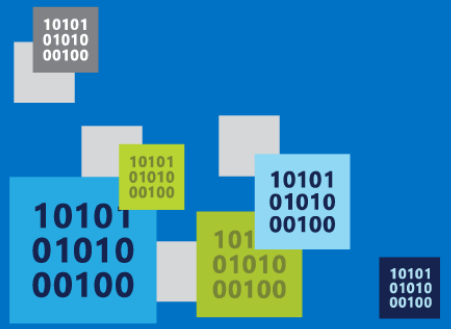
Microsoft Azure

# Infrastructure as a Service

Teerachai Laothong

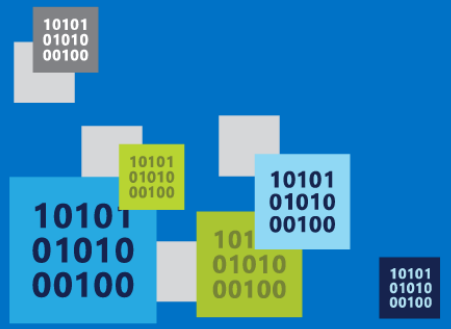



Microsoft

Microsoft Azure

# Azure IaaS

Teerachai Laothong

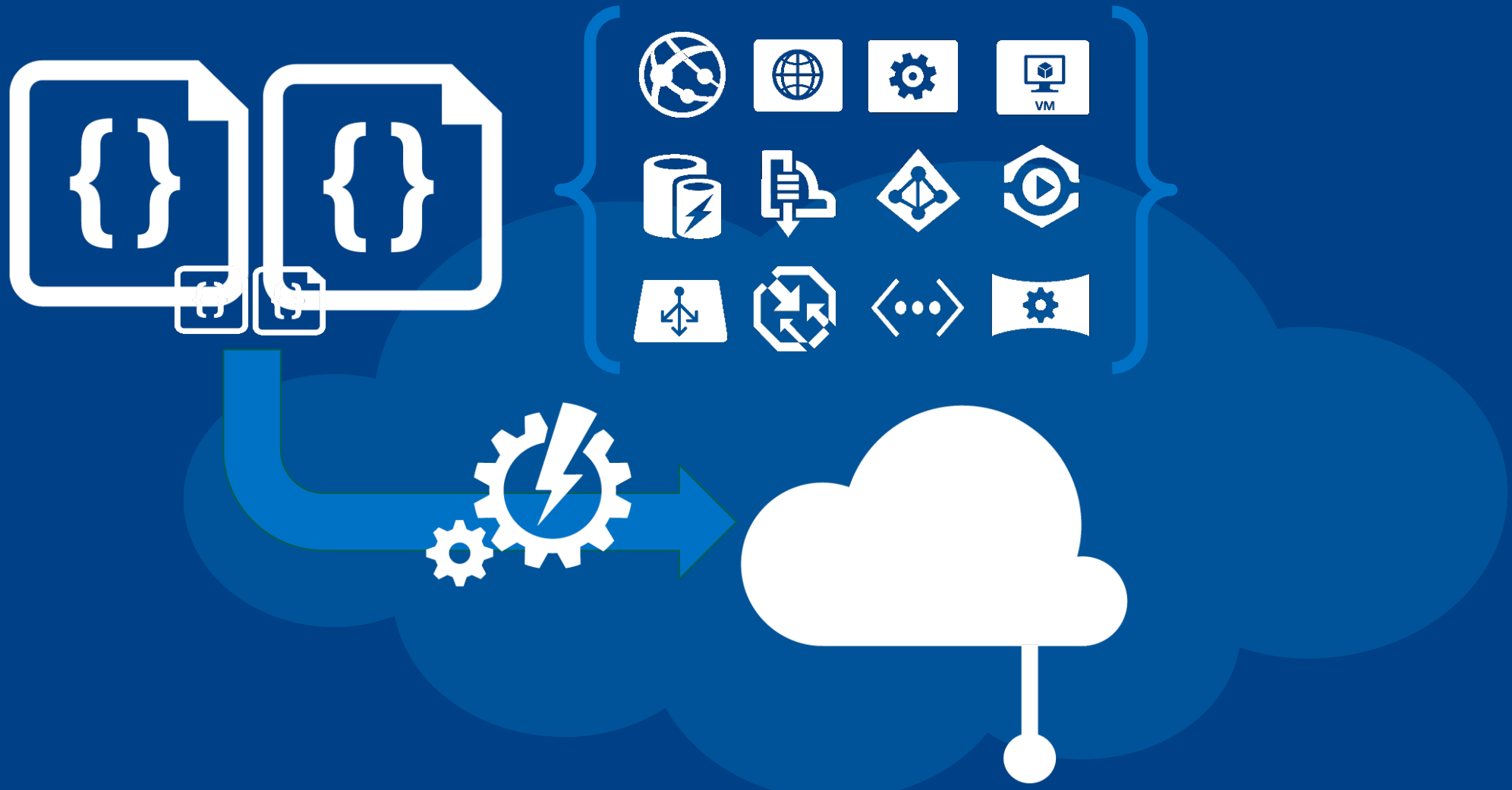



Microsoft

# Agenda

- Your services and Azure
- Virtual Machines
- Virtual Networks
- Azure Resource Manager

- Your application code
- Required infrastructure
- Resource code




**You:** Code (application, infrastructure)

**Azure:** Resources (IaaS, PaaS, SaaS)

# Virtual Machines

# Azure Virtual Machines








- Launch Windows Server and Linux in minutes
- Scale from 1 to 1000s of VM Instances
- Save money with per-minute billing
- Open and extensible

# Announcing – redhat now on Azure


THE WAIT IS OVER

## Use Red Hat products on Microsoft Azure

Security, consistency, reliability: These are why enterprises trust Red Hat® solutions. They're also why enterprises turn to a public cloud like Microsoft Azure. It's only natural that customers want to unite the 2.

Now you can. Red Hat and Microsoft are teaming up to offer open hybrid cloud solutions on Azure.

READ THE PRESS RELEASE

Microsoft Azure

"This partnership is a powerful win for enterprises, ISVs and developers. With this partnership, we are expanding our commitment to offering unmatched choice and flexibility in the cloud today, meeting customers where they are so they can do more with their hybrid cloud deployments – all while fulfilling the rigorous security and scalability requirements that

Microsoft

# Provisioning VM



## Getting Started

Management Portal

Scripting
(Windows, Linux and Mac)

REST API

## Select Image and VM Size

Windows Server

Linux

General Purpose
- Basic
- Standard

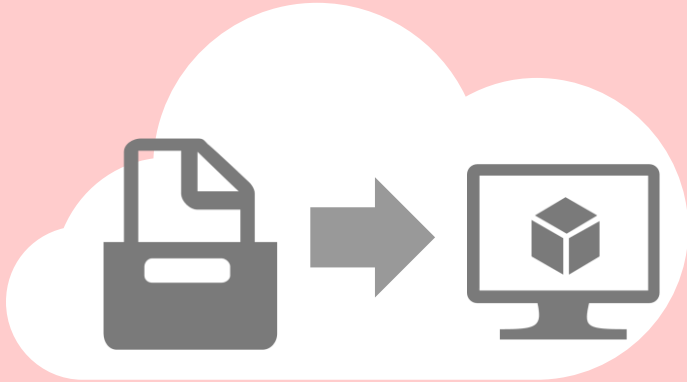
Optimized Compute

Performance Optimized

Network Optimized

## New Disk Persisted in Storage

Boot VM from New Disk



Cloud

Microsoft Azure

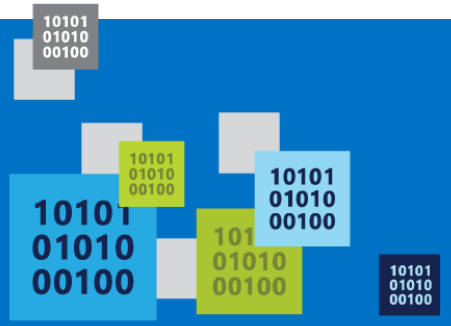
# VM Gallery

## A COLLECTION OF PREBUILT IMAGES FOR VARIOUS WORKLOADS


Microsoft

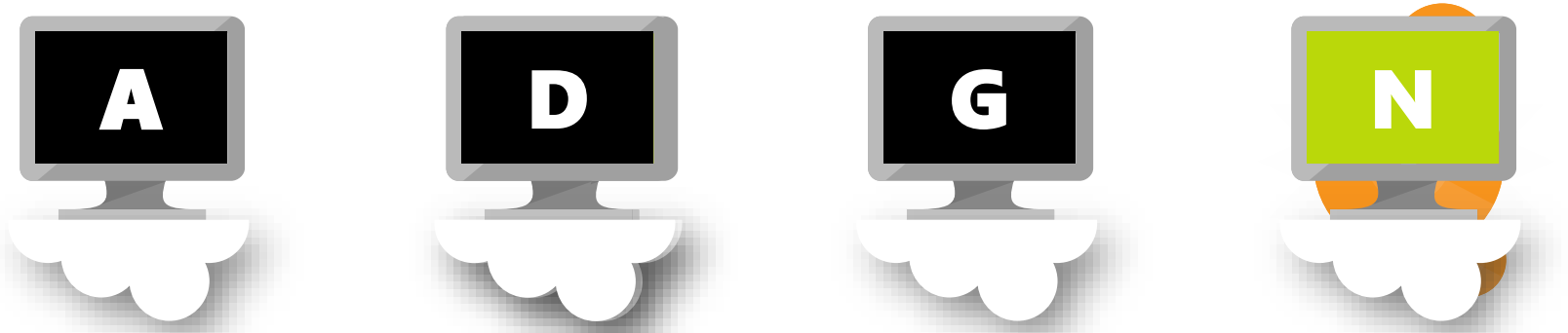
# Virtual Machine Sizess

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



# Scale-up options

**Highest value** → **Largest scale-up**




Highest value

New generation
of D-family VMs

35% faster than D

Intel E5-2673 v3 CPUs

Most memory
fastest CPUs

NVIDIA GPUs

Remote visualization

Compute-intensive + RDMA

## Largest virtual machines
## Fastest storage in the public cloud

# The G family

Optimized for data workloads

Up to 32 CPU cores, 448 GB RAM

6.5 TB local SSD

Latest generation Intel processor

Up to 64 attached disks!!

# General Purpose Compute



## Basic Tier

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

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

# General Purpose Compute



## Standard Tier

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

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

# General Purpose Compute



## Network optimized with Infiniband support

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

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

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

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

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

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

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

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

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

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

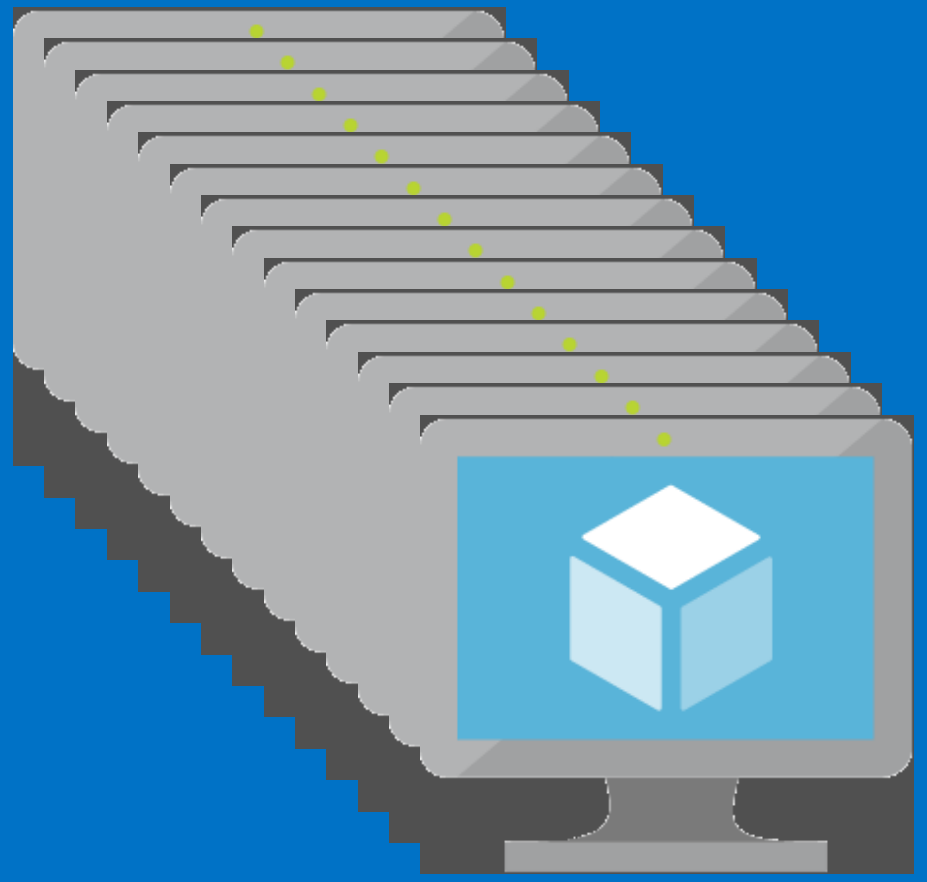
| Size | CPU cores | Memory | NICs (Max) | Max. disk size | Max. data disks (1023 GB each) | Max. IOPS (500 per disk) |
|---|---|---|---|---|---|---|
| Standard_G1 | 2 | 28 GB | 1 | Local SSD disk = 384 GB | 4 | 4 x 500 |
| Standard_G2 | 4 | 56 GB | 2 | Local SSD disk = 768 GB | 8 | 8 x 500 |
| Standard_G3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

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

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

# Key Improvements: Azure Virtual Machines (v2)

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



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

# NEW: VM Scale Sets

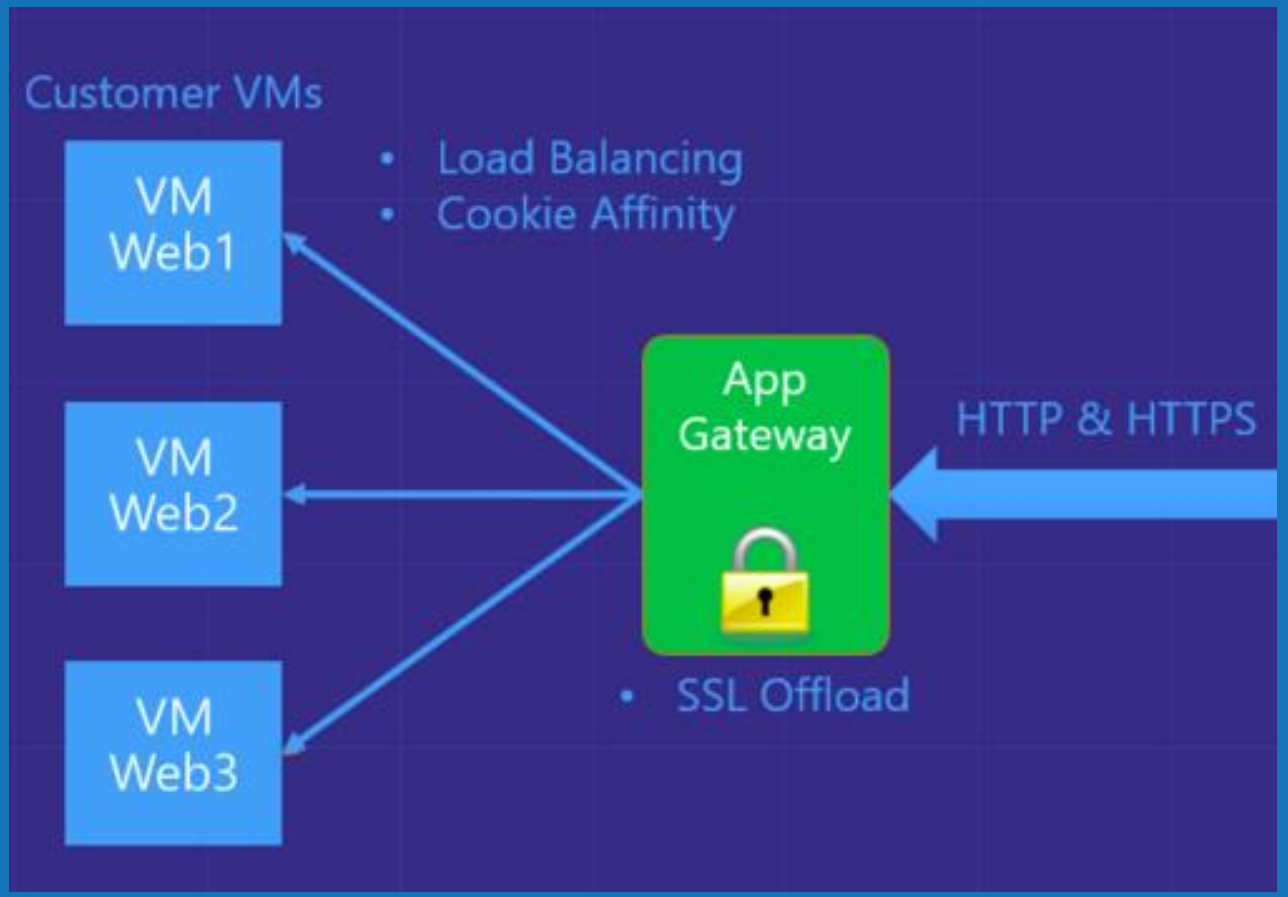
# Virtual Machine Scale Sets

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

# NEW: Application Gateway

# Azure Application Gateway

- Azure-managed, first party virtual appliances
- HTTP routing based on app-level policies
  - Cookies affinity
  - URL hash
- SSL termination and caching

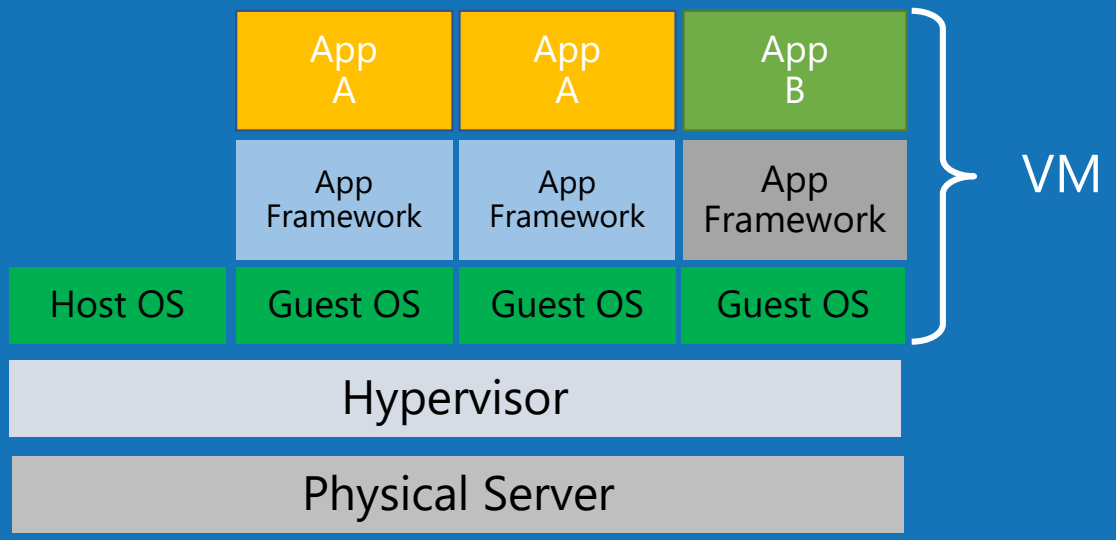


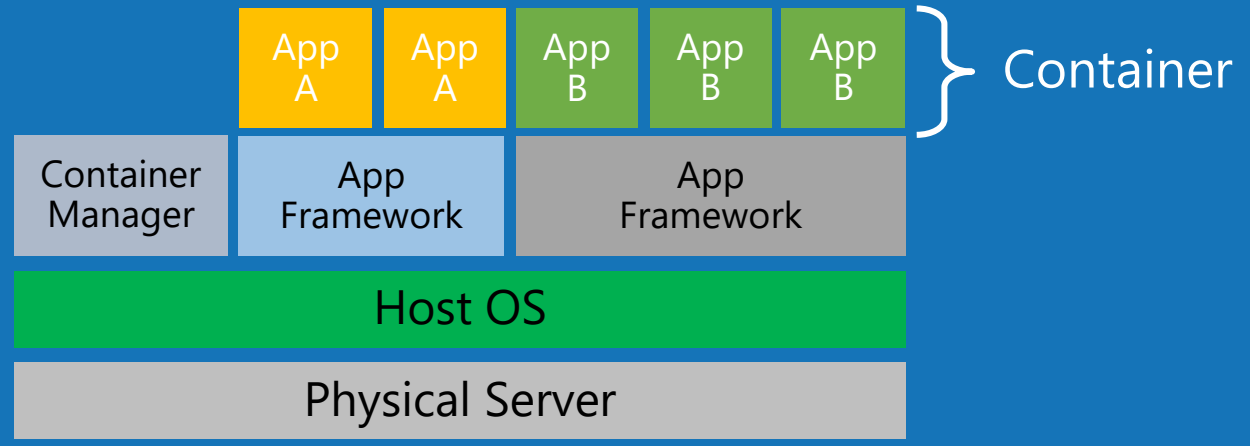

Microsoft

# VMs + Containers

# Containers

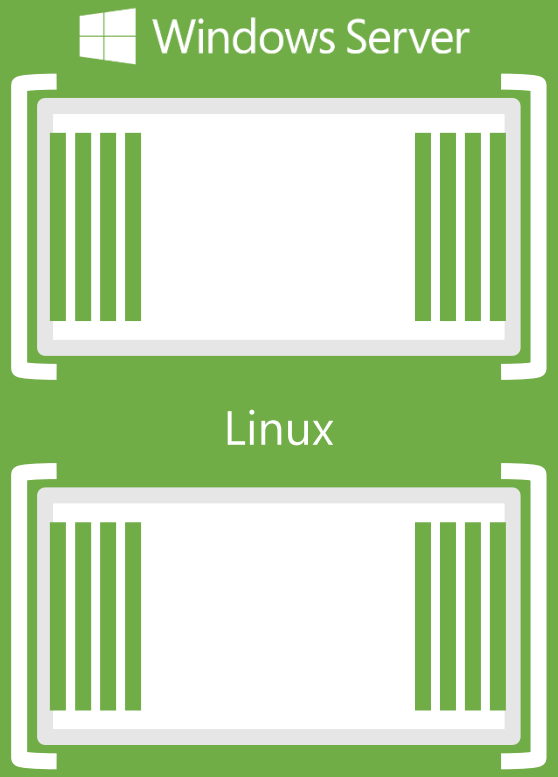
- What are they?
  - Unit of deployment
  - Isolated environment
  - Isolated collection of resources
- What are the benefits?
  - Instant startup
  - Repeatable and reliable execution
- Scenarios
  - Dev/Test
  - Great for micro-services



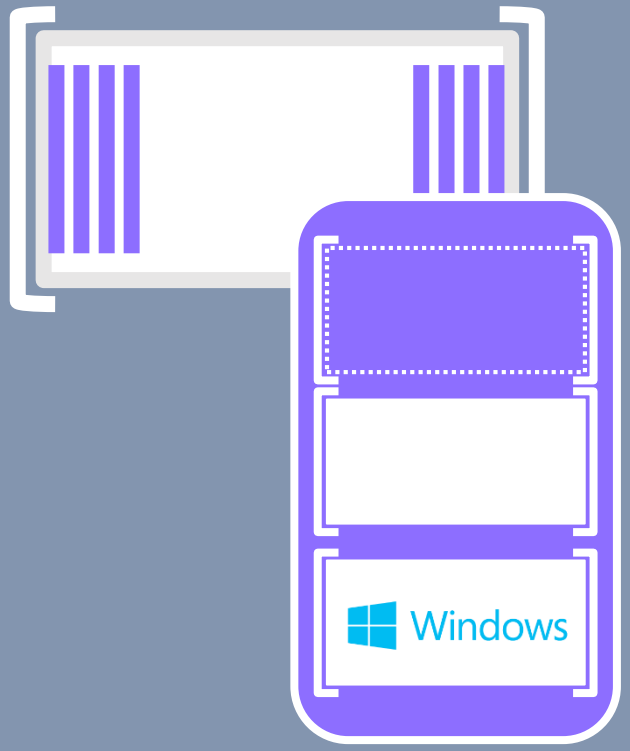
# Container Ecosystem via Docker

## Container Run-Time



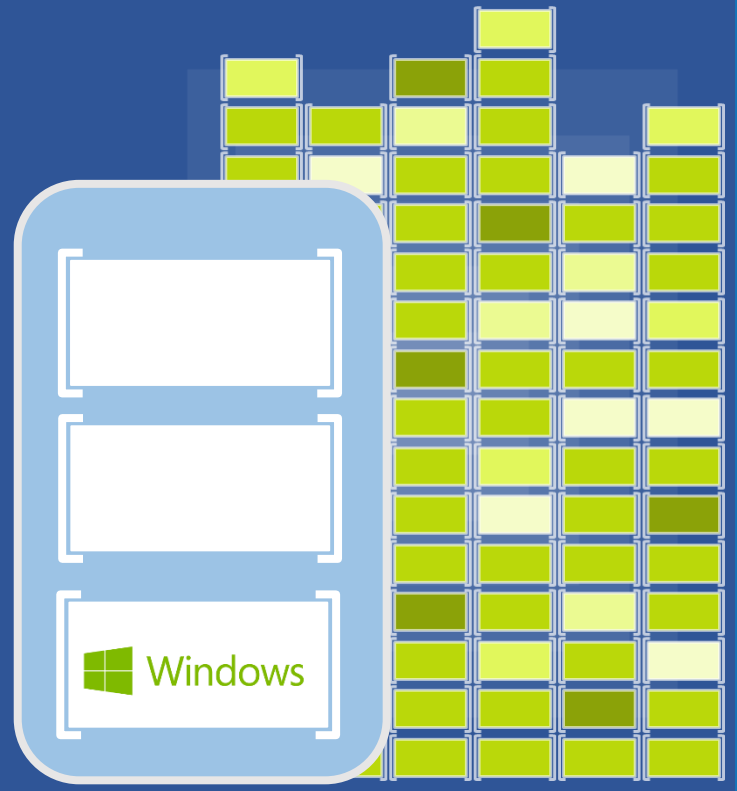

Docker API / Client

## Container Images



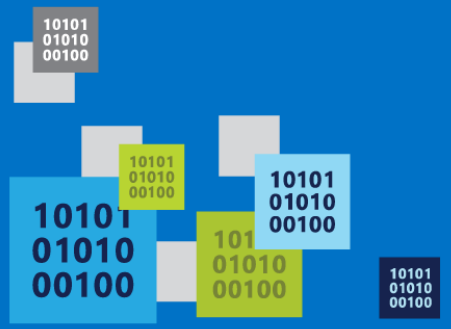

Docker images

## Image Repository

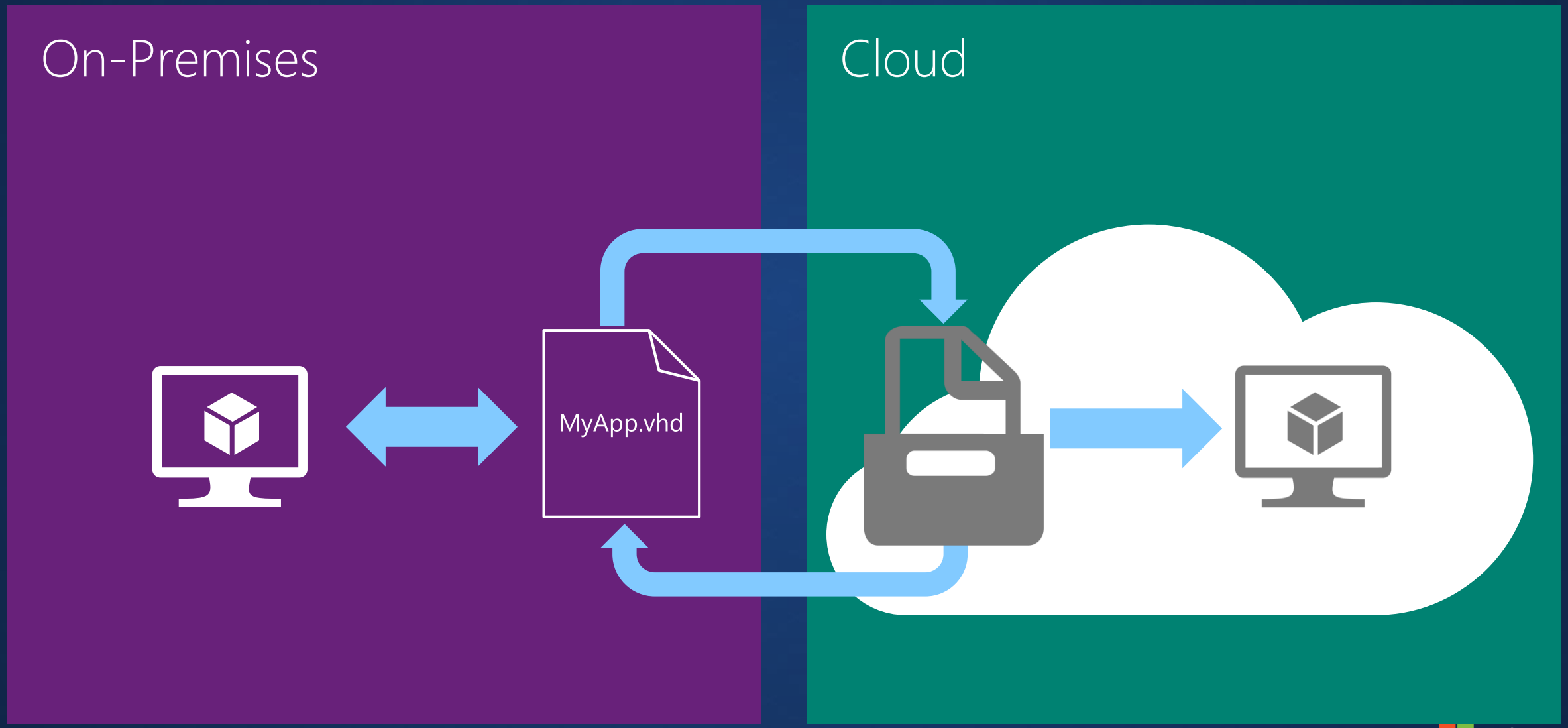



Docker Hub
(trusted repositories)

# Demo: Managing VMs using Azure portal



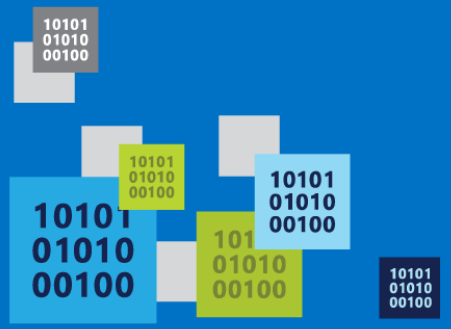
# Image Mobility



# VM Extensions

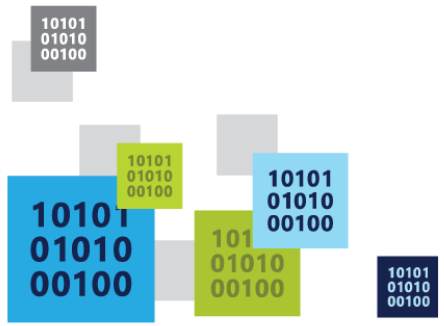
- Installable components to customize VM instances
- Enable various DevOps scenarios
- Can be added, updated, disabled or removed at any time
- Managed via portal, PowerShell and Management APIs

# Demo: Add an extension to a VM instance



# Data Persistence

- OS Disks
- Data Disks



## OS Images

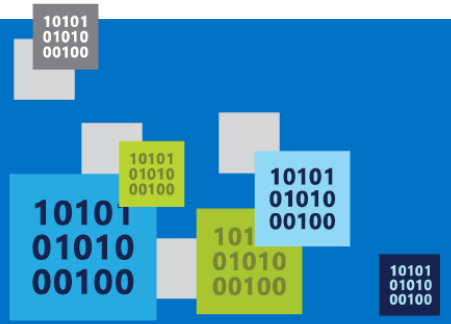
- Microsoft
- Partner
- User

Base OS image for new Virtual Machines
Sys-Prepped/Generalized/Read Only
Created by uploading or by capture

## Disks

- OS Disks
- Data Disks

Writable Disks for Virtual Machines
Created during VM creation or during upload of existing VHDs.



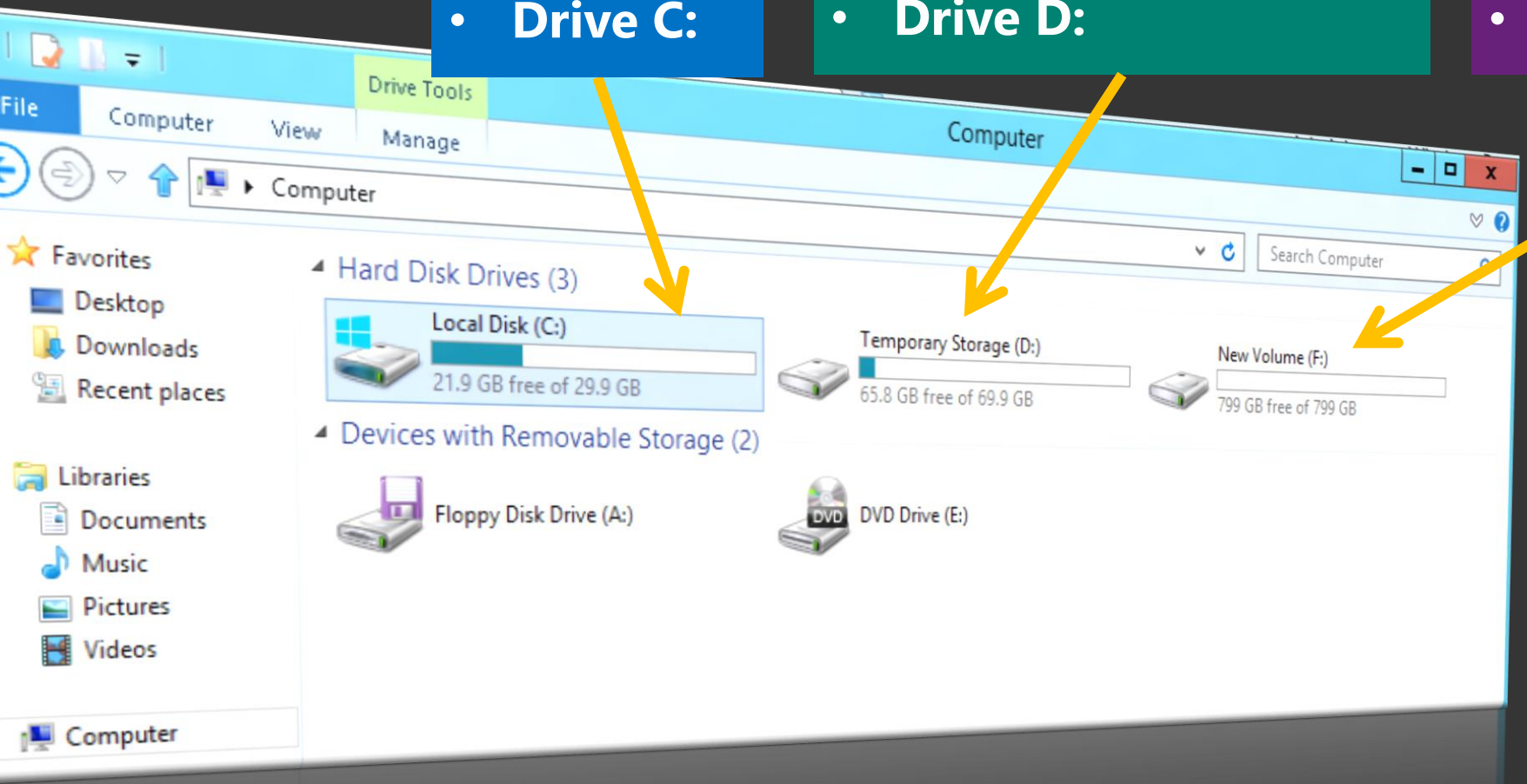

# Disks and Images

# VM disk layout

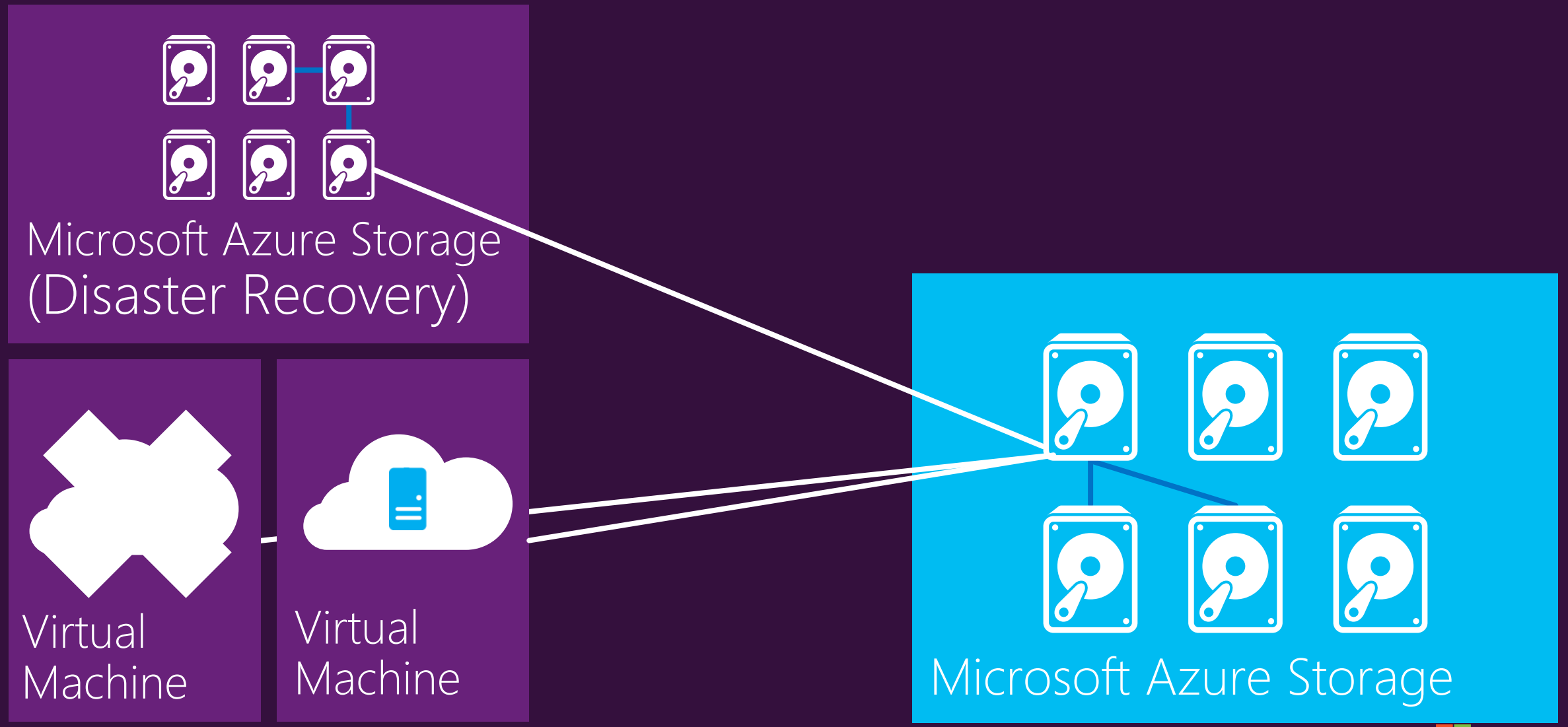
**OS Disk**
- Persistent
- SATA
- **Drive C:**

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

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



# Persistent Disks and Highly Durable



Microsoft Azure

# Linux on the Microsoft Cloud Platform

Microsoft

# Microsoft  Linux

The Register®
Biting the hand that feeds IT

DATA CENTRE SOFTWARE NETWORKS SECURITY BUSINESS HARDWARE SCIENCE BOOTNOTES

# Redmond top man Satya Nadella: 'Microsoft LOVES Linux'

Open-source 'love' fairly runneth over at cloud event

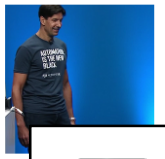
siliconANGLE

# Microsoft adds Linux monitoring to Azure in continued open-source push

by Maria Deutscher | Jun 11, 2015 | 0 comments

**Val Bercovici**
@valb00
Follow

Has hell frozen over or was that a pig I just saw flying overhead? 😜
Kudos to @Microsoft for getting your mojo back!



**Open at Microsoft** @OpenAtMicrosoft
"We love #Linux, we love #Docker, we love #Mesosphere..." @markrussinovich & @benh talking containers at #AzureCon

RETW
3

11:26

**Indefinite Ceiling**
@INCEILING
Follow

@Azure and its supports Linu
Microsoft. #AzureCon #Linux


TWEET FAVORITES
3

:37 AM - 29 Sep 2015

proprietary software,
have changed.

**Craig Sheppard**
@craigsheppard
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Microsoft talking open source at #ATO2015. I don't think Microsoft means what you think it means any more...


**Al Gillen**
@algillen
Follow

@Scottgu blew thru #AzureCon container news; if not obvious, it's Linux based containers. #MSFT loves Linux more each month.

RETWEETS 11 FAVORITES 7

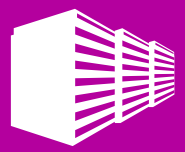
8:33 AM - 29 Sep 2015

# Microsoft is committed to Linux and open source

## Linux is a real business for Microsoft

25% of IaaS VMs in Azure are Linux

System Center manages hundreds of thousands of Linux/UNIX servers



Many enterprises and service providers run Linux as a guest on Hyper-V

## … and we're been in a long open source journey!

System Center has managed Linux and UNIX servers since 2009

Linux drivers for Hyper-V available since 2010

Azure IaaS has run Linux VMs since "day 1" in 2013

**Today** Linux and open source are a fundamental part of how we do business

# Virtual Machine Availability



- Meaning of 9's
- Fault domains, update domains and availability sets
- Load balancing

# Meaning of 9's

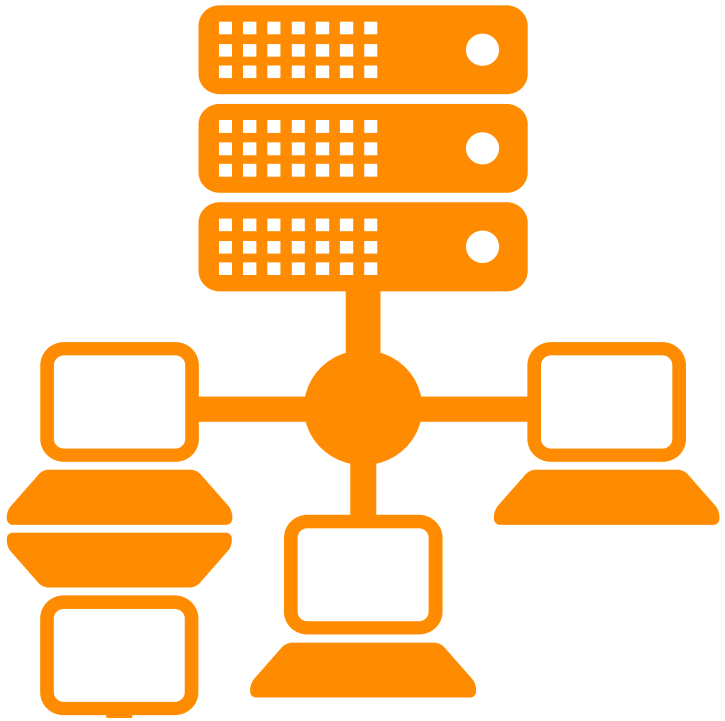
| Service Availability (%) | System Type | Annualized Down Minutes | Quarterly Down Minutes | Monthly Down Minutes | Practical Meaning | FAA rating |
|---|---|---|---|---|---|---|
| 90 | Unmanaged | 52,596.00 | 13,149.00 | 4,383.00 | Down 5 weeks per year | |
| 99 | Managed | 5,259.60 | 1,314.90 | 438.30 | Down 4 days per year | ROUTINE |
| 99.9 | Well managed | 525.96 | 131.49 | 43.83 | Down 9 hours per year | ESSENTIAL |
| 99.99 | Fault tolerant | 52.60 | 13.15 | 4.38 | Down 1 hour per year | |

*From Generic Requirements for Operation Systems Platform Reliability, Telcordia Technologies System Documentation,GR-2841-CORE and Federation Aviation Administration Handbook: Reliability, Maintainability, and Availability (RMA) Handbook, FAA-HDBK-006A, Jan 7, 2008.*

# Meaning of 9's

| Service Availability (%) | System Type | Annualized Down Minutes | Quarterly Down Minutes | Monthly Down Minutes | Practical Meaning | FAA rating |
|---|---|---|---|---|---|---|
| 99.999 | High availability | 5.26 | 1.31 | 0.44 | Down 5 minutes per year | CRITICAL |
| 99.9999 | Very high availability | 0.53 | 0.13 | 0.04 | Down 30 seconds per year | |
| 99.99999 | Ultra availability | 0.05 | 0.01 | - | Down 3 seconds per year | SAFETY CRITICAL |

*From Generic Requirements for Operation Systems Platform Reliability, Telcordia Technologies System Documentation,GR-2841-CORE and Federation Aviation Administration Handbook: Reliability, Maintainability, and Availability (RMA) Handbook, FAA-HDBK-006A, Jan 7, 2008.*



## 99.95% for multiple role instances

4.38 hours of downtime per year

## What's included

Compute Hardware failure (disk, CPU, memory)
Datacenter failures - Network failure, power failure
Hardware upgrades, Software maintenance – Host OS Updates

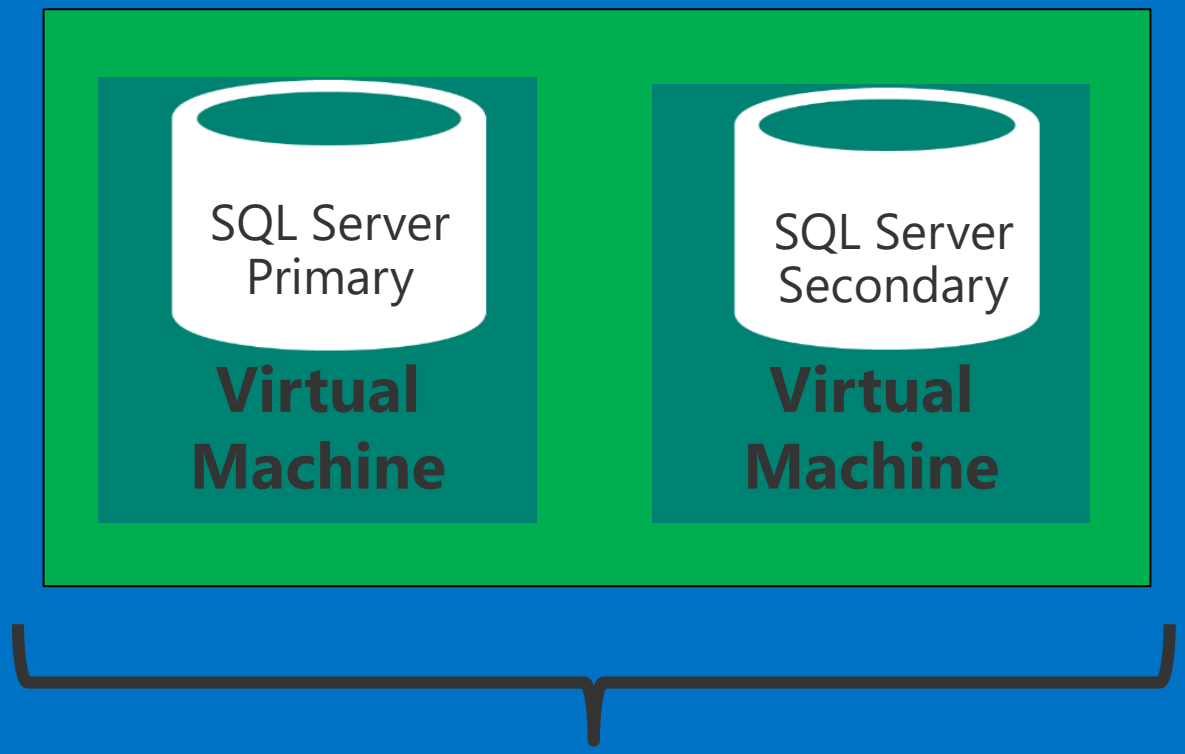
## What is not included

VM Container crashes, Guest OS Updates

# Service Level Agreements

# Availability Sets

## Availability set




SLA High Availability

Hardware and Software

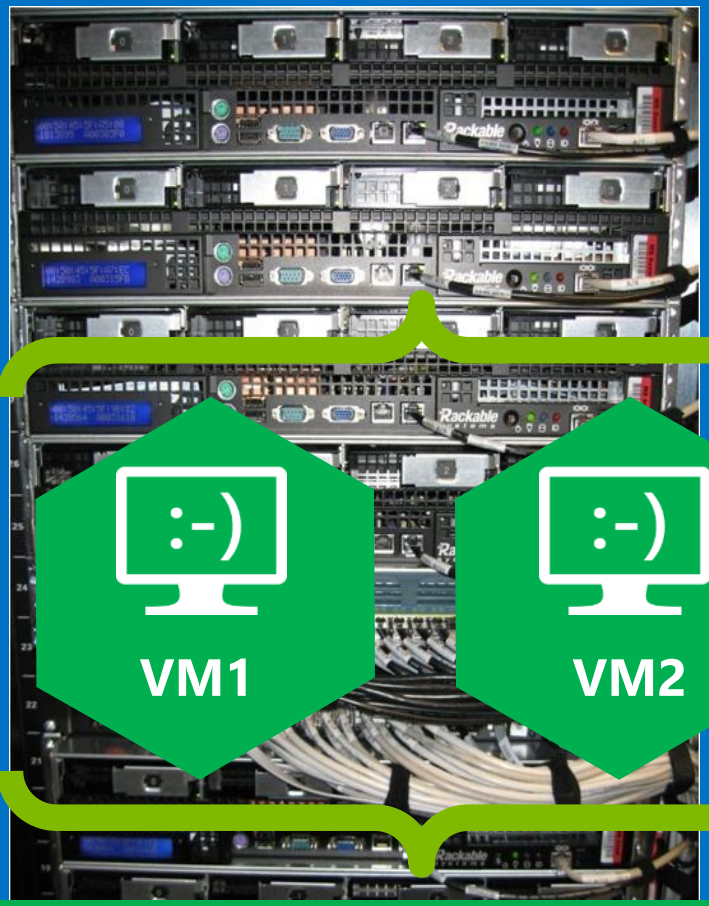
Windows and Linux

# Availability Sets

**Physical Machines**

**Power Unit**
**Rack Switch**

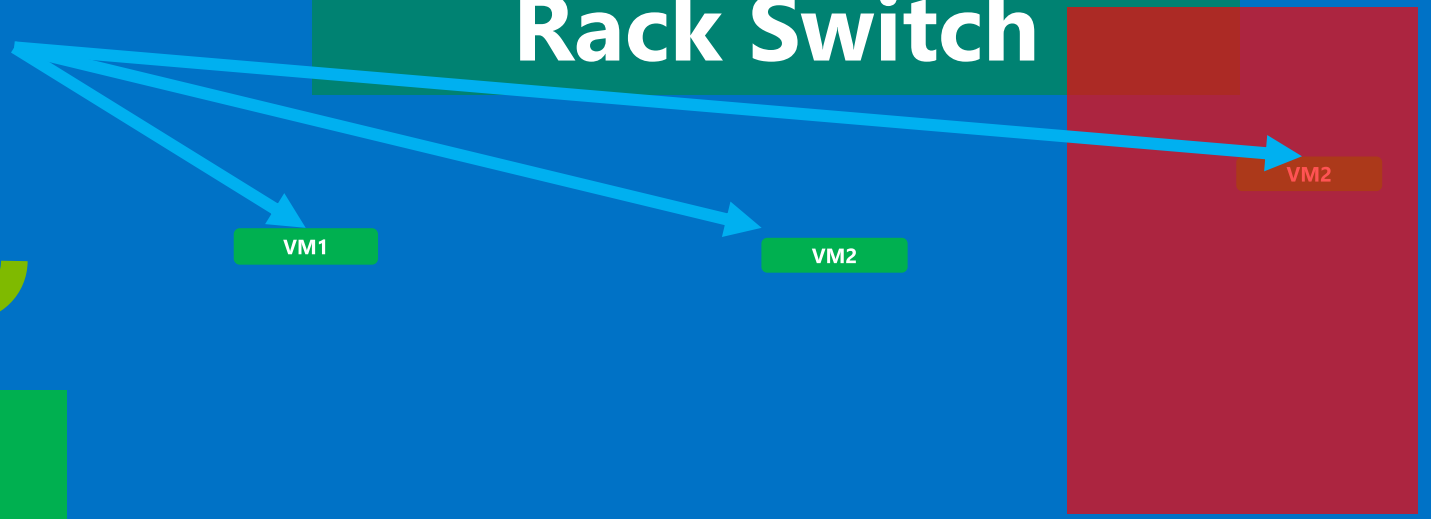
# Availability Sets



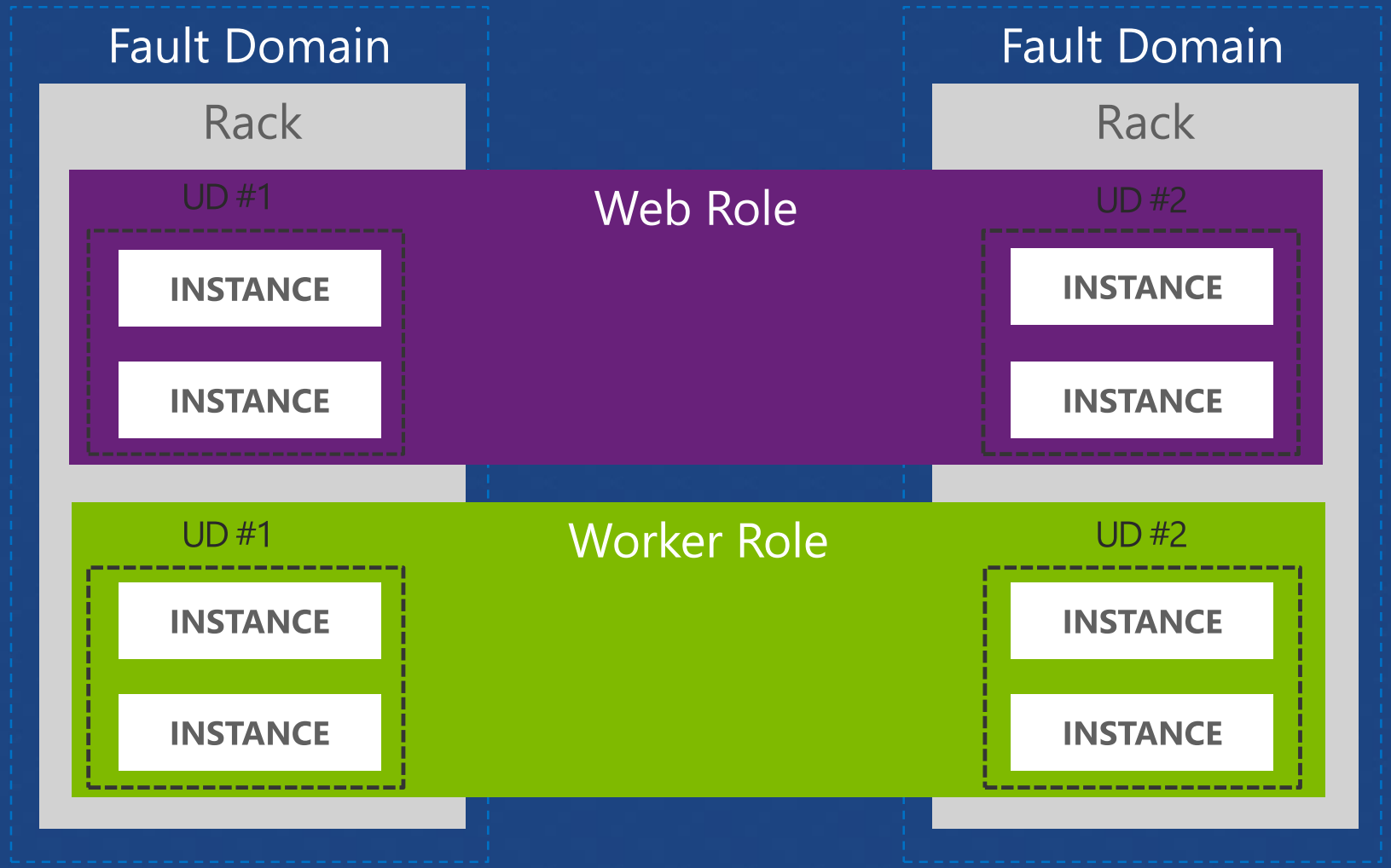

**Availability Set**

**Physical Machines**

**Power Unit**
**Rack Switch**

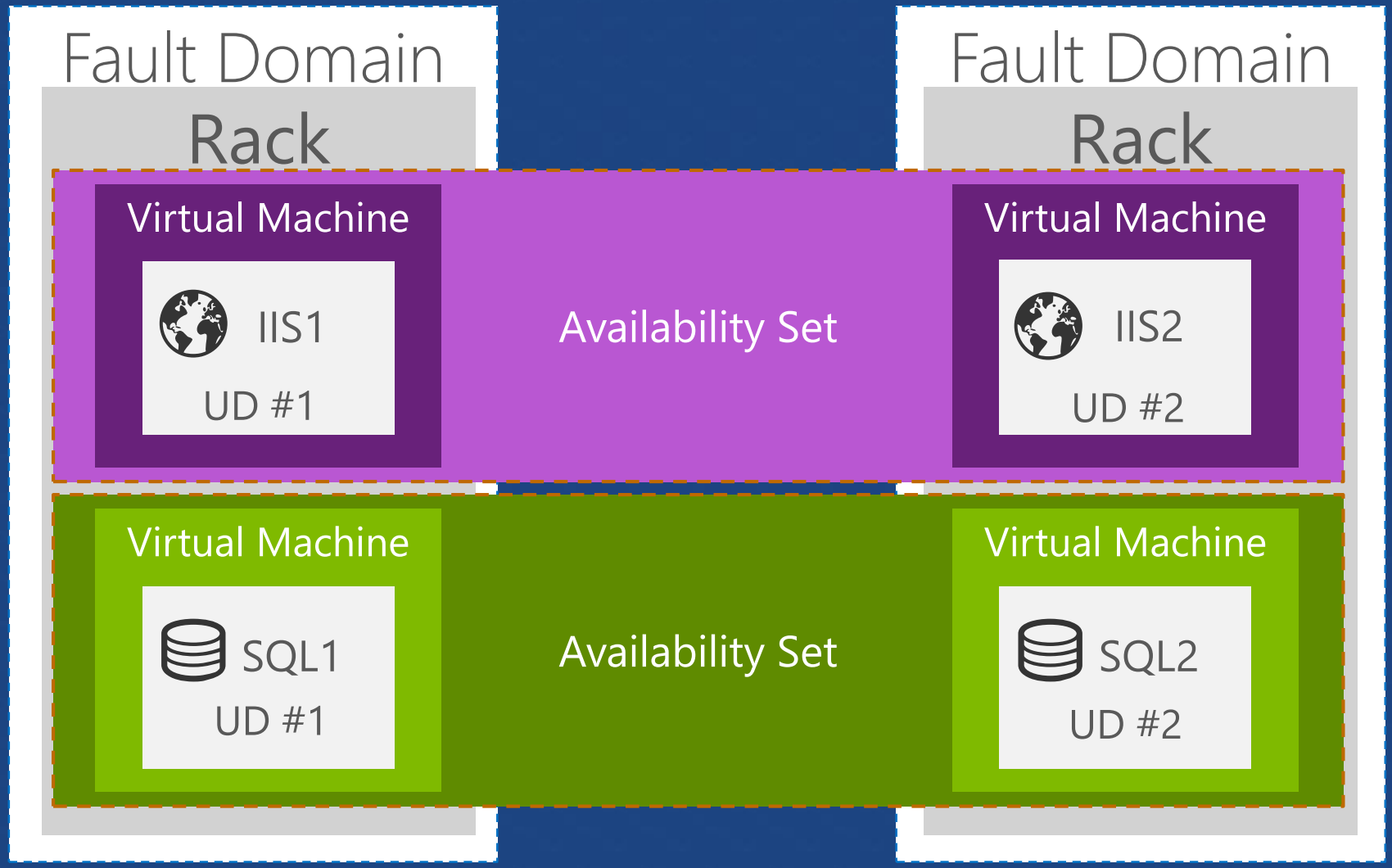


# Fault and Update Domains



# Virtual Machine Availability Sets

*UPDATE DOMAINS ARE HONORED BY HOST OS UPDATES*



# Availability Set Guidance

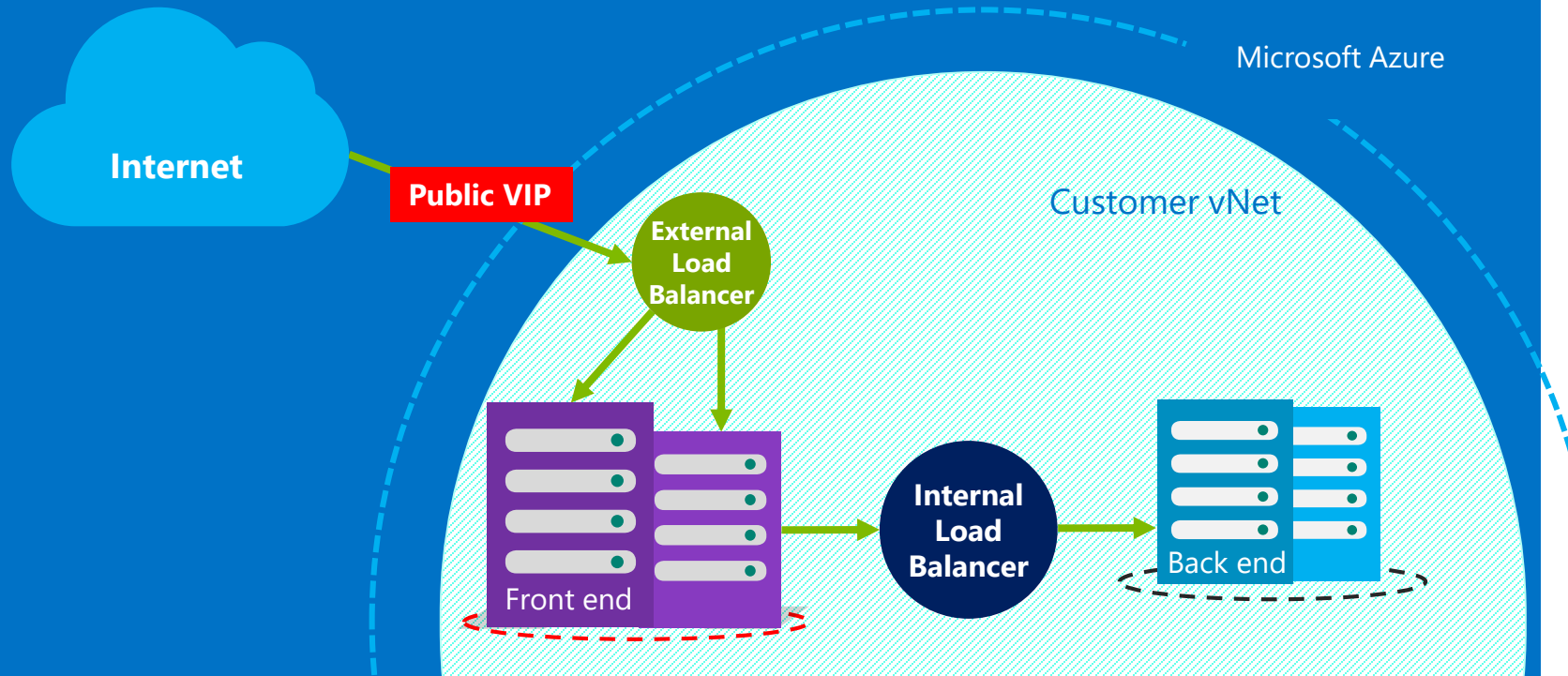
- VMs in Availability Set Must Be in Same Resource Group
- Availability Set: 5 Update Domains, 3 Fault Domains
  - Update Domain – Host Maintenance
  - Fault Domain – Isolation from component failure in rack unit
- Maximum of 100 VMs in a Availability Set
- Avoid Availability Sets with Single VM
  - This eliminates notification for host maintenance operations

https://azure.microsoft.com/en-us/documentation/articles/azure-subscription-service-limits/

# Load balancing



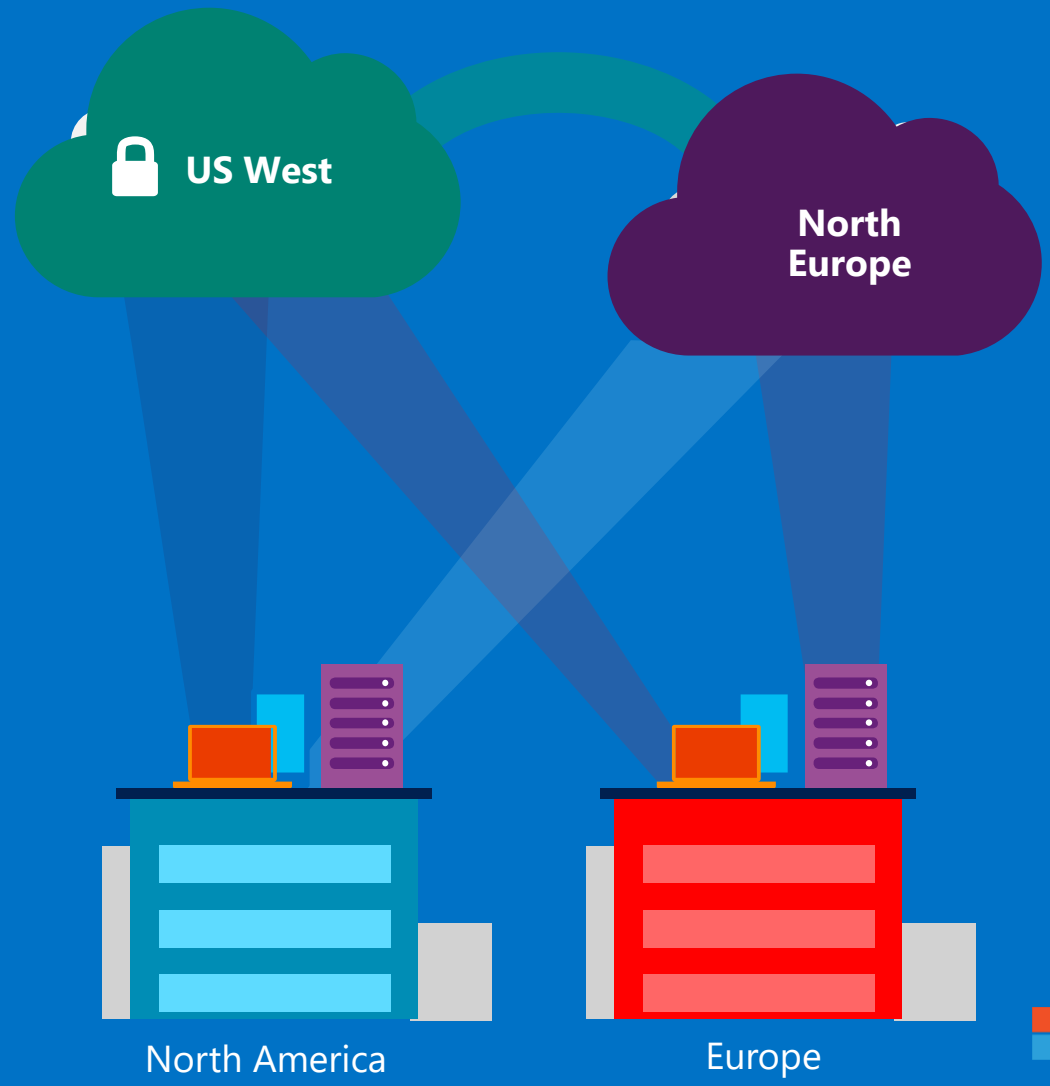
- Load balancing
  Multiple VMs share the workload via public facing endpoints
- Internal Load balancing
  Load balancing between VMs that don't have public facing endpoints



# Traffic Manager



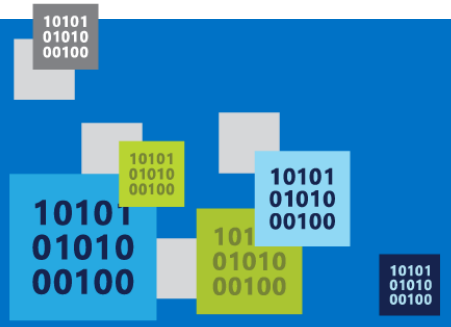
- Load balancing
- Failover



# Virtual Networks

# Azure Virtual Networks

- A protected private virtual network in cloud
- Extend enterprise networks into Azure
- Cross-premises connectivity



# Cross-premises Connectivity



- Site-to-site

  Create a secure connection between your on-premises site and your virtual network

- Point-to-site

  Create a secure connection via VPN to your virtual network

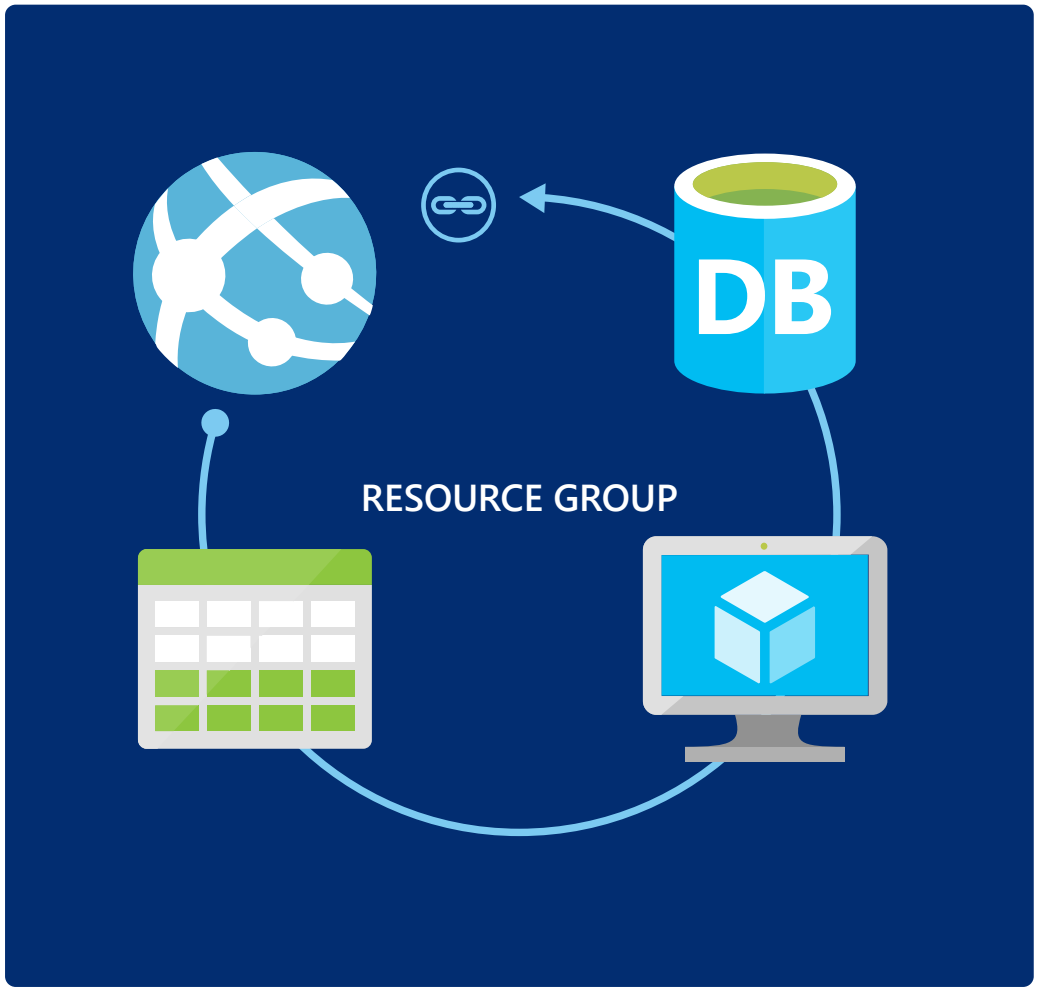
- ExpressRoute™

  Create a private connection between Azure data centers and infrastructures on your premises or in a co-location environment.

  - Connect at an ExpressRoute location (Exchange Provider facility)
  - Direct connect via a Network Service Provider

# Azure Resource Manager

# Azure Resource Manager & Resource Groups

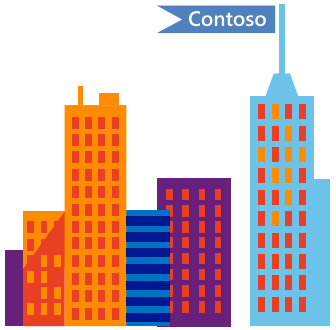



- Manage resources as a single unit
- Role based access and control (RBAC) on groups or resources
- Billing integrated tagging on groups or resources

# Azure Resource Manager (ARM)

## Consistent management layer

Tools


## Curated extensions


Provider rest points

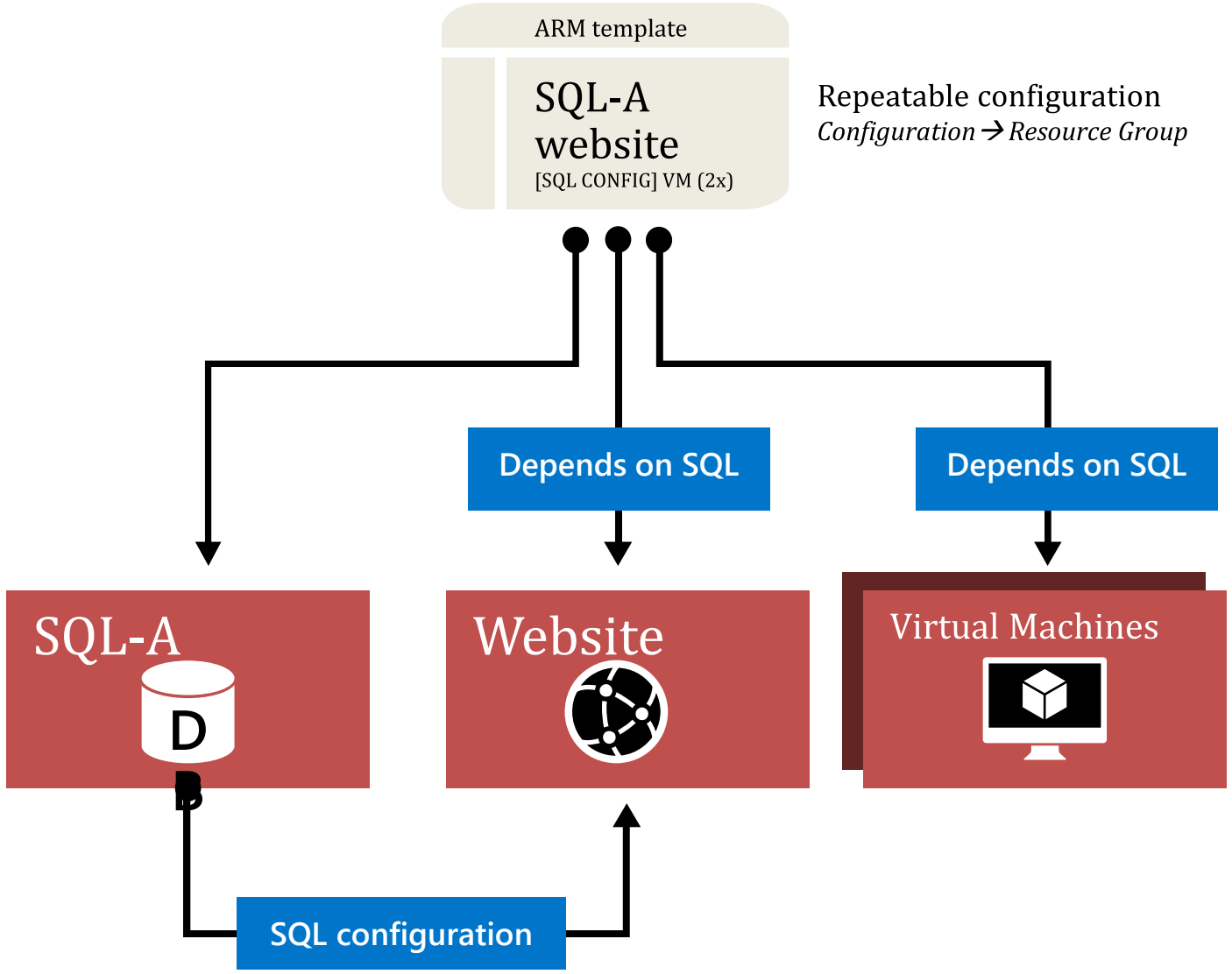
# Azure Resource Manager templates

## ARM templates can:

- Simplify deployment
- Simplify roll-back
- Provide cross-resource configuration and update support
- Be used as a learning tool to build to suit

## Azure templates are:

- Source file, checked-in
- Specifies resources and dependencies (VMs, websites, DBs) and connections (configuration, LB sets)
- Configurable parameters for input/output



# JSON files—simpler than they look

## Schema, content version, parameters, variables, resources, and outputs


# Get started

## Visit azure.microsoft.com

Microsoft