Azure Virtual Machines

Topics

Introduction
Provisioning VMs
Access & Security
Scalability & Reliability

Introduction

On-premises vs Azure Virtual Machines

Characteristic	On-Premises Hyper-V	Azure
Console access available to virtual machine	Yes	No
Support for VHDX file format	Yes	No
Upgrade Guest OS	Yes	Not supported
Requires ownership and control of physical hardware to run guest OS	Yes	No
Run anti-virus on virtual machines	Yes	Yes
Support for more than 1 virtual network adapter	Yes	Generally, No. Depends on VM size

Azure Virtual Machine Benefits

Choice

- Choose from thousands of pre-configured VM images or configure, capture, and upload your own custom images
- Leverage VM Extensions to do custom post-deployment configuration

Scalability & Reliability

- Select system profiles to best match your workload
- Configure drives for size and performance
- Leverage VM Scale Sets to scale from one to thousands of VM instances

Access & Security

- Configure Azure networking to the topology you require
- Extend your on-premises infrastructure into the Cloud

Azure Resource Manager —— ARM

• Definition:

- Resource
- Resource Group
- Resource Provider
- Resource Manager Template

• Benefits:

- Deploy, manage and monitor as a group
- Repeatedly deploy your solution with Tempaltes
- Role-Based Access Control
- Tags

```
"$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
"contentVersion": "1.0.0.0",
"parameters": {
   "virtualMachines_ignitevm1_adminPassword": {
        "defaultValue": null,
        "type": "SecureString"
    "virtualMachines_ignitevm1_name": {
        "defaultValue": "ignitevm1",
        "type": "String"
   "networkInterfaces ignitevm1946 name": {
        "defaultValue": "ignitevm1946",
        "type": "String"
   "networkSecurityGroups ignitevm1 nsg name": {
        "defaultValue": "ignitevm1-nsg",
        "type": "String"
    "publicIPAddresses ignitevm1 ip name": {
        "defaultValue": "ignitevm1-ip",
        "type": "String"
    "virtualNetworks Ignite vnet name": {
       "defaultValue": "Ignite-vnet",
        "type": "String"
    "storageAccounts ignitedisks name": {
       "defaultValue": "ignitedisks",
        "type": "String"
   "sites igniteweb1 name": {
```

Provisioning a VM

Provisioning Steps

Image

- Select an image from the VM Gallery
- Upload your own Custom-Prepped Image
- Use a Custom ARM Template

Scale

- General Purpose
- Compute Optimized
- Memory Optimized
- GPU
- High Performance Compute

Boot

- Create new disk in Storage
- Boot the machine

Easy as 1-2-3!

Deploy Windows Virtual Machines

- Tools for deploying virtual machines
 - Azure Portal
 - Classical Portal (manage.windowsazure.com) laaS v1 virtual machines
 - New Portal (portal.azure.com) laaS v1 and v2 virtual machines
 - Azure PowerShell
 - Azure CLI
- Portal creation options
 - Quick Create (classical portal)
 - Gallery (classic portal)
 - Azure Marketplace (new portal)

VM Gallery Images

































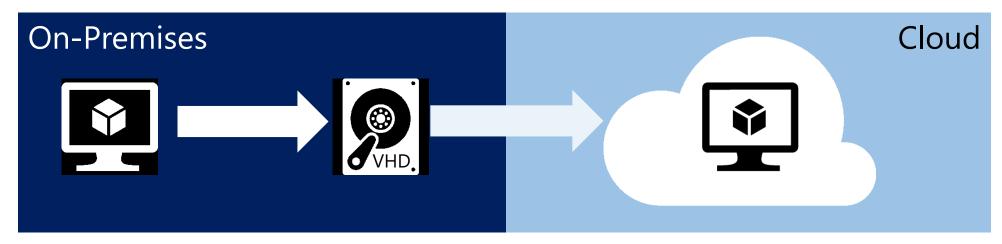




Microsoft Linux

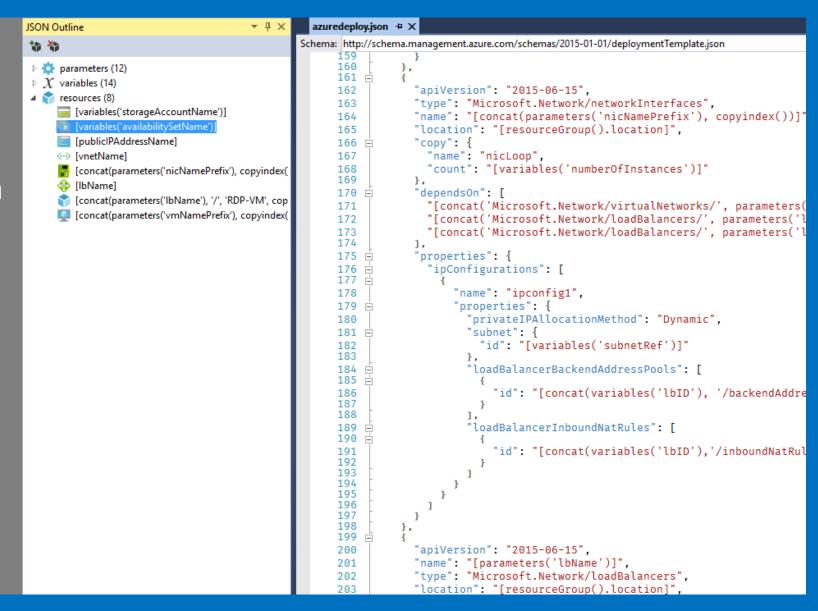
Custom Image Upload

- Prepare the VHD
- Optional generalize the VHD by using SysPrep/waagent
- Upload the VHD to Azure Storage
- Prepare networking resources
- Create the VM from uploaded generalized or specialized image



Deployment with ARM Templates

- Declarative deployment
- Maintain resources with the same lifecycle within a resource group
- Configure parameters for input/output
- Specify resources & dependencies
- Leverage Quickstart Templates or export existing resources



ARM Template Format

```
"$schema": "https://schema.management.azure.com/schemas/2015-01-01/deploymentTemplate.json#",
"contentVersion": "1.0.0.0",
"parameters": {
},
"variables": {
},
"resources": [
],
"outputs": {
}
```

VM Extensions

- Small applications that perform post-deployment configuration and automation tasks
- Extensions are published by Microsoft & trusted 3rd party publishers
- Can be added, updated, disabled, or removed at any time
- Managed via Azure Portal, PowerShell, and Management APIs







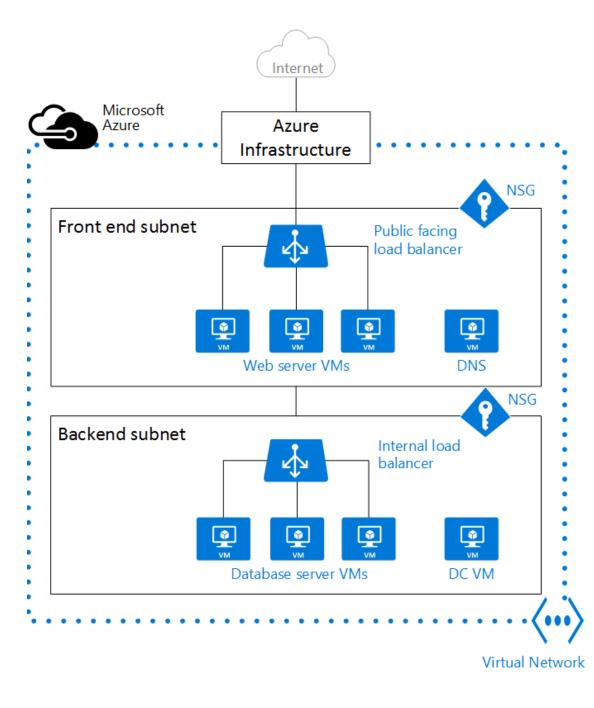






Virtual Networks

- "Bring your own network"
- Provides security and isolation by creating a private network inside of Azure
- Supports:
 - Defining subnets
 - "Peering" with other nonoverlapping VNETs in the same region
 - Defining Network Security Groups (ACL rules)
- Allows you to create complex and/or sophisticated network topologies around your VM's



Other Network Resources



Reserved Public IP Addresses



• Internal or External Load Balancers



Application Gateways



Application Gateway Web Application Firewall (Preview)

Define Network Security Group

Essentials ^

Resource group (change)

DL

Location

Japan East

Subscription name (change)

DavidTest

Subscription ID

b2f9961e-3940-43e2-89ae-168a4375270c

Security rules

2 inbound, 0 outbound

Associated with

0 subnets, 1 network interfaces

2 Inbound security rules $\stackrel{\rlap{}^{\checkmark}}{=}$

PRIORITY	NAME	SOURCE	DESTINATION	SERVICE	ACTION
1000	default-allow-ssh	Any	Any	SSH (TCP/22)	Allow
1010	RDP	Any	Any	RDP (TCP/3389)	Allow

$\mathbf{0}$ Outbound security rules $\overset{\boldsymbol{\uparrow}}{\smile}$

PRIORITY	NAME	SOURCE	DESTINATION	SERVICE	ACTION
No results.					

Access Control List

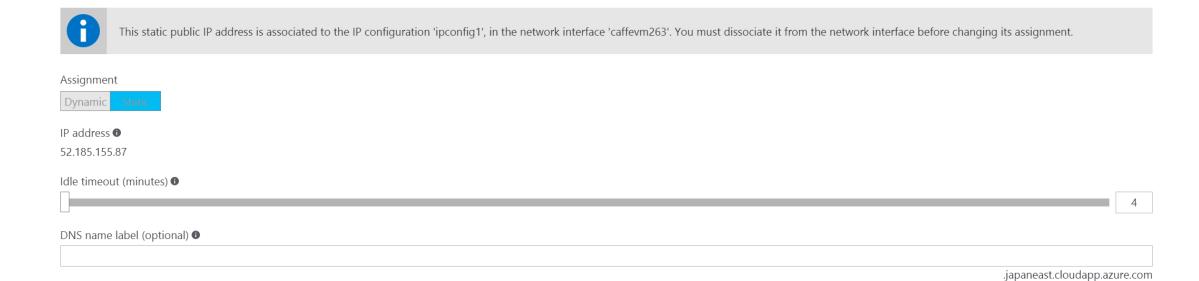
$2 \text{ Inbound security rules} \overset{\rlap{}^{\checkmark}}{\rightleftharpoons}$

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10	00	default-allow-ssh	Any	Any	SSH (TCP/22)	Allow
10	10	RDP	Any	Any	RDP (TCP/3389)	Allow

Outbound security rules

PRIORITY	NAME	SOURCE	DESTINATION	SERVICE	ACTION
No results.					

Reserved IP



Scalability & Reliability

Choosing a VM Size

General Purpose Compute Optimized

Memory Optimized

GPU

High
Performance
Compute

A0 – A5 Basic

F1, F2, F4, F8, F16

D11 – D14

NV6, NV12, NV24

A8 – A11

A0 – A7 Standard

D1 – D4

D1v2 – D5v2

D11v2 – D15v2

G1 – G5

NC6, NC12, NC24, NC24r H8, H8m, H16, H16m, H16r, H16mr

Disks vs Images

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.

Storage Disks

Standard Storage

- Cloud-scale reliable storage
- Maximum 500 IOPS, 60 MB per second throughput per disk
- Available in all VM Sizes

Premium Storage

- High-performance, low-latency disk support, ideal for I/O intensive workloads
- Maximum 5000 IOPS, 200 MB per second throughput per disk
- Only supported in "S" series VMS (DS, DSv2, GS, FS)
- Locally redundant storage only

Azure File Storage

- Mount Azure Storage as network share volumes
- Can be accessed via SMB 3.0 or REST APIs
- Up to 1000 IOPS, up to 60
 MB/second throughput per share
- Max share size = 5TB, Max file size = 1 TB.

Configuring virtual machine availability

Availability Set

Logical grouping of two or more virtual machines

Update domain

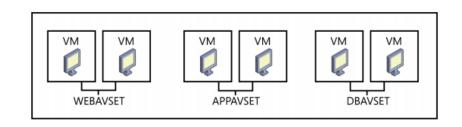
Separate Azure infrastructure grouped by update cycle

Fault domain

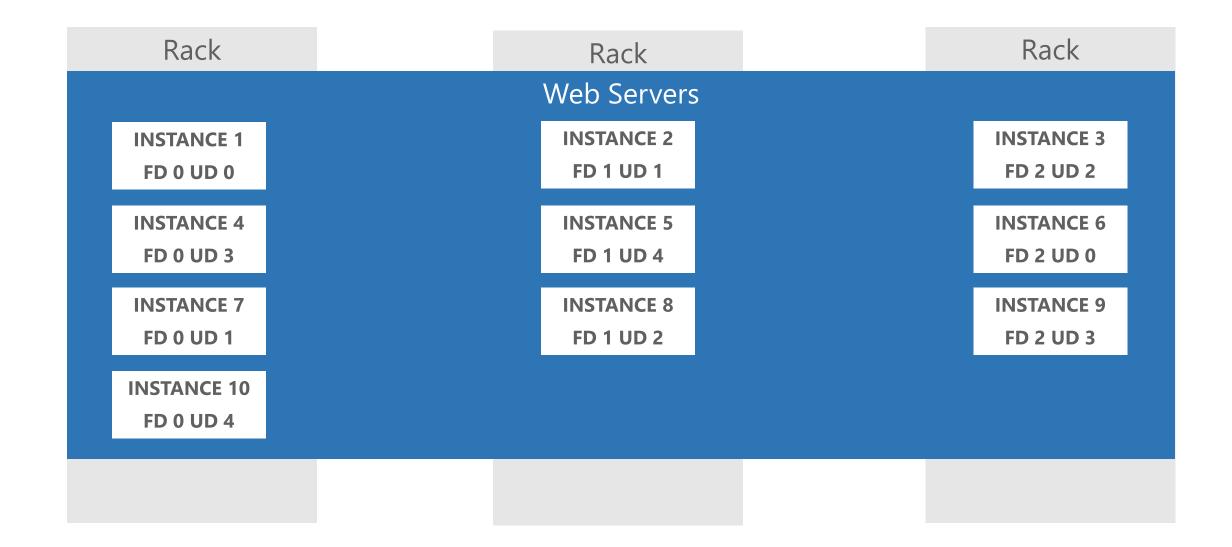
Separate Azure infrastructure grouped by hardware resources

Considerations

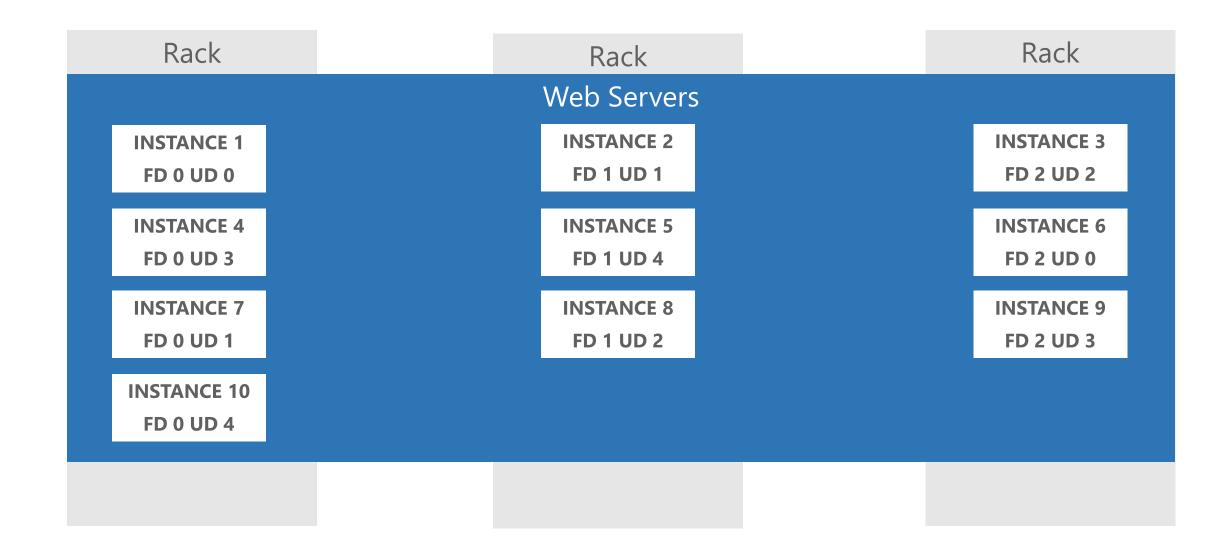
- Add multiple virtual machines to availability sets
- Place application tiers in separate availability sets
- Combine availability sets with load balancing
- Use multiple storage accounts for each availability set



Availability Sets



Availability Sets – Rack Failure



Availability Sets - Maintenance

Rack	Rack	Rack						
Web Servers								
INSTANCE 1	INSTANCE 2	INSTANCE 3						
FD 0 UD 0	FD 1 UD 1	FD 2 UD 2						
INSTANCE 4	INSTANCE 5	INSTANCE 6						
FD 0 UD 3	FD 1 UD 4	FD 2 UD 0						
INSTANCE 7	INSTANCE 8	INSTANCE 9						
FD 0 UD 1	FD 1 UD 2	FD 2 UD 3						
INSTANCE 10								
FD 0 UD 4								

Knowing Your 9's

Availability (%)	Description	Downtime (Minutes)		Practical Meaning	FAA Rating	
(70)		Annual	Quarterly	Monthly		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	131.15	4.38	Down 1 hour per year	
99.999	High Availability	5.26	1.31	.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

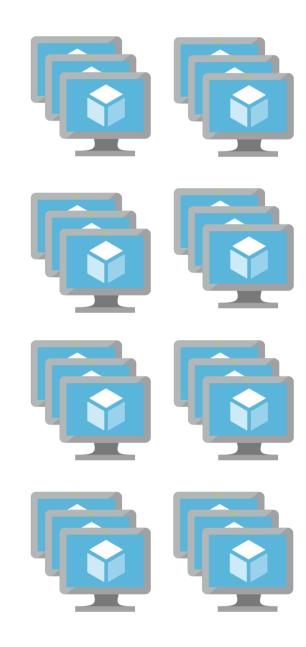
From Generic Requirements for Operation Systems Platform Reliability, Telcordia Technologies System Documentation, GR-2841-CORE and Federation Aviation Administration Handbook: Reliability, Maintainability, and Availability (RMA) Handbook, FAA-HDBK-006A, Jan 7, 2008.

Azure VM Service Level Agreement

- 99.95% for multiple role instances in an Availability Set
- What's Included
 - Computer hardware failure (disk, CPU, memory)
 - Data Center failures network, power
 - Hardware upgrades, software maintenance, Host OS Updates
- Not Included
 - VM Container crashes, Guest OS updates

VM Scale Sets

- Easily deploy a set of VMs based on the same image
- Implicitly balanced across Fault & Update Domains
- VM Scale sets are implicitly an Availability Set
- Manual or rule-based scaling for the Scale Set capacity
- Use a Load Balancer or Application Gateway to distribute requests across the available VM's in a Scale Set



Demo

- Provision a VM using Portal
- Provision a VM using PowerShell
- Provision a VM using ARM template (PowerShell)
- Network Security Group (Access Control List) & Reserved IP
- Availability and Scalability