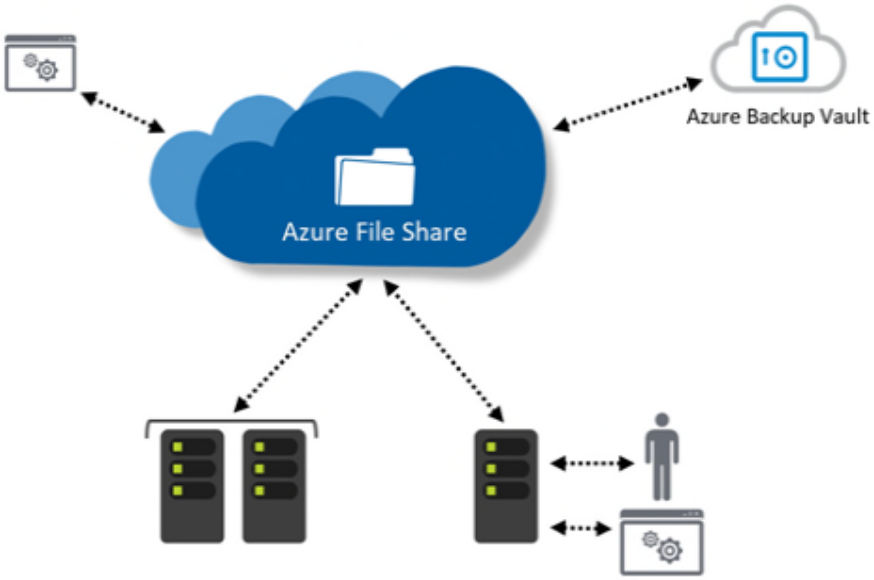
Azure File Sync : On Premises – Cloud File Share



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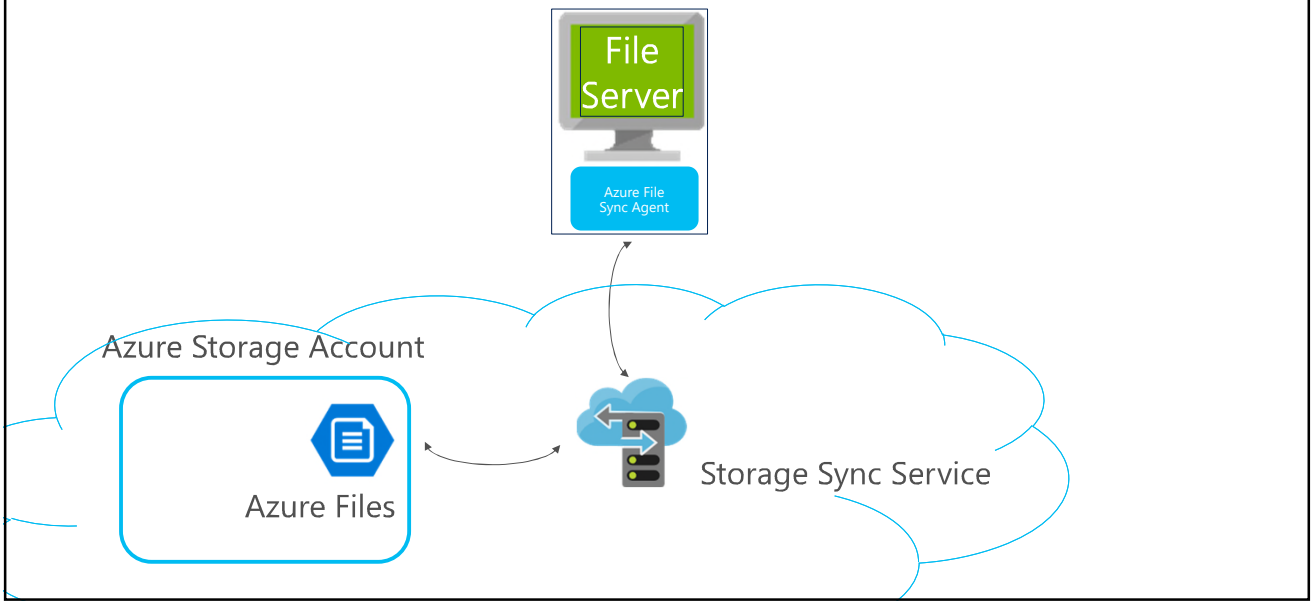
Azure File Sync (AFS) Components



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Azure Files and User Permissions (Preview 24-09-2018)

Microsoft

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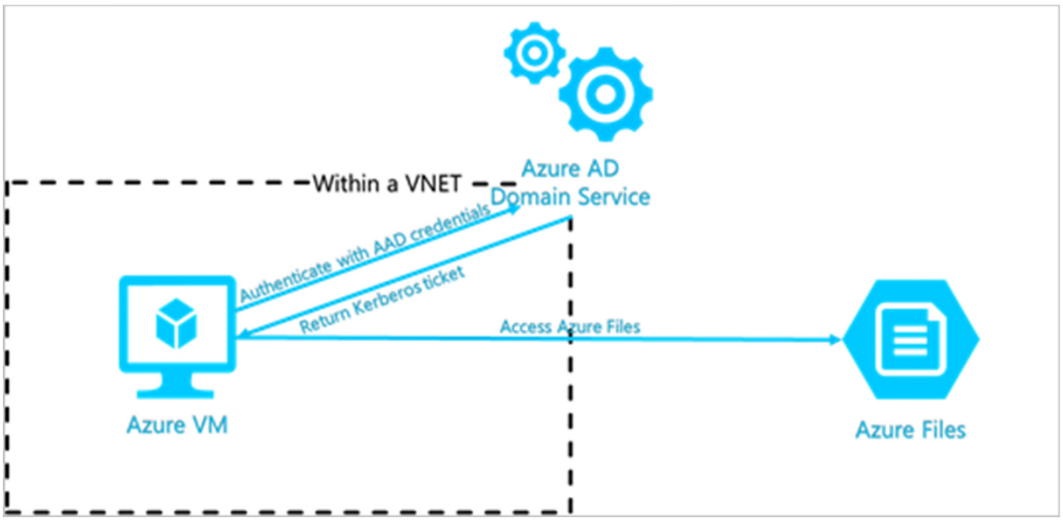
Azure Files with User Authentication



https://docs.microsoft.com/en-us/azure/storage/files/storage-files-active-directory-overview

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Azure Files and User Authentication

1. Setup Azure Active Directory Domain Services
2. Enable Azure AD authentication over SMB
3. Configure share-level permissions for Azure Files
    1. RBAC Roles
    2. https://docs.microsoft.com/en-us/azure/storage/files/storage-files-active-directory-enable

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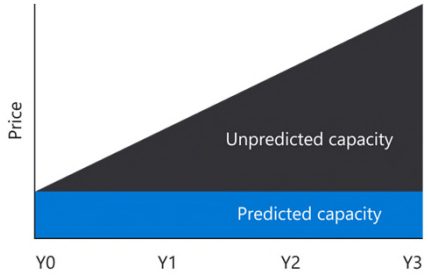
Azure Storage Reservations (Ignite 2019)

- Announced during Ignite 2019
- Available in Standard Storage Accounts (Hot – Cool – Archive)
    - Blob Storage
    - General Purpose v2
- NOT available in Premium Storage Accounts
- Available today in 100 TB increments
- One-Year / Three-Year
- https://azure.microsoft.com/en-us/pricing/reserved-capacity/



Azure

INGRAM MICRO

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Demo:
Azure Storage Accounts

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Lab 4:
Configure Azure Storage

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VNets and SubNets

Microsoft

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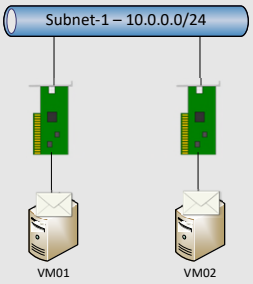
What is a virtual network (VNet) ?

- Logical Network Security Boundary
- Address Space
  - Not overlapping Address Ranges
  - Private IP Addres space (example 10.0.0.0/16)
  - Only Reachable within the Vnet
- Subnets
  - In an VNet Address Space you can have one or more Subnets
  - Example 10.0.0.0/24 and 10.0.1.0/24 and 10.0.3.0/24
  - By Default no security boundery between Subnets
  - Services in each Subnet can talk to each other



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VNet considerations

- A Vnet cannot span Azure regions
- Every Vnet is isolated from every other Vnet
- Do not use overlapping network addresses
- Don’t waste address spaces
  - 10.0.0.0/8 includes 16 million IP Addresses

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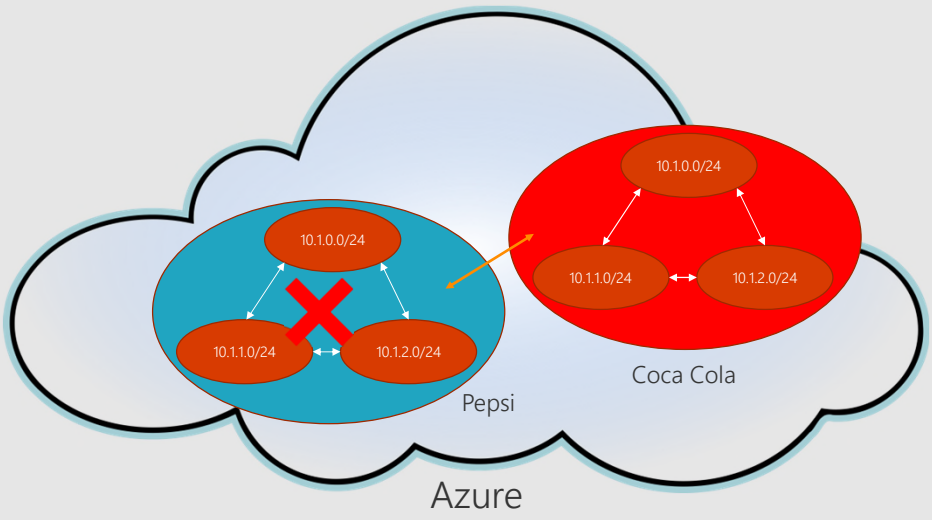
Azure Virtual Networks



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SubNet considerations

- Azure reserves the first four Addresses
- Azure reserves the last Address
- Example : 10.1.0.0/24
  - Reserved : 10.1.0.0 / 10.1.0.1 / 10.1.0.2 / 10.1.0.3 / 10.1.0.255
- VLANs not Supported
- MultiCast & BroadCast not supported
- You Cannot Reserve IP Addresses
- Do Not Assign Manually IP Addresses in VM's

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IPv4 Address Basics

- An IP address is made up of pieces:
  - For networks: Network prefix + subnet number
  - For devices: Network prefix + subnet number + machine number
- Division is determined by subnet mask:
  - 255.255.0.0 = /16
  - 255.255.255.0 = /24
- Network examples:
  - Network address: 10.1.0.0/16
  - Subnets: 10.1.0.0/24, 10.1.1.0/24, 10.1.2.0/24
- Machine examples:
  - 10.1.0.4, 10.1.0.5, 10.1.0.6, 10.1.0.7, …

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Possible Address Spaces for VNets

- Azure VNets can only use private IP address spaces
  - 192.168.X.X
  - 172.16.X.X
  - 10.X.X.X
- Carve those spaces into:
  - Multiple VNets: each with a network address
  - Multiple subnets per VNet: each with a network address
- We'll get to Internet addresses & routing later

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Azure Public IP Address SKUs

Basic	Standard
The original public IP address	Different price point
Static or dynamic allocation	Static allocation only
Assigned to any public IP-addressable resource	Assigned to vNICs or Standard Internet-facing load balancers
Can be assigned to a specific availability zone	Zone redundant by default
Not zone redundant	

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DNS

- Specify your own DNS Server (On-Prem or in Azure)
  - Or
- Azure Provided Name Resolution
- If you have multiple VNet's interconnected, you need to have your own DNS Server

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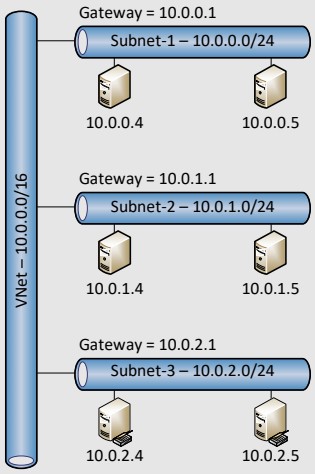
VNet and Subnet Example

- Simple example VNET:
  - Network address: 10.0.0.0/16
- Divide the IP space into 3 subnets:
  - Subnet-1: 10.0.0.0/24
  - Subnet-2: 10.0.1.0/24
  - Subnet-2: 10.0.2.0/24
- Each subnet routes to other subnets in VNet via default gateway
  - 10.0.0.1, 10.0.1.1, 10.0.2.1
- Addresses available to VMs
  - 10.0.0.4 – 10.0.0.254
  - 10.1.0.4 – 10.0.1.254
  - 10.2.0.4 – 10.0.2.254



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Virtual network capabilities

- IP address allocation:
  - Dynamic (default) — support for static IP address assignments
- Traffic routing:
  - User defined routes and forced tunneling
- Traffic filtering:
  - Network Security Groups

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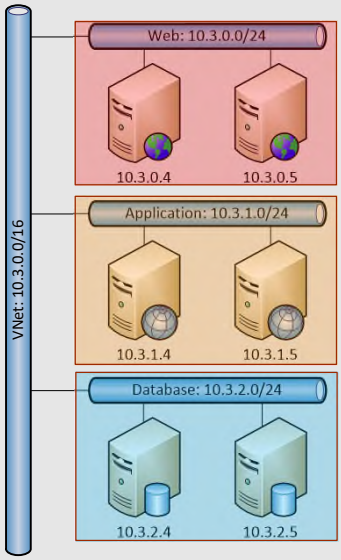
Why Create Subnets?

- Old theory:
  - Manage broadcast domains
- In Azure:
  - Create security boundaries within a VNet
  - Different security policies for each subnet



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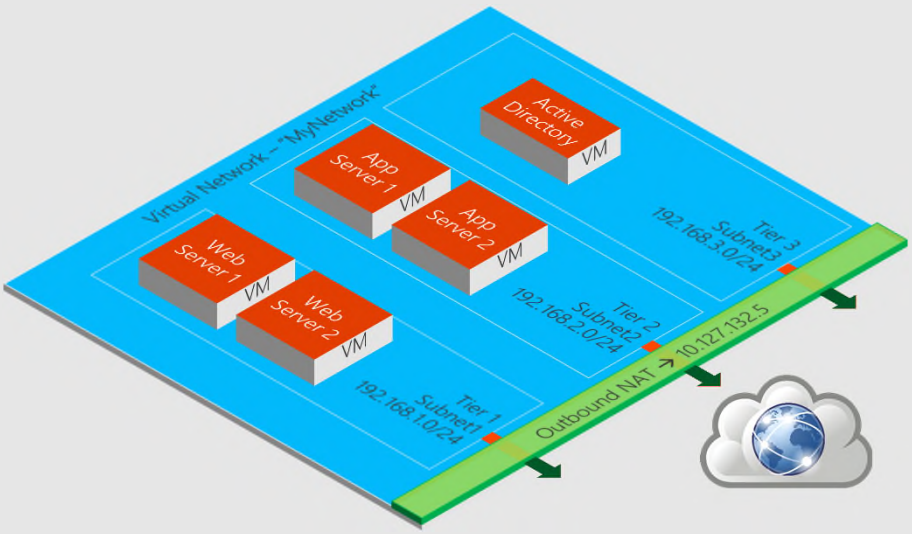
Access to the Internet



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Network Security Groups

Microsoft

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Distributed Layer-4 Firewall Rules

- You don't need to deploy a firewall appliance for simple protocol/port firewall rules
- Create policies
- Called Network Security Groups (NSGs)

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What is an NSG?

- A set of prioritised stateful inbound rules
- A set of prioritised stateful outbound rules
- Each rule blocks or allows based on:
  - Source address/location
  - Destination address/location
  - Source protocol (TCP/UDP/*)
  - Destination protocol (TCP/UDP/*)
  - Source port (range)
  - Destination port (range)
  - Direction (in/out)
  - Priority (to have general/granular rules)
    - Low number = high priority

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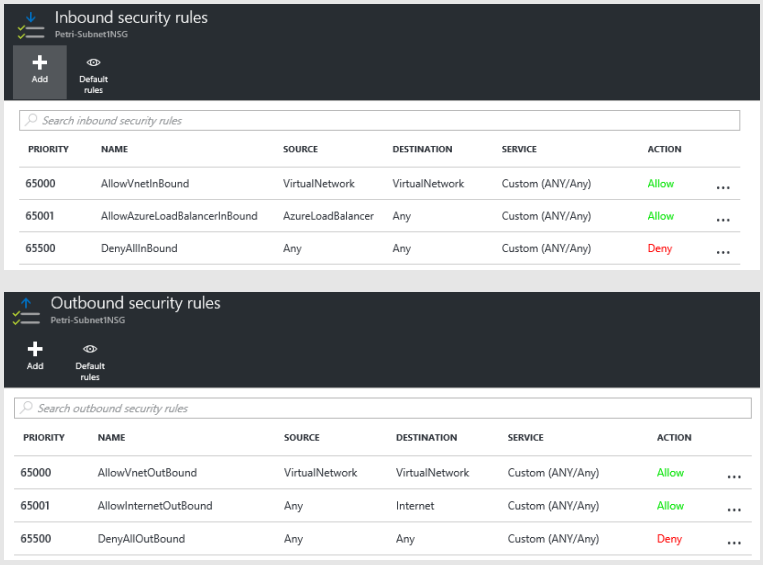
Default Rules in a New Network Security Group



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Possible Scopes of an Network Security Groups

- You have two options
- Assign NSG to each Virtual NIC
  - Not recommended!
  - Too many NSGs and too complex to troubleshoot
- Assign NSG to subnet
  - Recommended by Microsoft!
  - Create set of rules in single NSG for a subnet
  - Deploy 1 subnet for every security policy in a VNet
  - VM picks up policy when joining a subnet
- You can reuse NSGs
  - Might not be a good idea!
  - Subnet specialisations could get too complex

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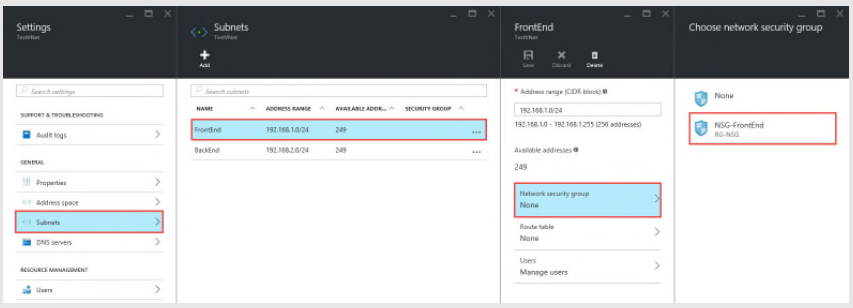
Assign Network Security Group

- Select the Vnet
- Select Subnets
- Select the Subnet
- Click Network Security Group
- Assign your NSG



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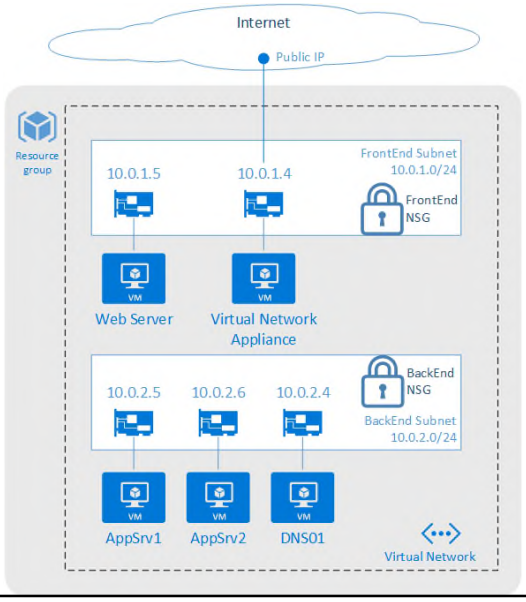
Network Security Groups



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Network Security Group Service Tags

```
VirtualNetwork
AzureLoadBalancer
Internet
AzureCloud
AzureTrafficManager
Storage
Sql
AzureActiveDirectory
```

AllowVNetInBound

Priority	Source	Source ports	Destination	Destination ports	Protocol	Access
65000	VirtualNetwork	0-65535	VirtualNetwork	0-65535	All	Allow

AllowAzureLoadBalancerInBound

Priority	Source	Source ports	Destination	Destination ports	Protocol	Access
65001	AzureLoadBalancer	0-65535	0.0.0.0/0	0-65535	All	Allow

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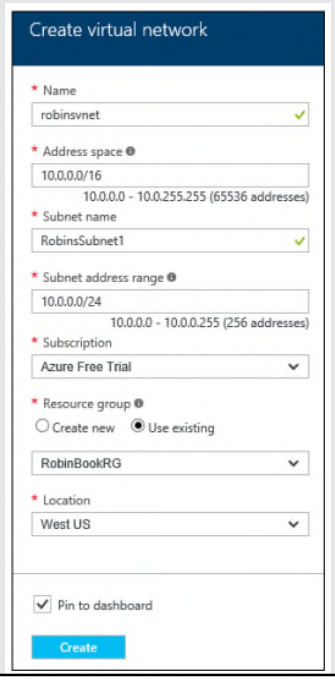
Create Virtual Network



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Leave Guest OS of the VM with DHCP Config

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Testing Bandwidth, Throughput, Latency

Microsoft

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Bandwidth/Throughput Testing

- Recommended Tool : NTTTCP
- Throughput Benchmark Tool from Microsoft
- https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-bandwidth-testing
- https://github.com/microsoft/ntttcp/releases/download/v5.35/NTttcp.exe

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Test VM Network Latency

- Measure Network Latency
- Exclude other types of latency (Application Latency)
- https://docs.microsoft.com/en-us/azure/virtual-network/virtual-network-test-latency
- https://github.com/microsoft/latte/releases/download/v0/latte.exe

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Network Connections to a VNet

Microsoft

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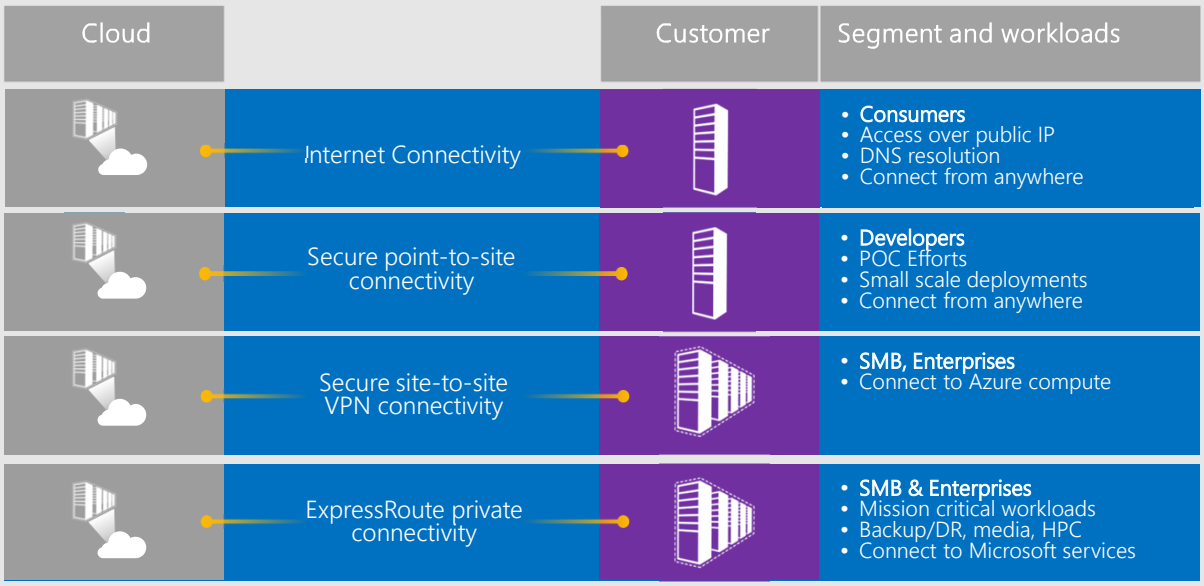
Virtual network connectivity



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Public Inbound Access From The Internet

- Option 1: Per-VM Public IP (PIP) Address
  - Not recommended!
  - Each VM has a direct connection from the Internet
- Option 2: Load Balancer
  - Recommended
  - The load balancer is the single entry point to the VNet from the Internet

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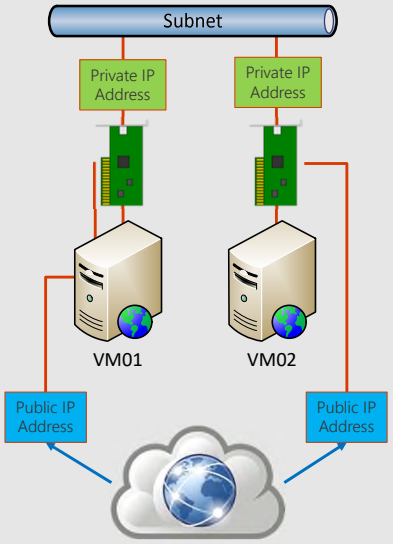
Per VM Public IP (PIP) Address

- You can have 1 public IP address per VM
  - Assigned to the vNIC
- Address assigned by Azure
- Not advisable!
  - Too much management
  - Adds cost (even if it's small)
  - Impossible to do load balancing, etc
  - Only option for Basic A-Series VMs



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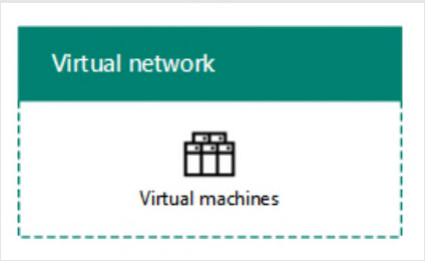
Cloud-Only VNet

- no connection to an on-premises network



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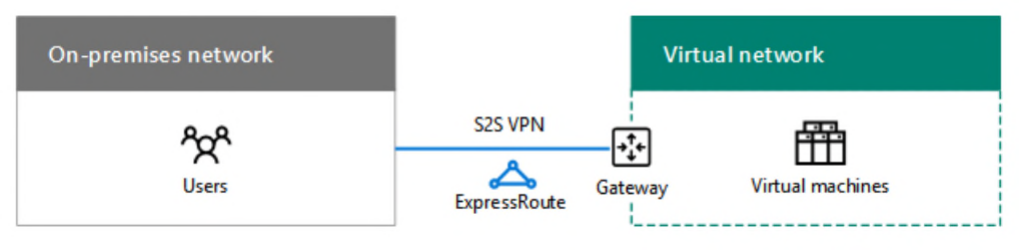
Cross-Premises Network

- site-to-site (S2S)
  - Or
- ExpressRoute
- Azure Gateway



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Azure VPN Gateway

Microsoft

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Azure VPN Gateway

- Used to allow private connections
  - From an outside source
  - To an Azure VNet
- Max of 1 gateway per VNet
  - Deployed into small (/29) dedicated subnet

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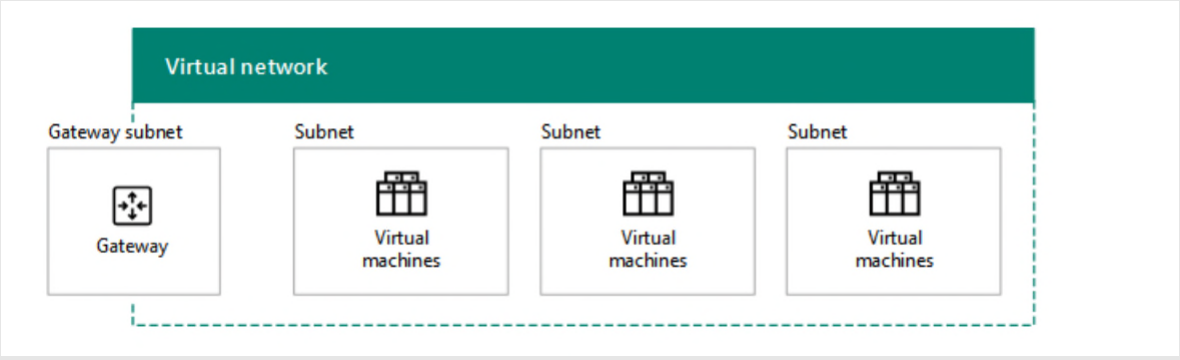
Azure VPN Gateway and Multiple Subnets

- Subnet for Front-End Servers
- Subnet for Back-End Servers
- DMZ



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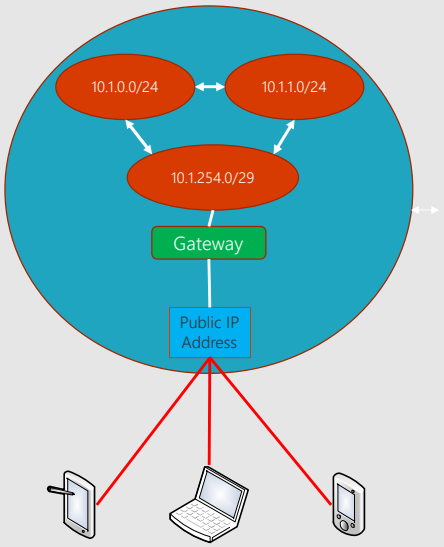
Point-to-Site VPN

- A user creates a VPN connection to a VNet from their device
- Private & secure tunnel over the Internet
- Managed on a per-user basis
- Management/access is not scalable
- Intended for "administrators" as a back door



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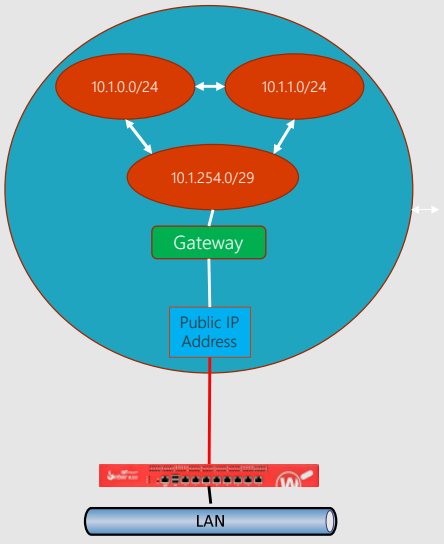
Site-to-Site (S2S) VPN

- VPN connection to a VNet from an external network
- Private & secure tunnel over the Internet
- Pros:
  - Low cost
  - Fast deployment
  - Central management
  - Perfect for small/medium enterprise (SME)
- Cons
  - Only supports connections to VNets
  - Microsoft cannot give SLA for the Internet
  - Not a WAN solution



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Azure VPN Gateway Specifications

VPN GATEWAY TYPE	PRICE	BANDWIDTH	S2S TUNNELS	P2S TUNNELS
Basic	€0.04/hour	100 Mbps	Max 10 1-10: Included	Max 128 1-128: Included
VpnGw1	€0.1603/hour	650 Mbps	Max 30 1-10: Included 11-30: €0.013/hour per tunnel	Max 128 1-128: Included
VpnGw2	€0.4133/hour	1 Gbps	Max 30 1-10: Included 11-30: €0.013/hour per tunnel	Max 128 1-128: Included
VpnGw3	€1.0542/hour	1.25 Gbps	Max 30 1-10: Included 11-30: €0.013/hour per tunnel	Max 128 1-128: Included

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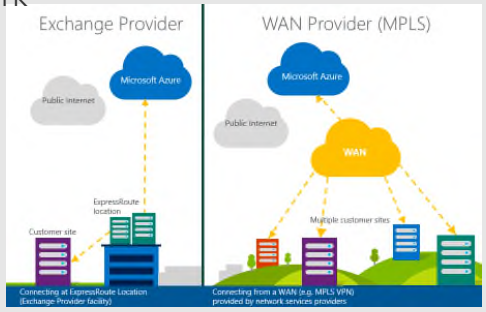
ExpressRoute

- Private WAN Connection
- Pros:
  - SLA on network connection
  - Physically private network
  - All Azure services
  - Complex routing
- Cons:
  - Limited ISP availability
  - Quite expensive



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Network Virtual Appliances

Microsoft

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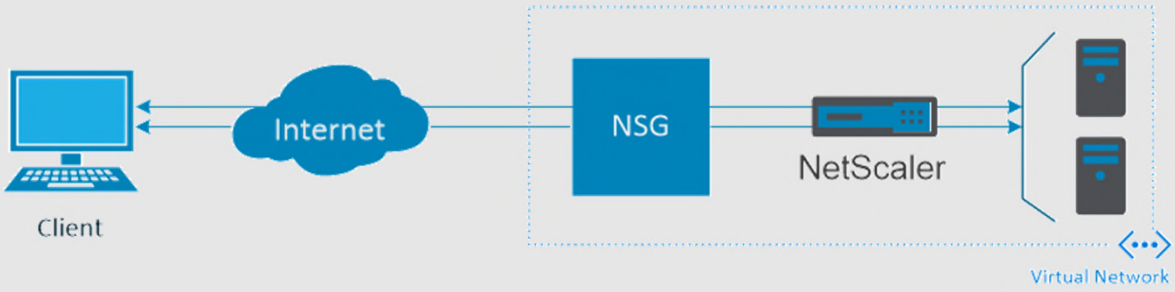
NetScaler Virtual Appliance on Azure



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SonicWall on Azure

- Coming Soon …

221

Connecting VNets

Microsoft

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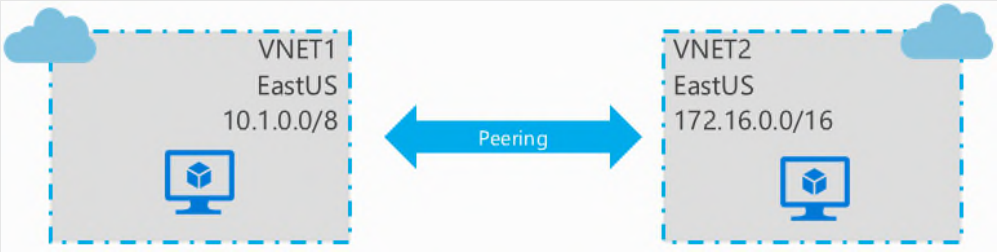
Connecting Two Vnet's (same Region)

- Same Region
- Use VNet Peering



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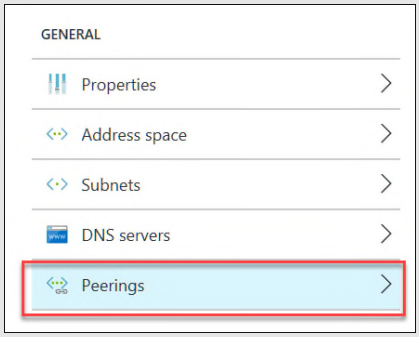
VNET Peering

- Low-latency, high-bandwidth connection between VNETs
- Connect two VNETs in the same region
- Utilizes the Azure Backbone network
- No Encryption as traffic is isolated and
- on the MS backbone
- VNET address spaces cannot overlap
- VNET peering is between 2 VNETs
- VNETs can be in different subscriptions



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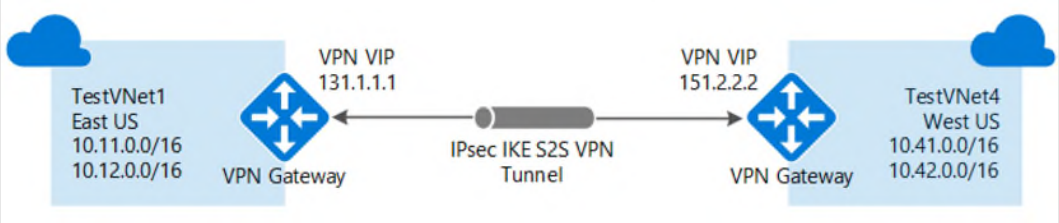
Connecting Two VNet's (different Region)

- When the Region is different
- Two times a VPN Gateway Needed



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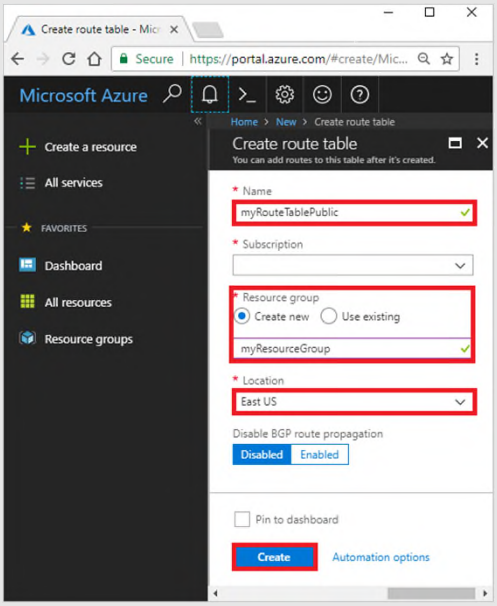
User-Defined Routing : Route Table

- Table of Customized Routes
- Assigned to a Subnet

https://docs.microsoft.com/en-us/azure/virtual-network/tutorial-create-route-table-portal



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Comparing Hybrid Options

CAPABILITIES

	Bandwidth	Security	Management	Workloads
ExpressRoute	10 Mbps – 10 Gbps Committed Bandwidth	Private isolated network between provider and Azure. Control over routing and traffic.	Configure once, simple to add new virtual networks	Enterprise Connectivity Mission Critical Disaster Recovery Hybrid Applications
Site-to-Site	~80 Mbps – ~200Mbps No performance commitment	Encrypted tunnel over the Internet	Configuration of IPSEC VPN device for each Virtual Network Created	Hybrid Applications Dev/Test Secure Management
Point-to-Site	~80 Mbps – ~200Mbps No performance commitment	Encrypted tunnel over the Internet	Configuration with each individual client machine.	Dev/Test Secure Management

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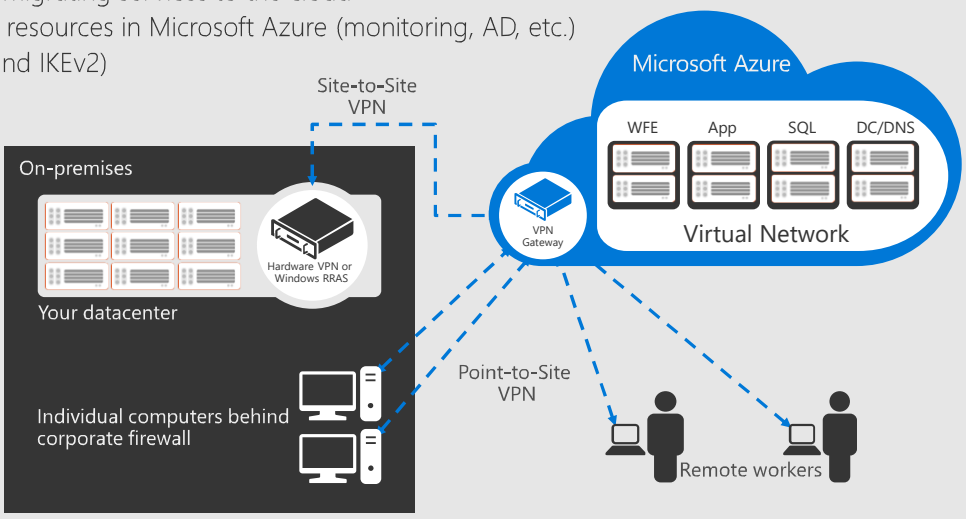
Site-to-Site Virtual Network

- Extend on-premises to the cloud securely (IPSec)
- On-ramp for migrating services to the cloud
- Use on-prem resources in Microsoft Azure (monitoring, AD, etc.)
- IPSec (IKEv1 and IKEv2)



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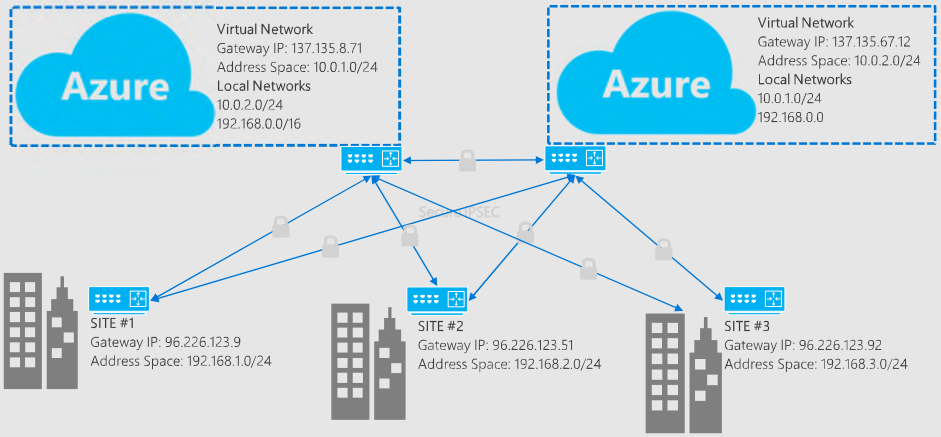
Multi-Site Virtual Networks



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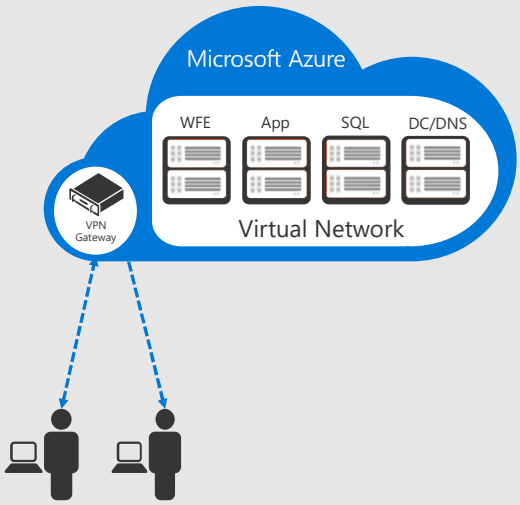
Virtual Networks & P2S Connectivity

- Connect from anywhere securely
- Secure Sockets Tunneling Protocol (SSTP)
- Ideal for secure management, prototyping, development, & demos
- P2S and S2S coexist on the same gateway (must be dynamic)



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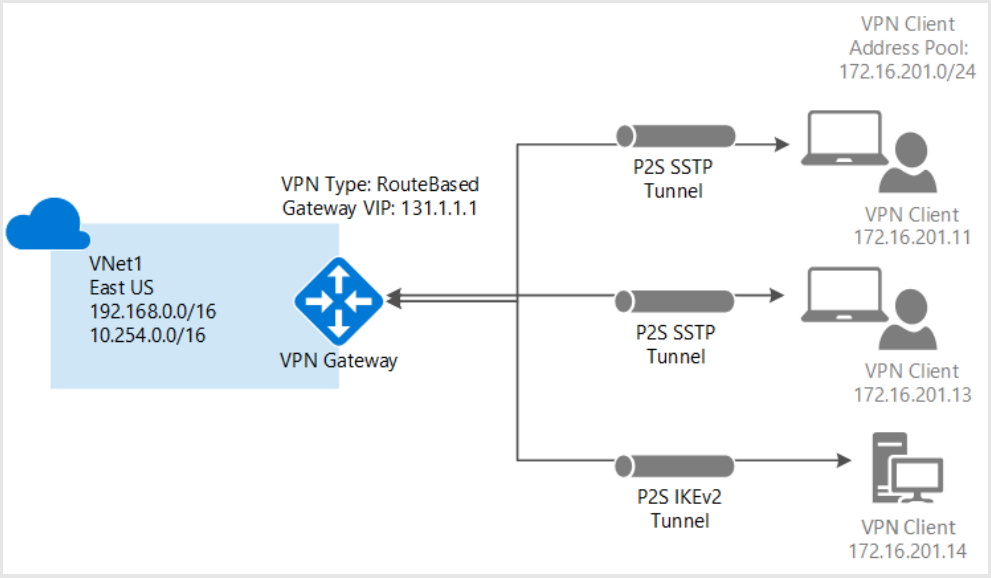
Point-to-Site Virtual Network Gateway Config



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Networking : What you need to know

- you cannot add a new NIC that is connected to a subnet that is in a different VNet

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Demo:
Azure Networking

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Lab 5:
Microsoft Azure Networking

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Module 6:
Azure Backup

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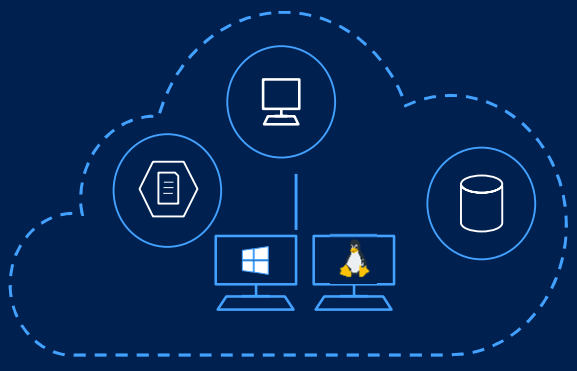

Protecting Azure Resources

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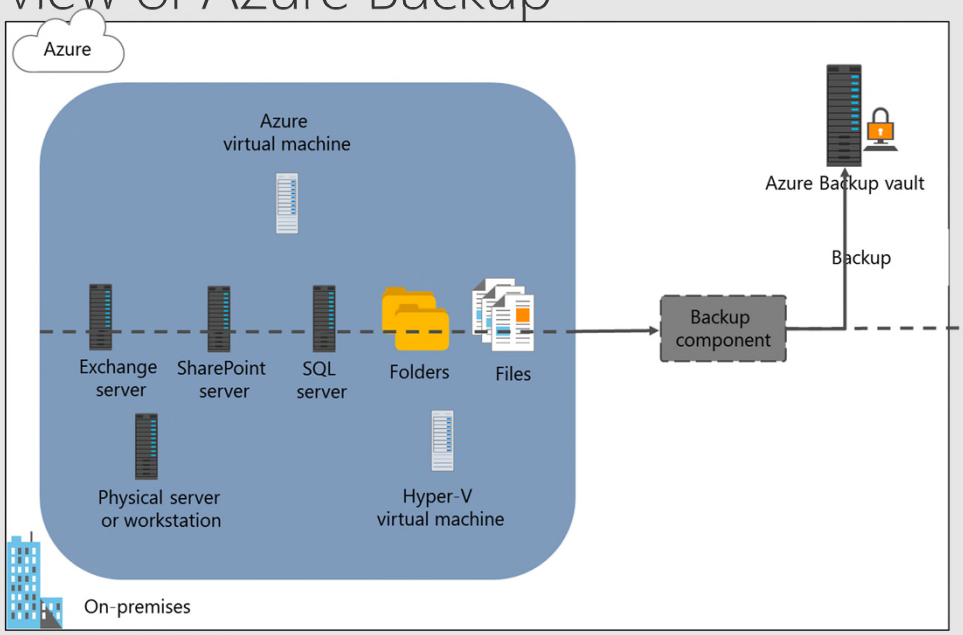
Overview of Azure Backup



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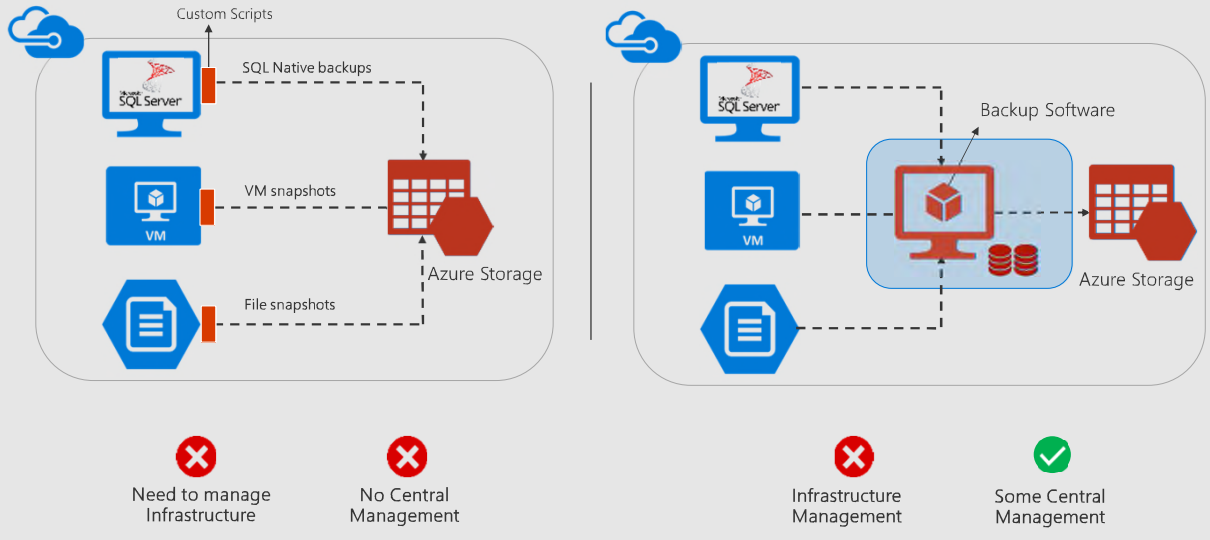
Conventional backup approaches



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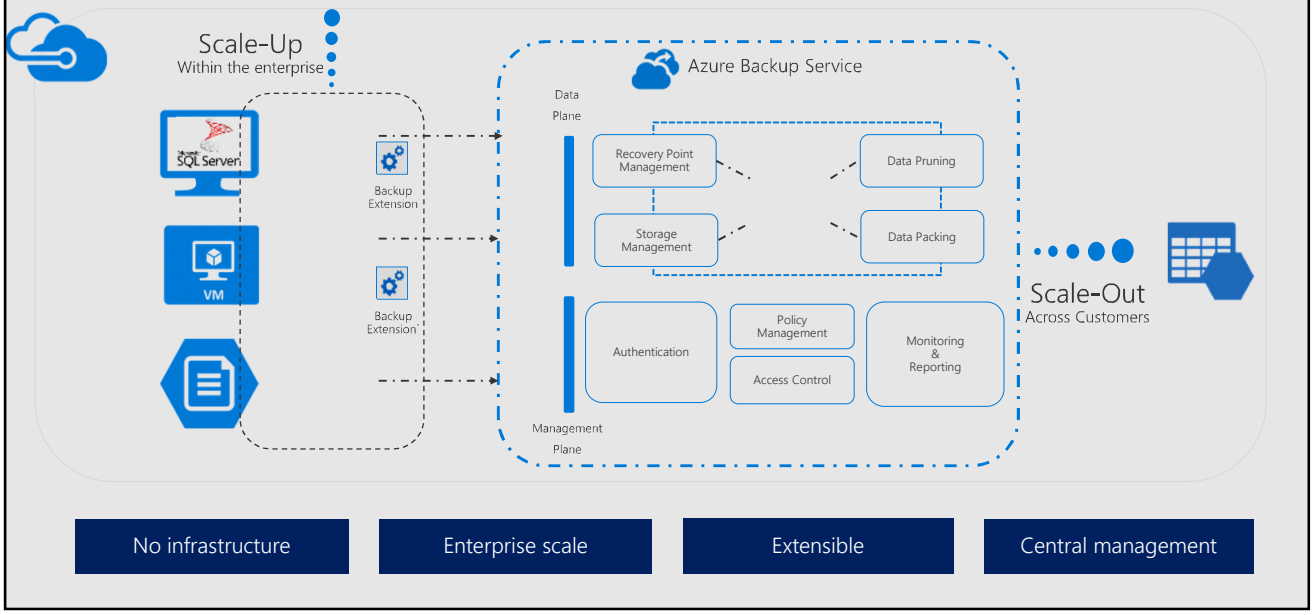
Azure Backup – Architecture matters



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Azure Backup Components

- **Recovery Services Vault**
- **Azure Recovery Services Agent (MARS)**
- **Azure Backup Server (MABS)**

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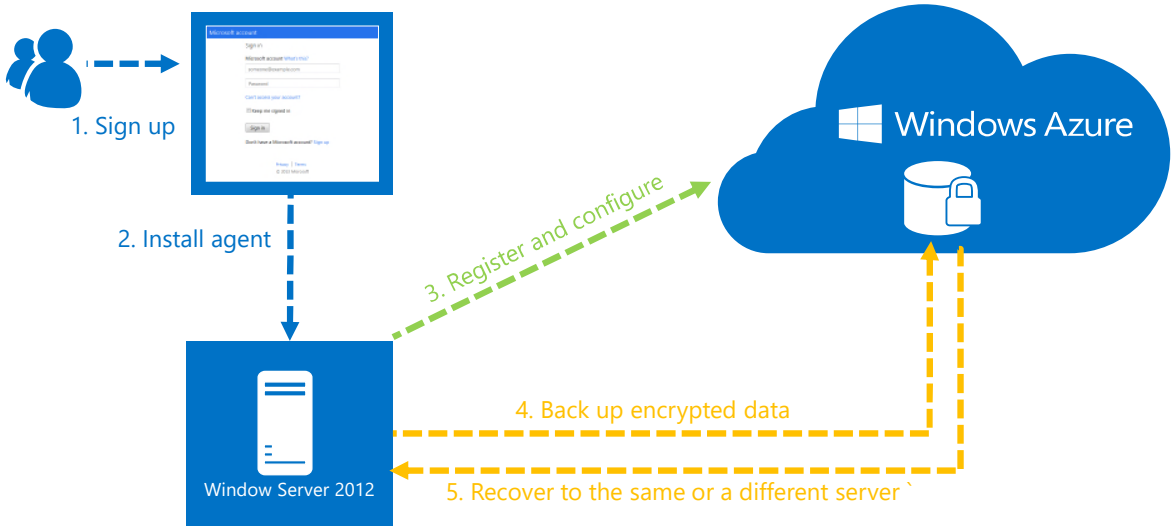
What can you Backup ?

- On-premises Files/Folders using MARS agent
- On-premises VMs using DPM or MABS Server
- Azure VMs using MARS agent
- Azure Managed Disks
- Azure File shares
- SQL Server in Azure VMs
- SAP HANA database in Azure VMs
- Azure Database for postgrSQL
- Azure Blobs

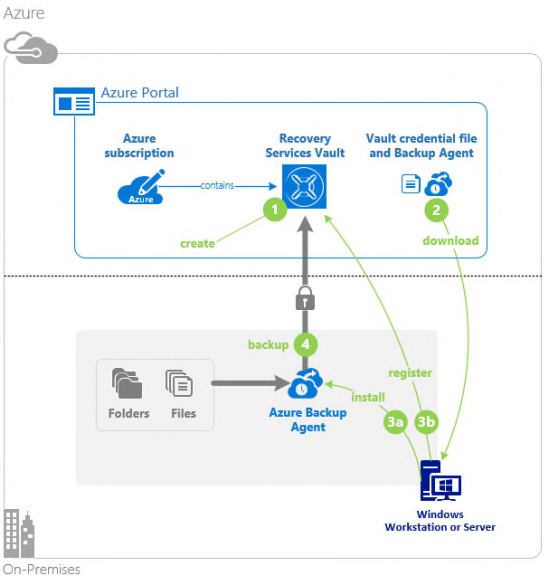
241

How Windows Azure Backup works



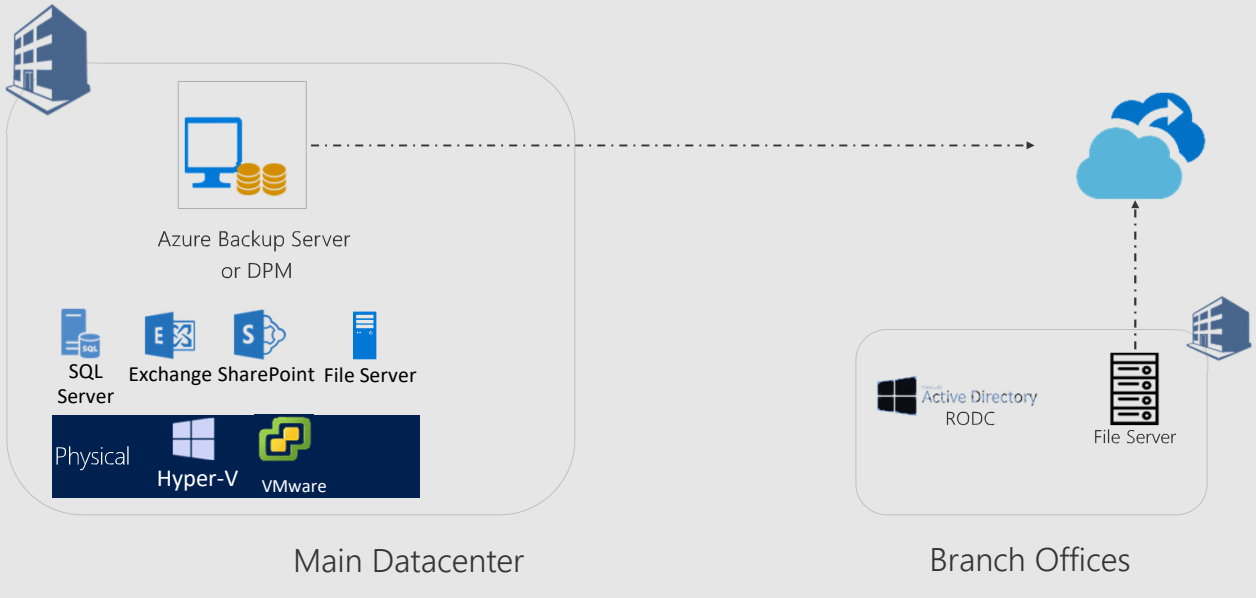
242

Backup Windows Files and Folders (On-Premises)



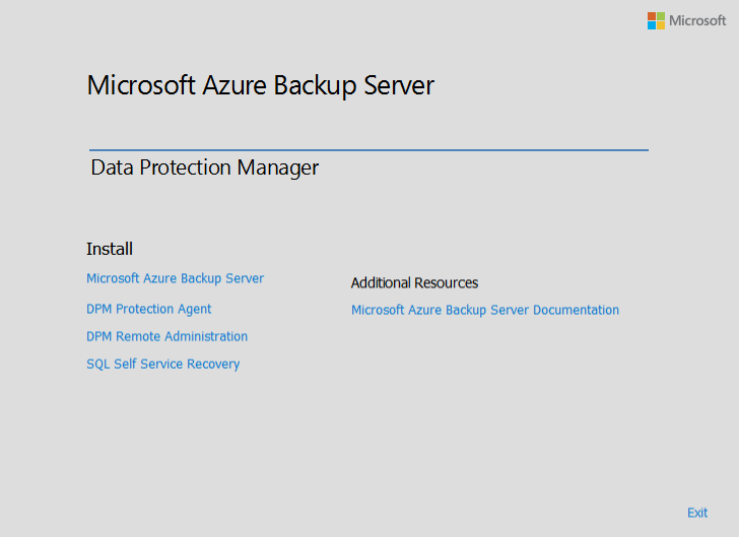
243

Azure Backup Server (Hybrid Model)



244

Azure Backup Server Installation v3



245

How to Setup Azure Backup

Microsoft

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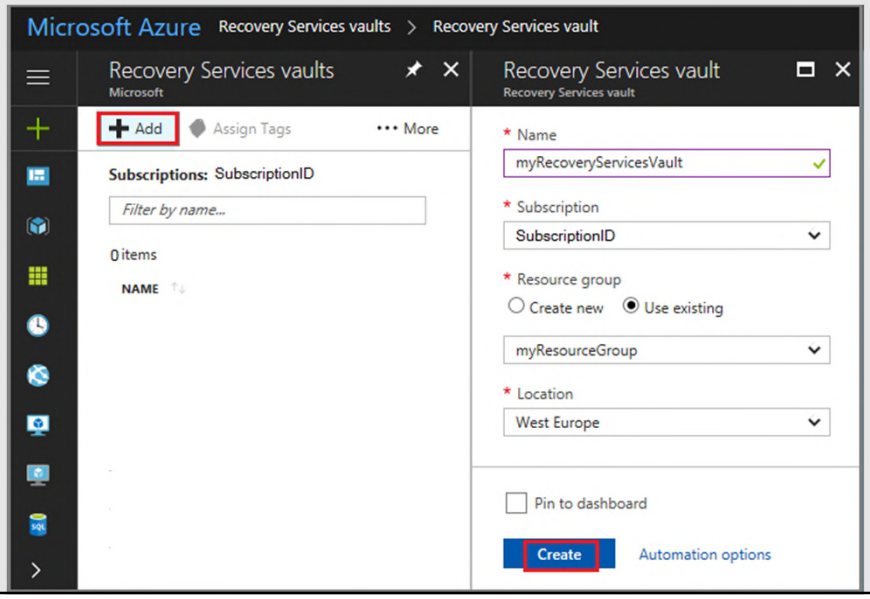
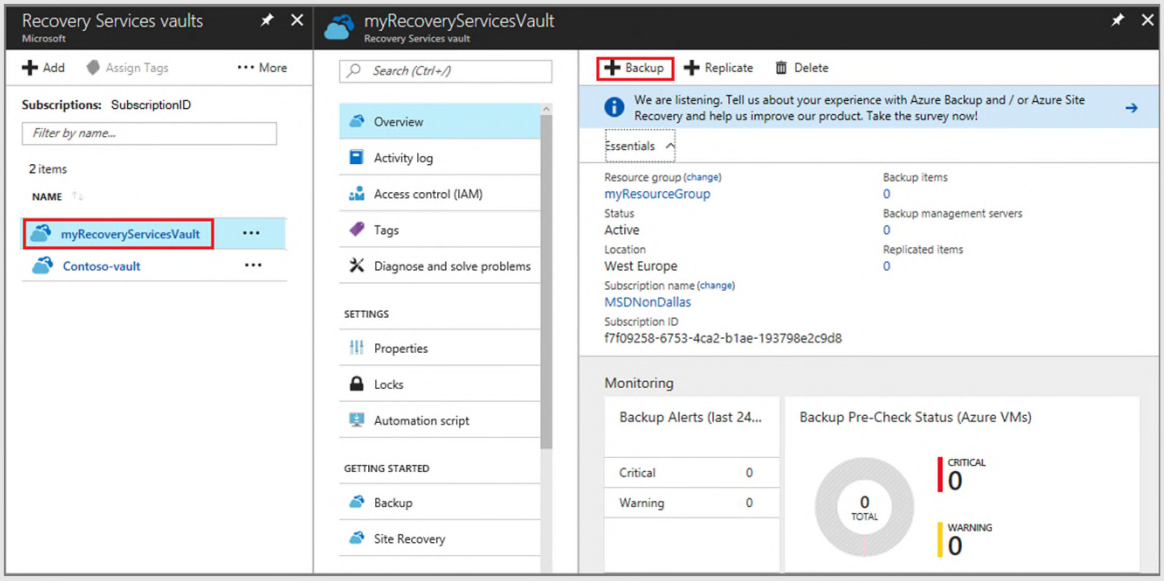
1. Create Recovery Services Vault



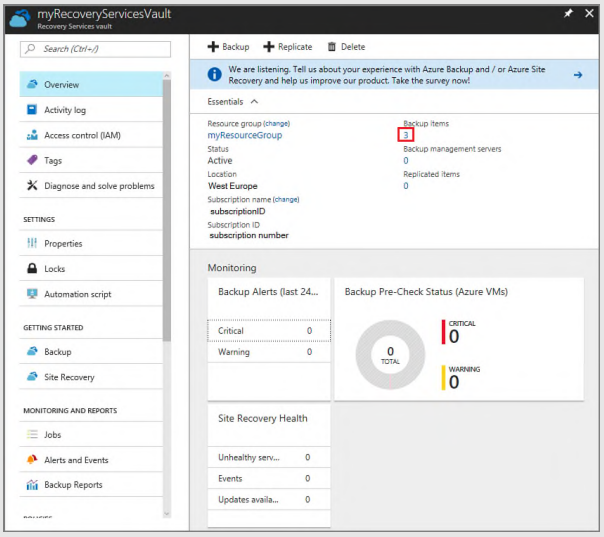
247

2. Create a Backup Policy



248

3. Start your Initial Backup



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Delete Recovery Services Vault

- Delete All Backup Jobs first
- Delete RSV

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Resources

- Azure Backup's Cloud-First Approach
- https://azure.microsoft.com/blog/azure-backup-cloud-first-architecture/
- Azure Backup blogs
- http://blog.azure.com/tag/azure-backup/
- Azure Backup videos
- https://channel9.msdn.com/Series/Azure-Backup
- Azure Backup landing page
- http://azure.microsoft.com/en-us/services/backup/
- Feedback (UserVoice)
- https://feedback.azure.com/forums/258995-azure-backup-and-scdpm/

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Demo: Azure Backup

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Lab 6:
Microsoft Azure Backup

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Veeam and Azure

Microsoft

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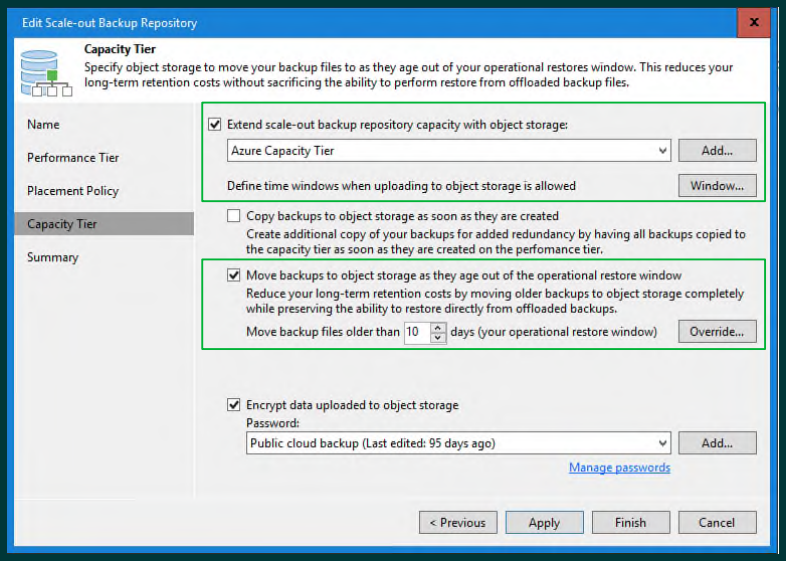
Veeam Object Storage Repository

Repository intended for long-term data storage in Azure Cloud

Object Storage Repository can be used for

- Scale-out backup repository as Capacity Tier
- Scale-ou backup repository as Archive Tier



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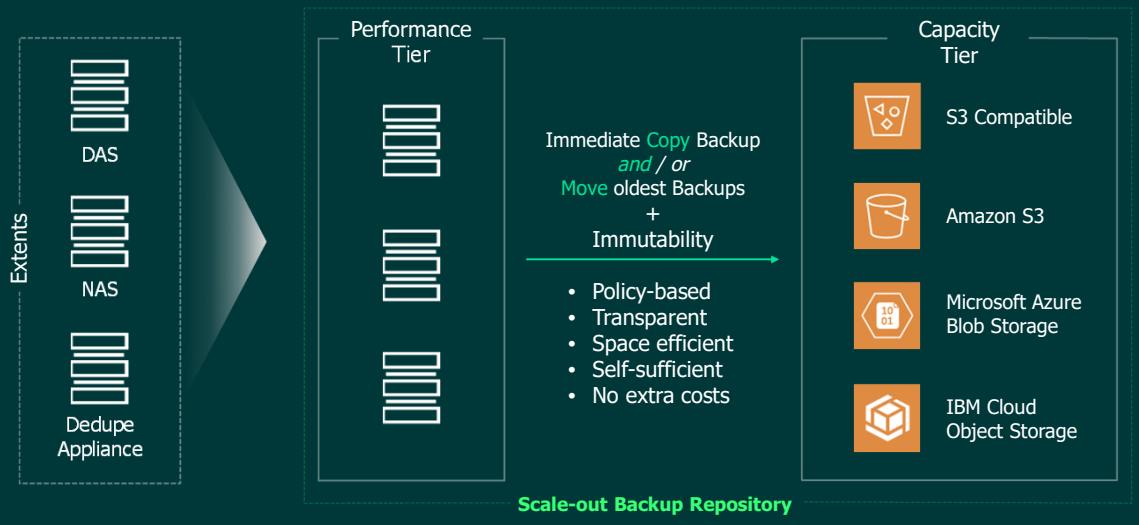
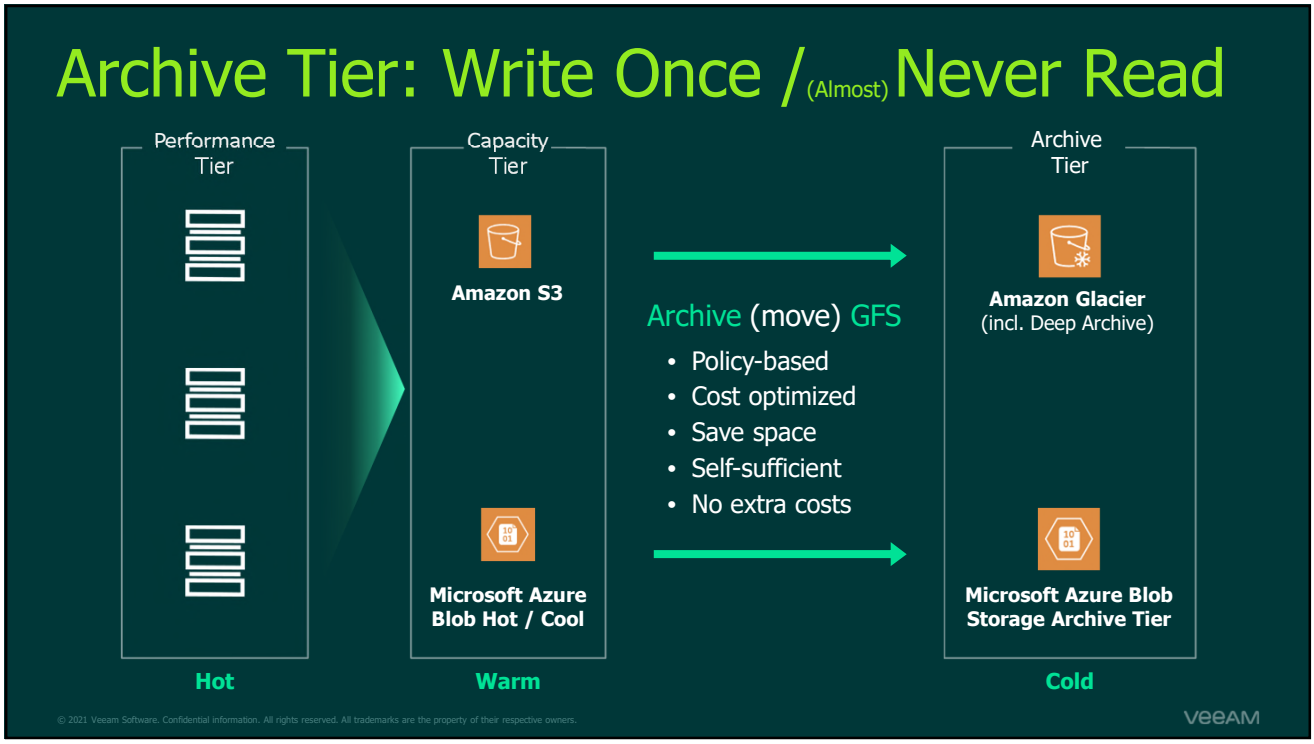
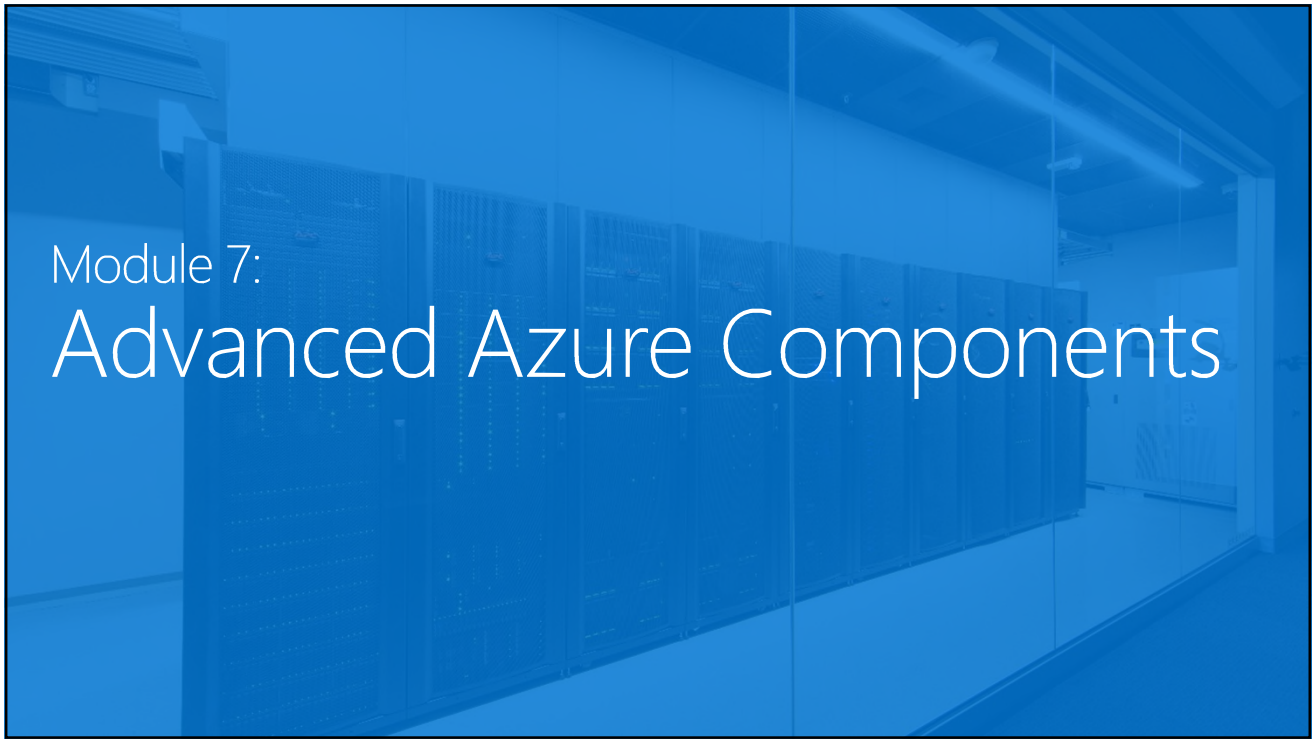
SOBR - Capacity Tier



256



257



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Azure Load Balancer

Microsoft

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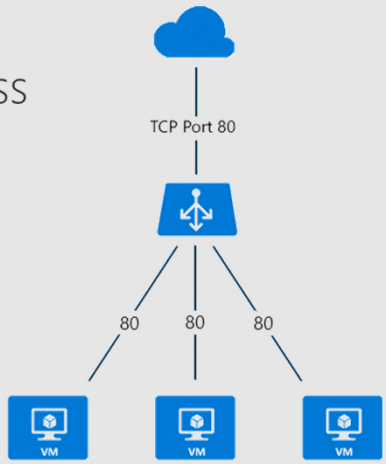
Public Load Balancer

- Public IP Address and Port Number
- Incoming Traffic to Private IP Address



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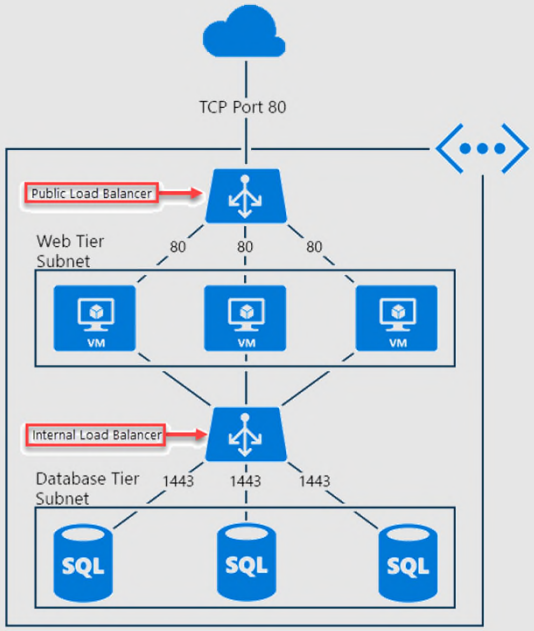
Internal Load Balancer

- Inside a Virtual Network



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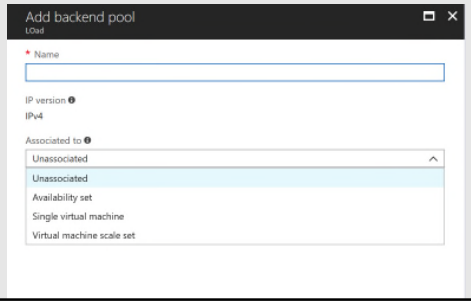
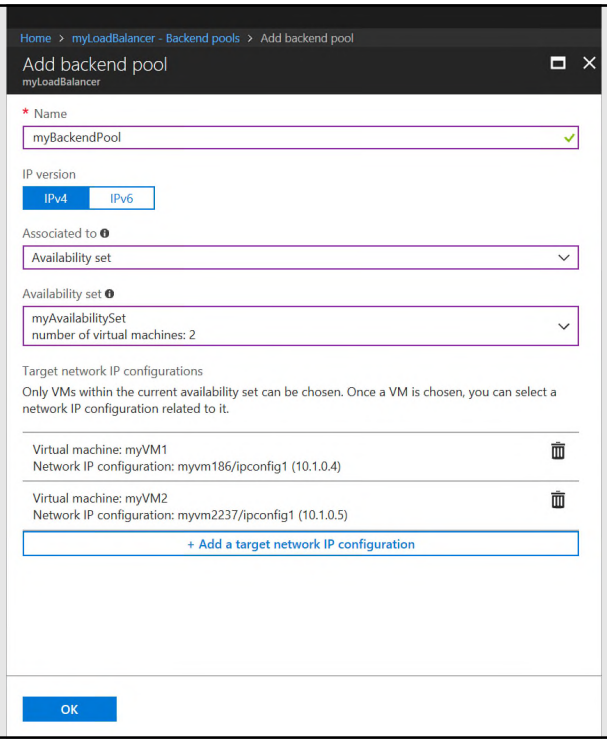
Backend Pool

- Distribute Traffic to IP Addresses of Machines in an Availability Set

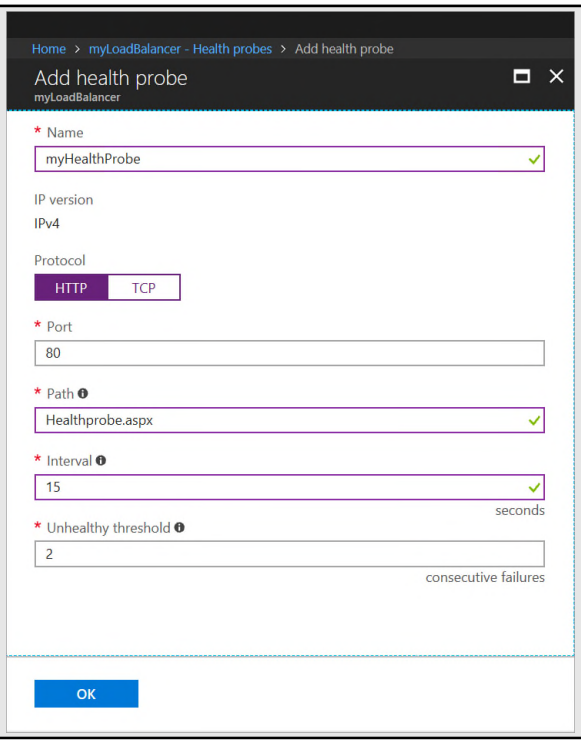




262

Health Probe

- Monitor the Status of your Application Service
- Add/Remove Dynamically VMs from the Load Balancer
- Health Checks



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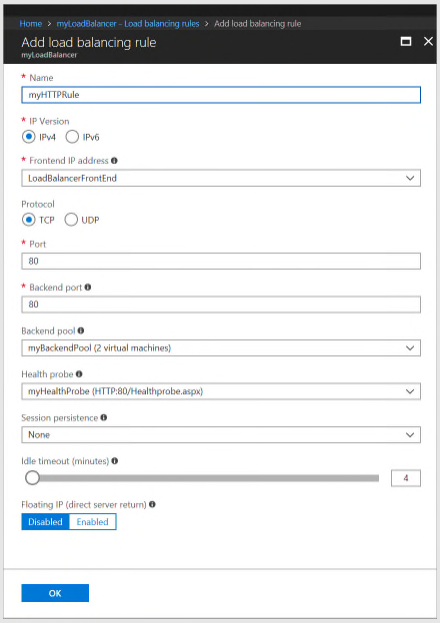
Load Balancing Rule

- Define how traffic is distributed to the VMs
- Assign Backend Pool
- Assign Health Probe
- Define Persistency
- Load Balancing License based on number of Rules



https://docs.microsoft.com/en-us/azure/load-balancer/load-balancer-get-started-internet-portal

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Azure Load Balancer SKU's

	Standard SKU	Basic SKU
Backend Pool Size	Up to 1000 instances	Up to 100 instances
Health Probe	TCP, HTTP, HTTPS	TCP, HTTP
Backend Pool	Any VM	VMs in Availability Set
Pricing	Based on LB Rules	No Charge

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Azure Traffic Manager

Microsoft

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Azure Traffic Manager

- Second Load Balancing Solution
- Distribute User Traffic in different Regions
- Using DNS to Direct Client Request to the most appropiate Service

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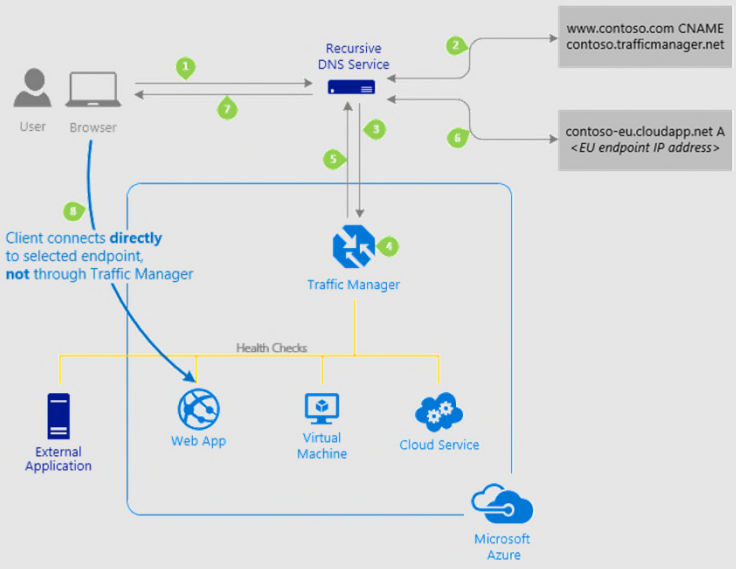
Azure Traffic Manager



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Availability Set

Microsoft

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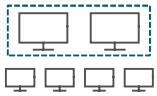
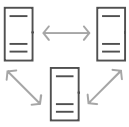
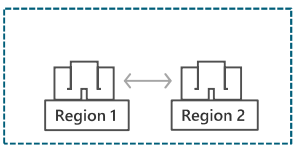
High availability options

Industry-only	High availability SLA		Disaster recovery
VM SLA 99.9%	**VM SLA** 99.95%	**VM SLA** 99.99%	**Regions** 54
			
Single VM Protection with Premium Storage	**Availability sets** Protection against failures within datacenters	**Availability zones** Protection from entire datacenter failures	**Region pairs** Protection from disaster with Data Residency compliance

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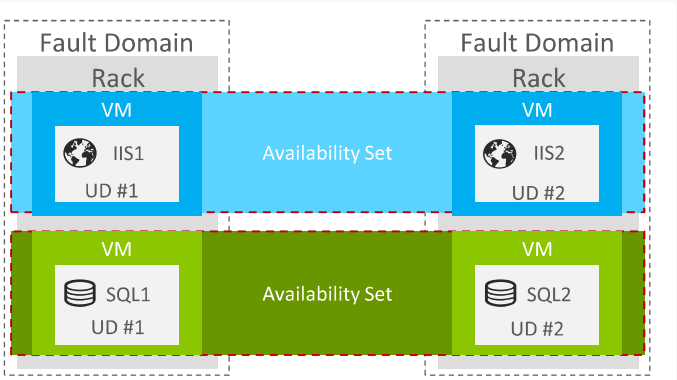
VM Availability Sets



- Fault Domains
- Update Domains

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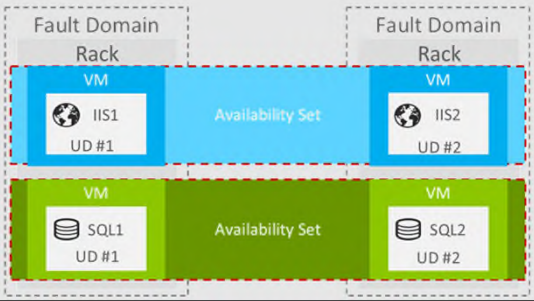
Fault Domains (FD)

- A space with VMs that share the same subsystems, like :
  - Network Switch or Power Source
- VMs running in an Availability Set are running in different Fault Domains
- Azure guarantees to spread them across Fault Domains



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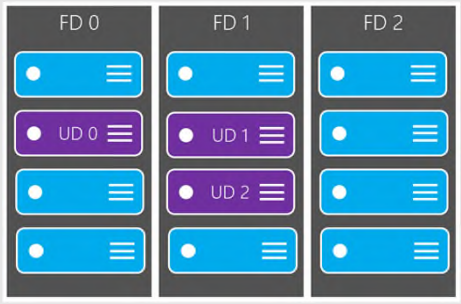
Update Domains

- Updates are Planned Events
- Example : Restart after patched VMs
- Patching is Scheduled in Update Domains
- There are normally 5 different Update Domains



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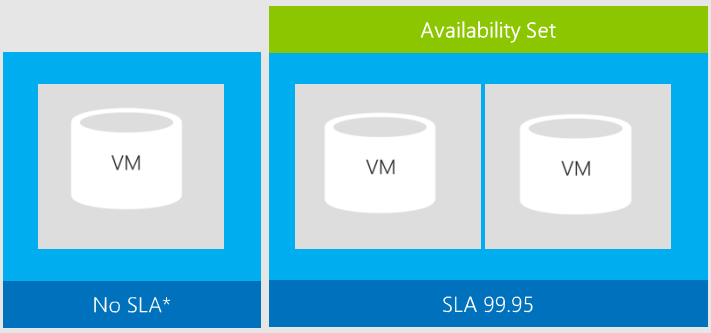
How Does this Relate to the SLA?



* No guaranteed SLA for single VM instance

274

Scale Set (VMSS)

Microsoft

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Virtual Machine Scale Set

- Create thousands of identical virtual machines in minutes
- Quickly scale your big compute and big data applications
- Rely on integrated load balancing and auto-scaling
- Run Cassandra, Cloudera, Hadoop, MongoDB and Mesos

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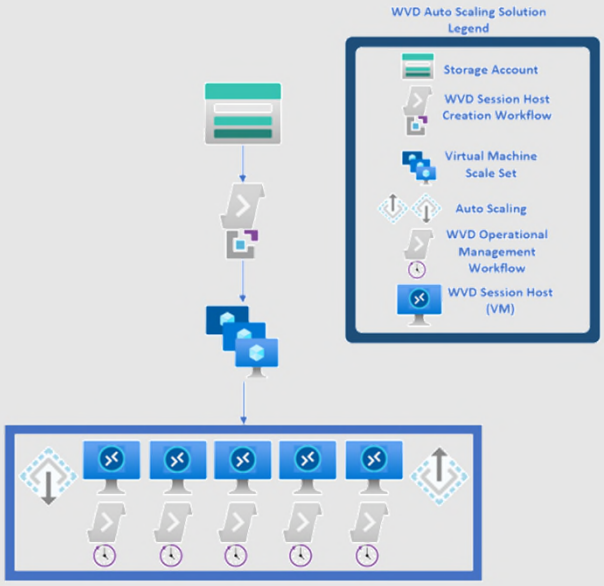
VMSS and Azure Virtual Desktop



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Module 8:

Azure Site Recovery (ASR)

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Disaster Recovery Plan

- After a Disaster :
  - How much data do you accept that may be lost ?
  - How much downtime do you accept ?

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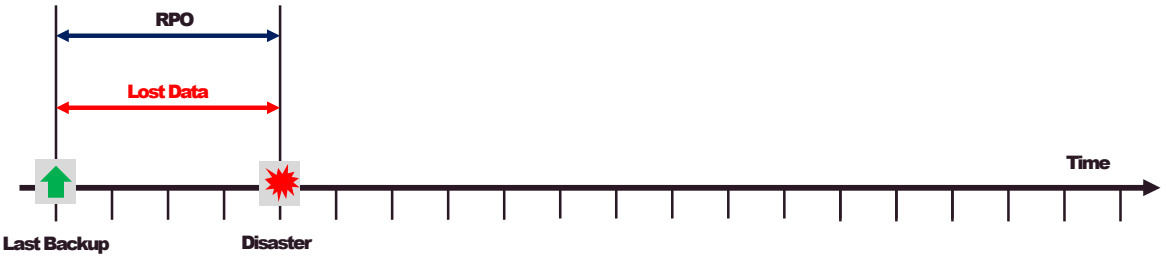
Recovery Point Objective (RPO)

- RPO :
  - Maximum tolerable amount of data loss measured in time
    - For Azure Backup usually 1 DAY
    - For Azure Site Recovery as low as 30 seconds till 5 minutes
    - Azure Site Recovery oldest recovery point : 72 hours



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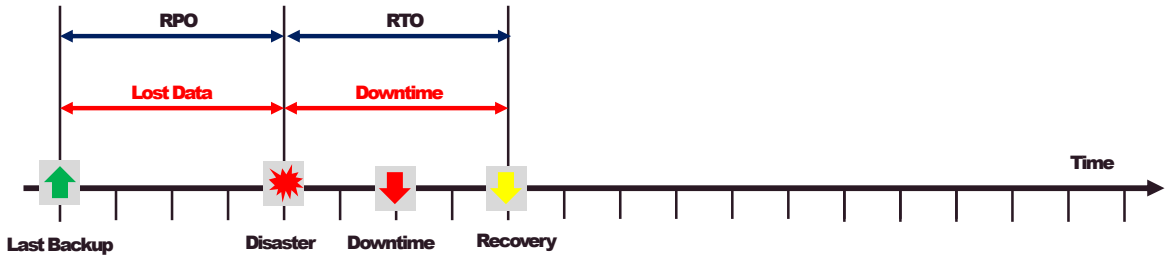
Recovery Time Objective (RTO)

- **RTO :**
  - **maximum tolerable amount of time needed to bring all critical systems back online**
    - **For Azure Backup multiple Hours**
    - **For Azure Site Recovery multiple Minutes**



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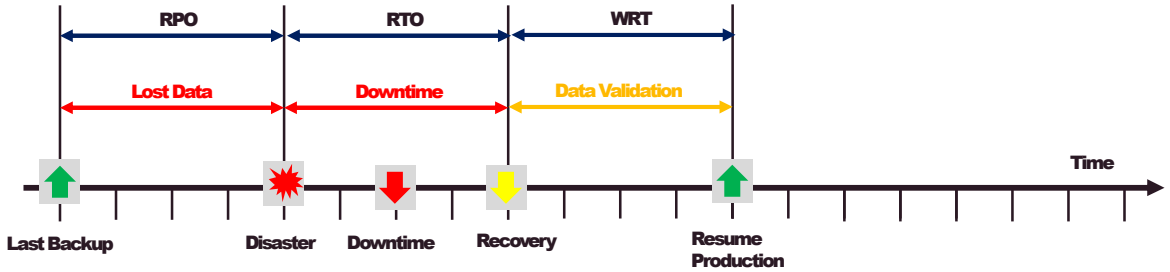
Work Recovery Time (WRT)

- **WRT :**
  - **Maximum tolerable amount of time to verify the recovered systems and/or data integrity**



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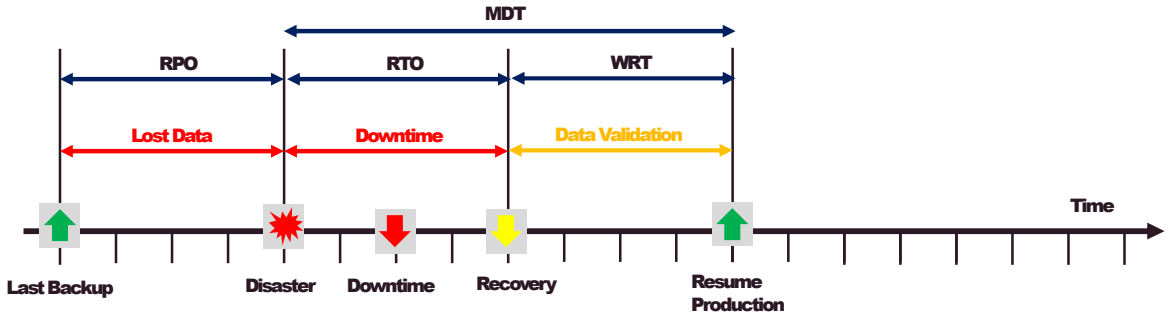
Maximum Tolerable Downtime (MTD)

- **MDT :**
  - **total amount of time that a business process can be disrupted without causing any unacceptable consequences**



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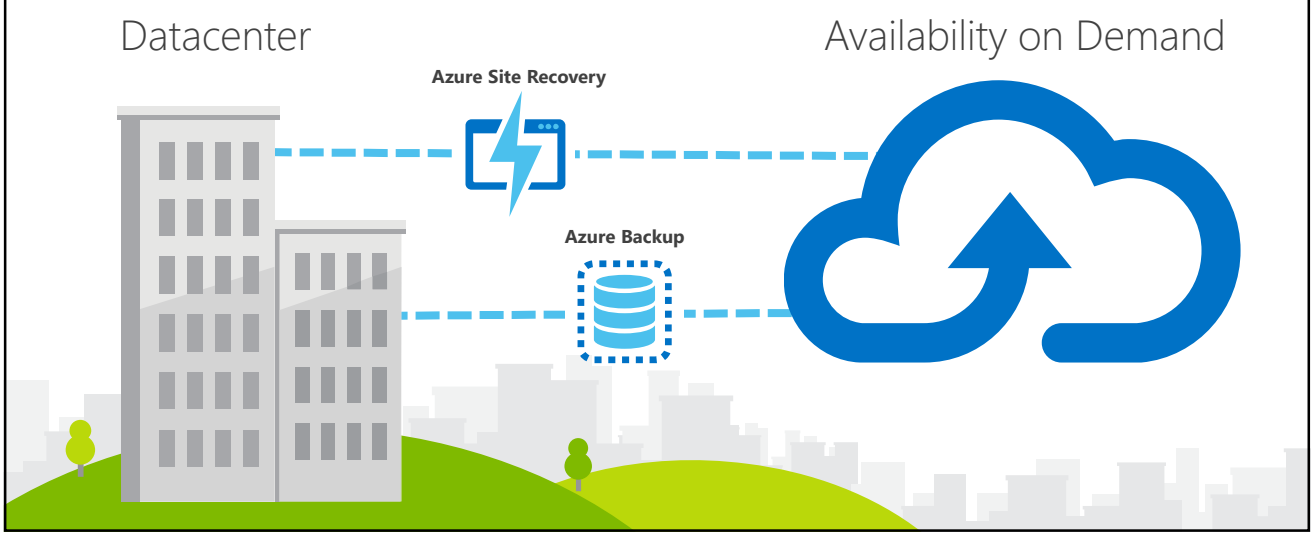
Azure Site Recovery



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Azure Backup + Azure Site Recovery

- **Increase the Oldest Recovery Point time**
  - **Azure Backup : Multiple Years**
  - **Azure Site Recovery : 72 Hours**

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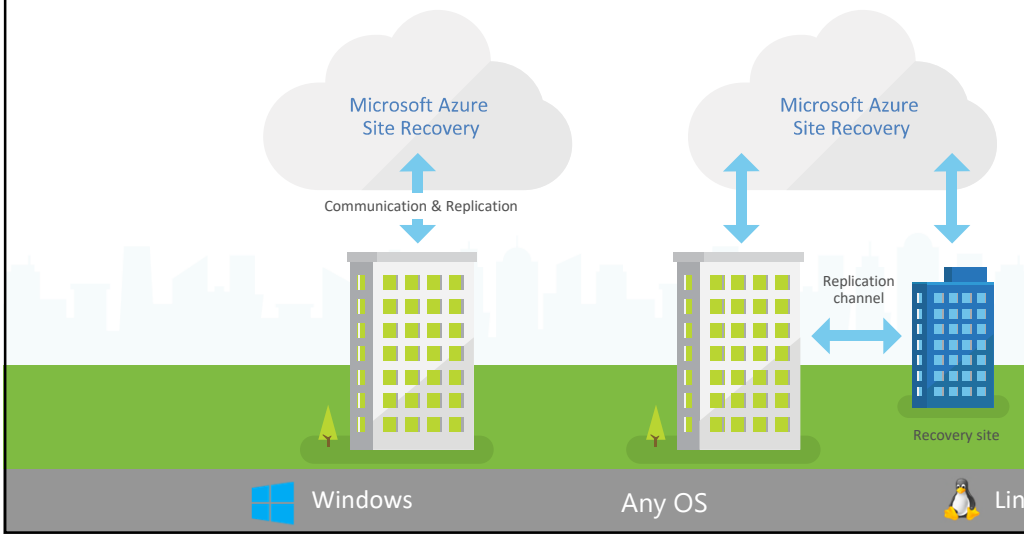
Replicate: on-prem or Azure

Secure Hyper-V, VMware, and physical servers



- VM Replication
- RTO/RPO Near Zero
- Heterogynous
- Secure
- Monitoring
- Orchestration
- Migrate

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Use Cases

Planned failover	Unplanned failover	Testing and staging	Migration
✓	✓	✓	✓
• Execute a failover in a controlled manner for testing or for controlled business need.	• Process focused orchestrated disaster recovery.	• Mirror production deployments to Azure. • Use the DR copy as a testing/staging environment.	• Replicate to Azure, validate the deployment, application behaviors, etc. Disconnect from on-premises.

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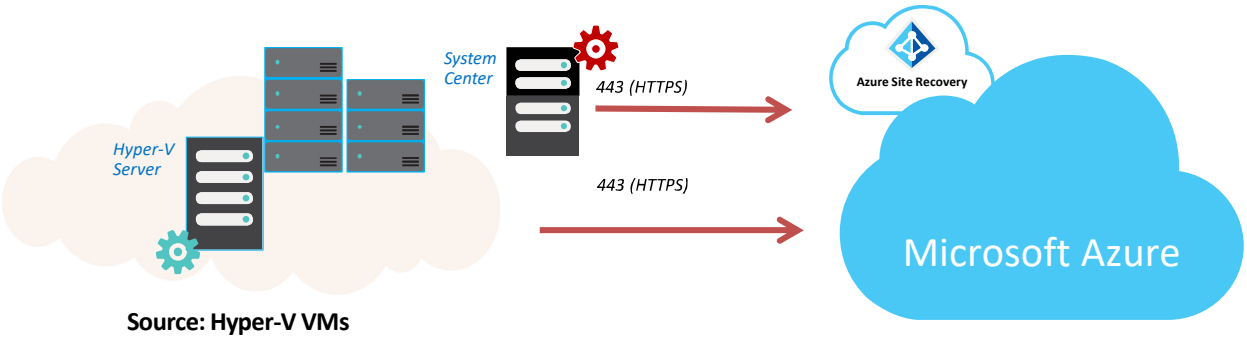
Hyper-V : No need for VPN or extra Infrastructure



Microsoft Azure Recovery Services Agent
Replicates data to Azure

Microsoft Azure Site Recovery DRA
Centralized Management

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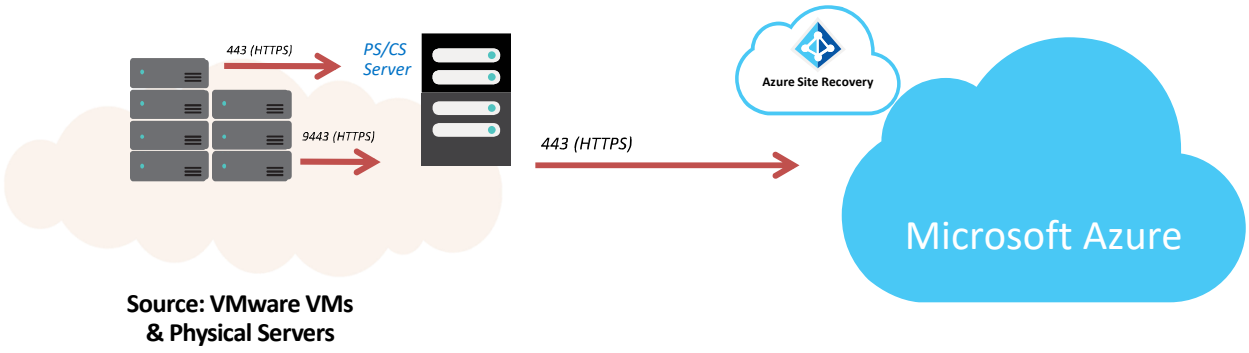
VMware and Physical Servers
Process Server / Configuration Server



Process Server
Used for caching, compression, and encryption

Configuration Server
Used for centralized management

Mobility Service
Captures all data writes from memory

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Module 9:
Azure Pricing Calculator

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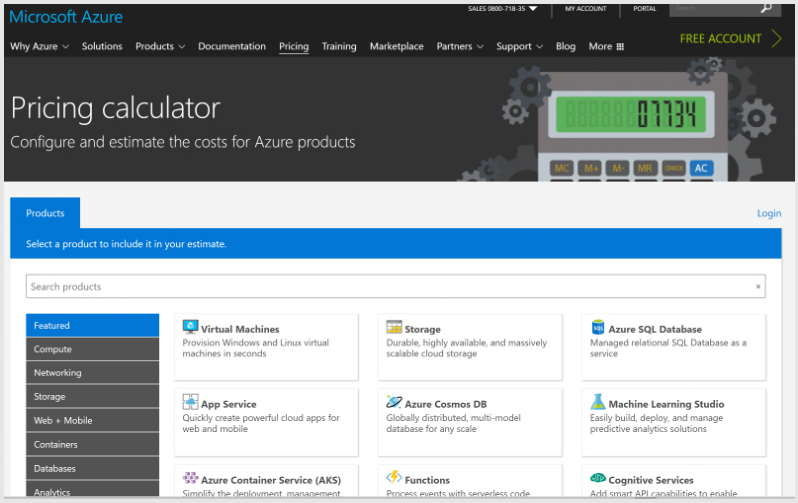
Azure Pricing Calculator

- https://azure.microsoft.com/en-us/pricing/calculator/



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Virtual Machines

- Price calculated per Second
- In the calculator : Price for 730 hours (= 1 Month)
- You do not need keep all VMs Powered On
- Virtual Machine running from :
  - 7h till 23h (5 days a week) = 350 hours
- Don't forget your Data-Disk !
- Outbound Traffic : € 74 per Terabyte
- Prices different per Region

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Storage Account

- Managed or UnManaged
- Block Blob Storage
  - Hot
  - Cool
  - Archive
- Page Blob Storage
- File Storage

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VPN Gateway

- Basic
- VPN GW1
- VPN GW2
- VPN GW3

- Price calculated for uptime (Use 730 Hours)

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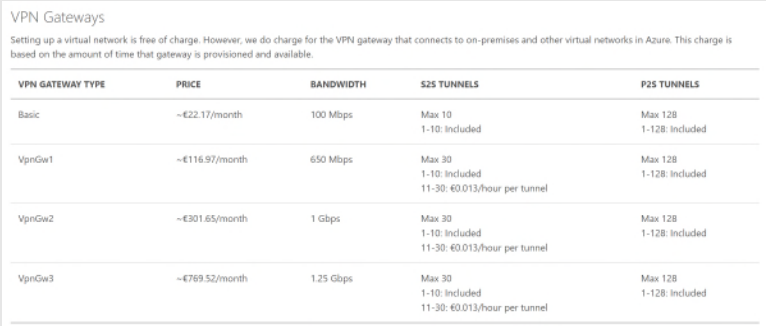
VPN Gateway (examples)



VPN Gateways

Setting up a virtual network is free of charge. However, we do charge for the VPN gateway that connects to on-premises and other virtual networks in Azure. This charge is based on the amount of time that gateway is provisioned and available.

VPN GATEWAY TYPE	PRICE	BANDWIDTH	S2S TUNNELS	P2S TUNNELS
Basic	~€22.17/month	100 Mbps	Max 10 1-10: Included	Max 128 1-128: Included
VpnGw1	~€116.97/month	650 Mbps	Max 30 1-10: Included 11-30: €0.013/hour per tunnel	Max 128 1-128: Included
VpnGw2	~€301.65/month	1 Gbps	Max 30 1-10: Included 11-30: €0.013/hour per tunnel	Max 128 1-128: Included
VpnGw3	~€769.52/month	1.25 Gbps	Max 30 1-10: Included 11-30: €0.013/hour per tunnel	Max 128 1-128: Included

- VNet-VNet = Free (ONE REGION ONLY)
- VNet-OnPrem = Outbound Traffic
- FAQ : https://docs.microsoft.com/en-us/azure/vpn-gateway/vpn-gateway-vpn-faq

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Azure Backup

- Local Redundant Storage
- Geo Redundant Storage

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Log Analytics

- Free : 500 MByte

297

Automation

- 500 minutes of Process automation are Free

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Demo:
Azure Pricing Calculator

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Lab 9:
Microsoft Azure Pricing Calculator

300

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