CodeValue

Azure Cloud Camp February 2017

IaaS

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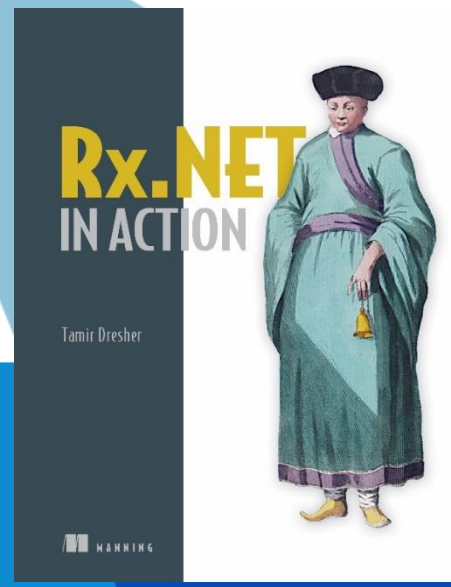
Senior Software Architect

OzCode Your Road to Magical Debugging



About Me

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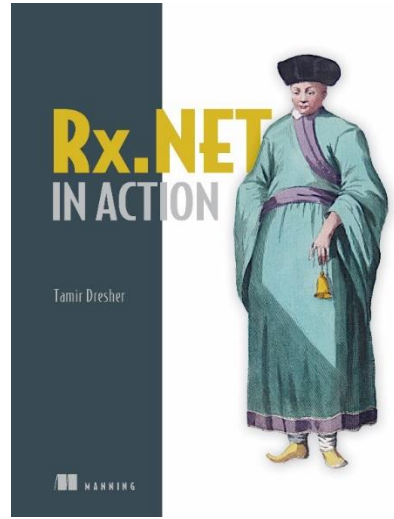
OzCode Your Road to Magical Debugging

- Author of *Rx.NET in Action* (manning publications)
- Software architect, consultant and instructor
- Software Engineering Lecturer @ Ruppin Academic Center
- Expert in large-scale, server-side, highly-concurrent systems
- Member of Microsoft Azure Advisors group



IaaS

- Infrastructure as a Service
- Infrastructure means
  - CPU
  - Memory
  - Networking
  - Storage (Disks)
- Azure provides IaaS with VMs

Azure 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

https://github.com/CodeValue/AzureCloudCampFeb2017

Provisioning VMs

Getting Started

Management Portal

Scripting
(Windows, Linux and Mac)

REST API

Select Image and VM Size

Windows Server

Linux

General Purpose
- Basic
- Standard

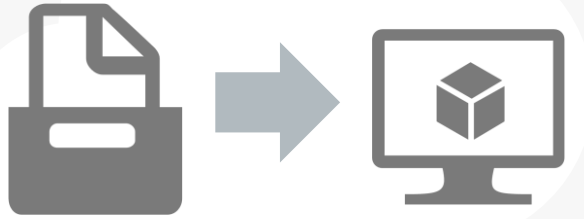
Optimized Compute

Performance Optimized

Network Optimized

New Disk Persisted in Storage

Boot VM from New Disk

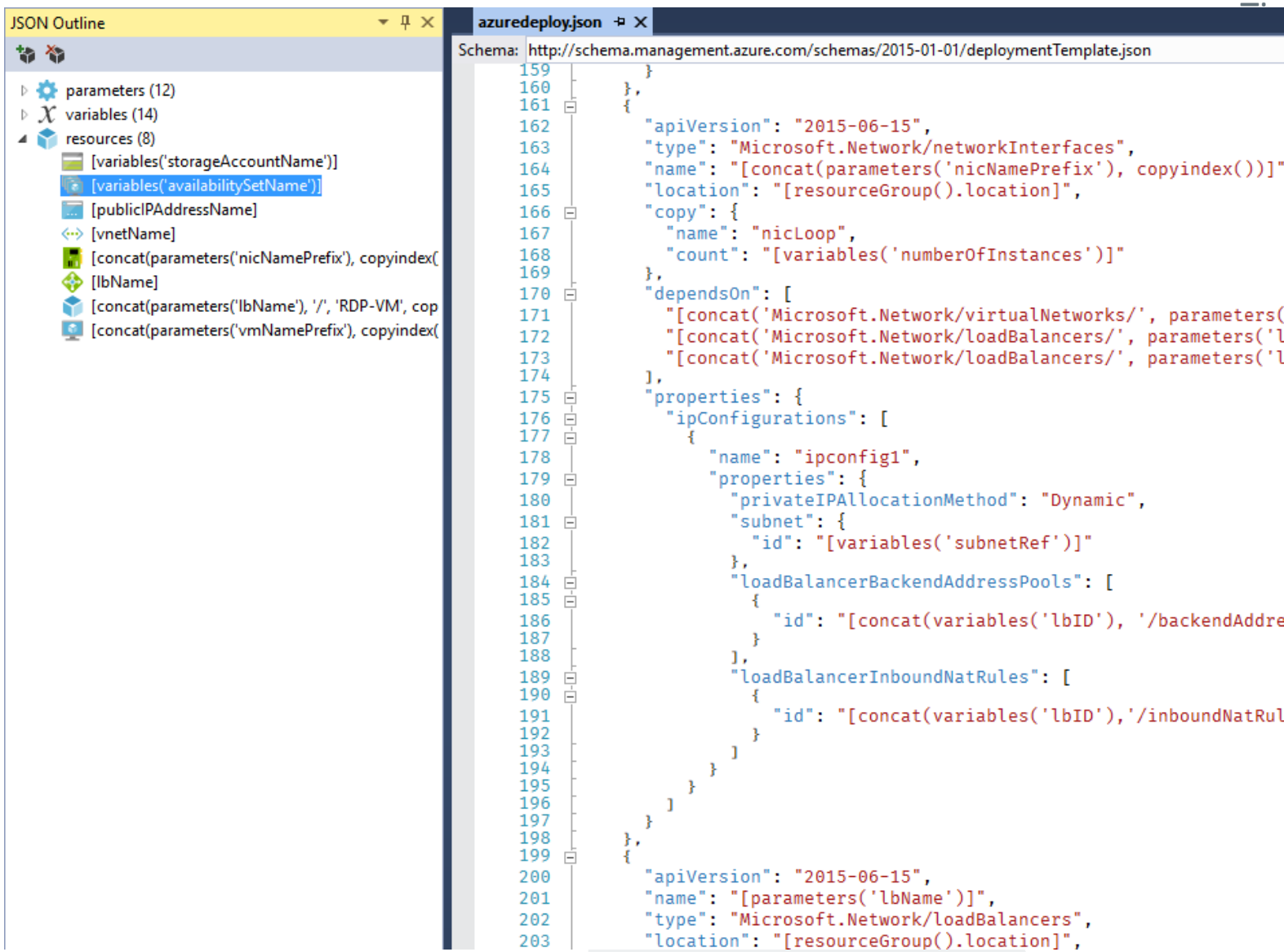


Cloud

https://github.com/CodeValue/AzureCloudCampFeb2017

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



```
"name": "MyUbuntuVM",
"type": "Microsoft.Compute/virtualMachines",
"apiVersion": "2015-06-15",
"location": “eastus",
"properties": {
 "hardwareProfile": {
  "vmSize": "Standard_D2_v2“
 },
 "osProfile": {
  "computerName": “AzureLabVM",
  "adminUsername": "azureuser",
  "adminPassword": "Azure4Research“
 },
 "storageProfile": {
  "imageReference": {
   "publisher": "Canonical",
   "offer": "UbuntuServer",
   "sku": "16.04-LTS",
   "version": "latest“
  },
  "osDisk": {
   "name": "osdisk",
   "vhd": {
    "uri": "https://vmlabstorage.blob.core.windows.net/vhds/myosdisk.vhd“
   },
   "caching": "ReadWrite",
   "createOption": "FromImage“
  }
 },
 "networkProfile": {
  "networkInterfaces": [
   {
    "id": "[resourceId('Microsoft.Network/networkInterfaces/myVMNic'))]“
   }
  ]
 }
```

ARM Template Format

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

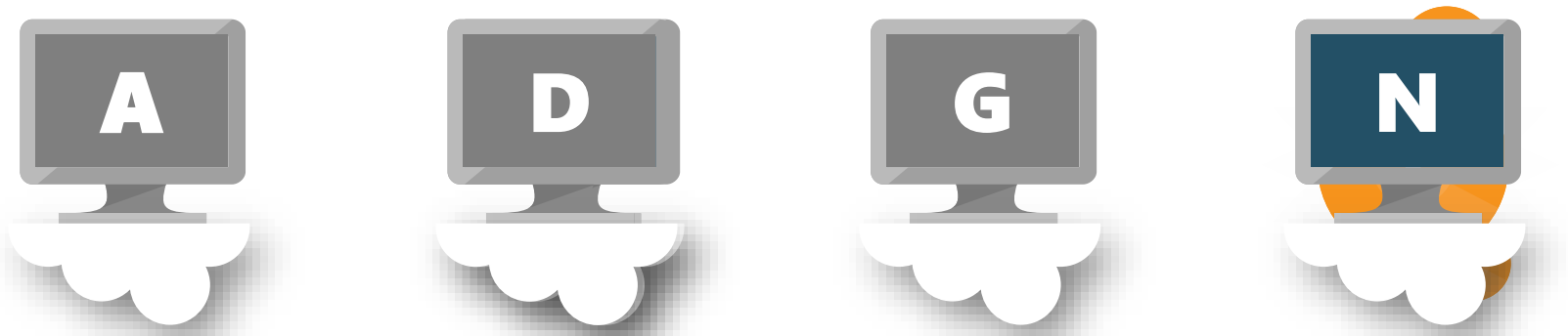
VM Gallery

- A collection of prebuilt images for various workloads

https://github.com/CodeValue/AzureCloudCampFeb2017

Scale Up Options

Highest value **Largest scale-up**



Highest value

New generation of D-family VMs

SSD storage

Faster CPUs

35% faster than D

Intel E5-2673 v3 CPUs

Most memory

fastest CPUs

GPU, enabled

Premium storage

NVIDIA GPUs

Remote visualization

Compute-intensive + RDMA

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

https://github.com/CodeValue/AzureCloudCampFeb2017

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		D11v2 – D15v2	NC6, NC12, NC24, NC24r	H8, H8m, H16, H16m, H16r, H16mr
D1 – D4		G1 – G5		
D1v2 – D5v2				

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

https://github.com/

Demo

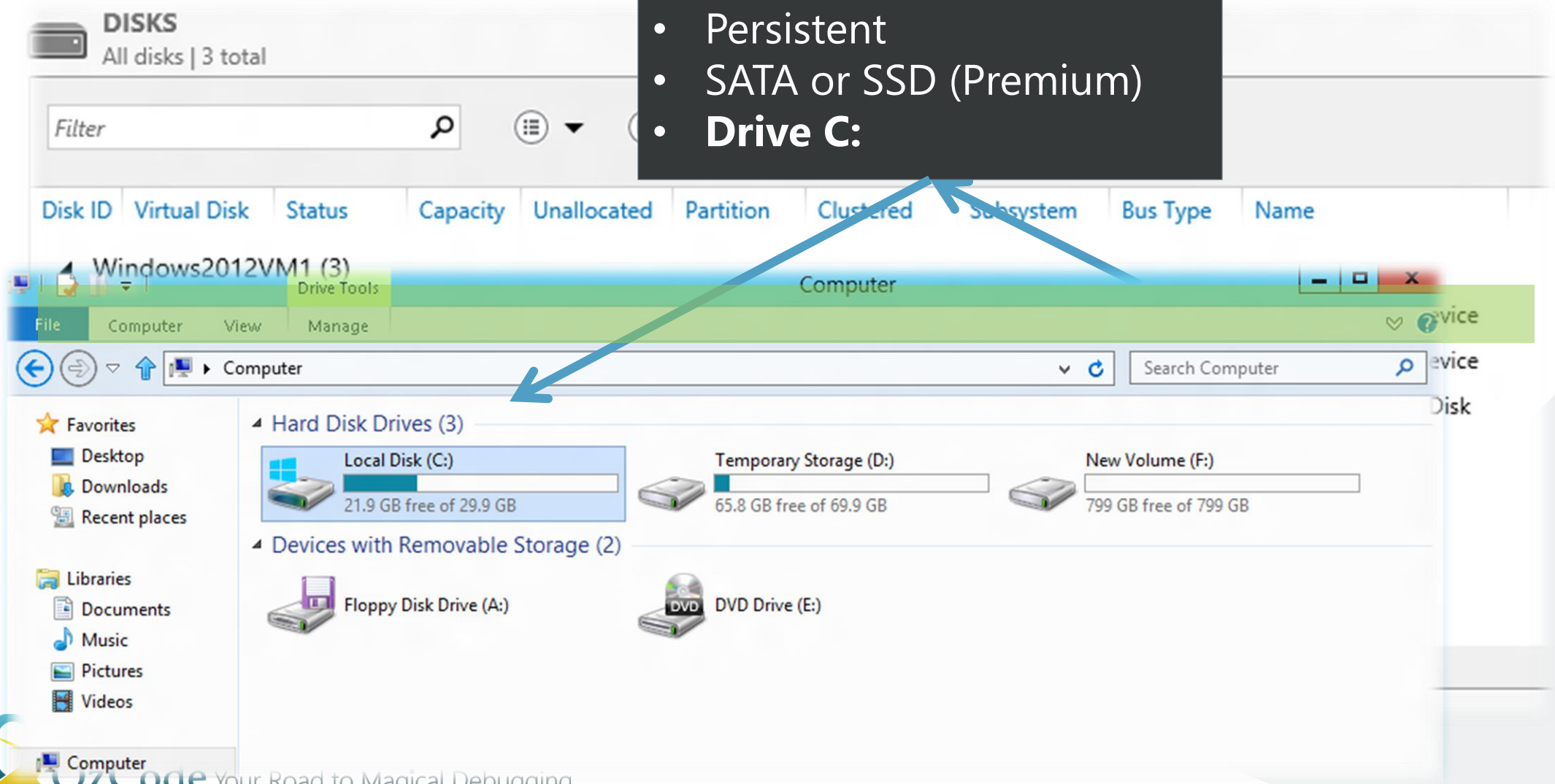
Creating a VM in the Portal

VM and Billing

- There is a direct relationship between the VM's status and billing:
  - **Running** The VM is on and running normally (billable).
  - **Stopped** The VM is stopped but still deployed to a physical host (billable)
  - **Stopped (Deallocated)** The VM is not deployed to a physical host (not billable).
- Stopping a VM
  - `Stop-AzureRmVM -Name "AMyVMName" -ResourceGroup “MyRmGroup" -StayProvisioned`

VM Disk Layout

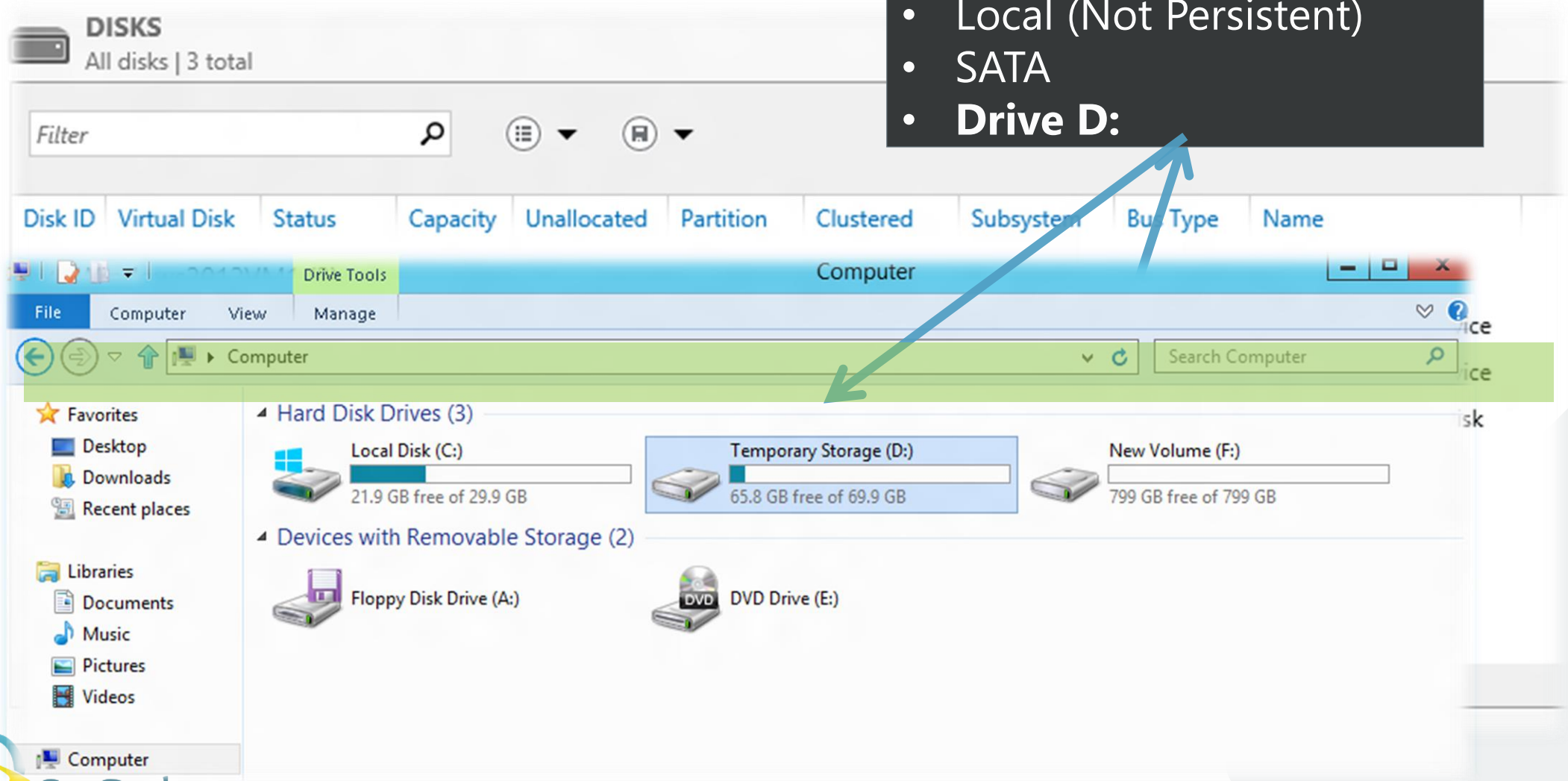
OS Disk
- Persistent
- SATA or SSD (Premium)
- **Drive C:**



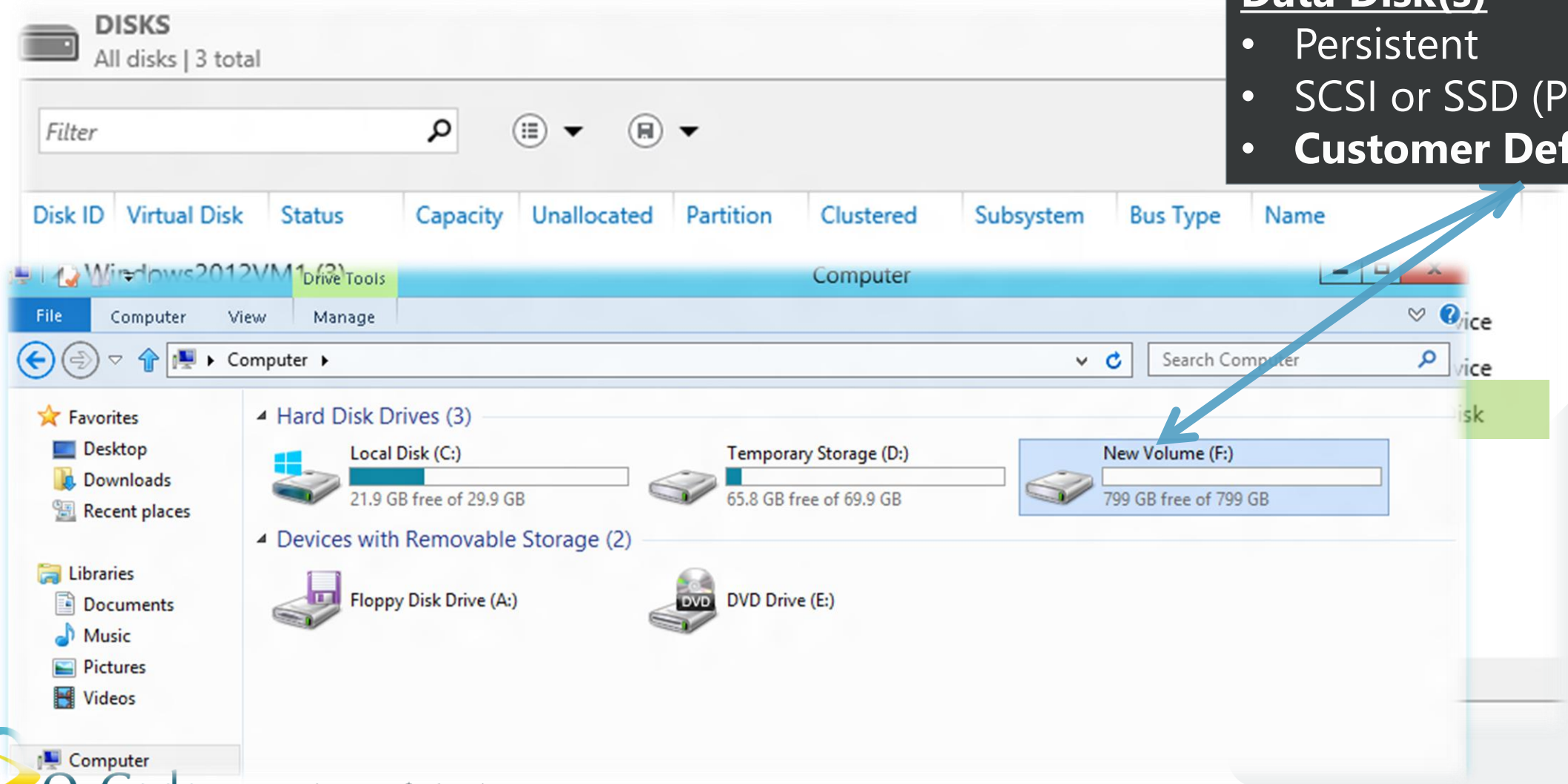
VM Disk Layout

Temporary Storage Disk

- Local (Not Persistent)
- SATA
- **Drive D:**



VM Disk Layout



Data Disk(s)

- Persistent
- SCSI or SSD (Premium)
- **Customer Defined Letter**

https://github.com/CodeValue/AzureCloudCampFeb2017

Azure Disks

- Backed by Page BLOBs
  - Stored in an Azure Storage account
- Mounted by a single VM at a time
  - Lease is taken on BLOB itself
- Can be backed by Standard or Premium storage
  - Standard – up to 500 8KB IOPS per disk (60 MB/s)
  - Premium – up to 5000 8KB IOPS per disk (200 MB/s)
- Max disk size (per disk) – 1 TB
- Pay for actual storage only
  - Not paying for capacity itself!
- Premium storage can only be attached to DS & GS machines

Azure Files

- Shared Network File Storage for Azure
  - File Share as a Service
- Can be mounted by multiple VMs concurrently
- Availability, durability, scalability are managed automatically
- Supports two interfaces: SMB and REST
  - Individual files stored in share are accessible via REST
- Max file share storage (per share) – 5 TB
- Max file size (within share) – 1 TB
- Scale limit – up to 1000 8KB IOPS (up to 60 MB/s per file share)

Temporary Drive Guidance

- Never Place Critical Unreplicated Data on Temp Drive!!
- Use for SQL TempDB and Buffer Pool Extension on D-Series and G-Series VM Sizes Only (SSD Temp Disks)
  - Detailed instructions: http://blogs.technet.com/b/dataplatforminsider/archive/2014/09/25/using-ssds-in-azure-vms-to-store-sql-server-tempdb-and-buffer-pool-extensions.aspx
- Use Scheduled Tasks to Configure Temporary Disk
- Test Scheduled Tasks via Resize VM Operation

Disk Caching

Disk Type	Default	Supported
OS Disk	ReadWrite	Read-only and ReadWrite
Data Disk	None	None, Read-only and ReadWrite

Modify using Set-AzureOSDisk or Set-AzureDataDisk

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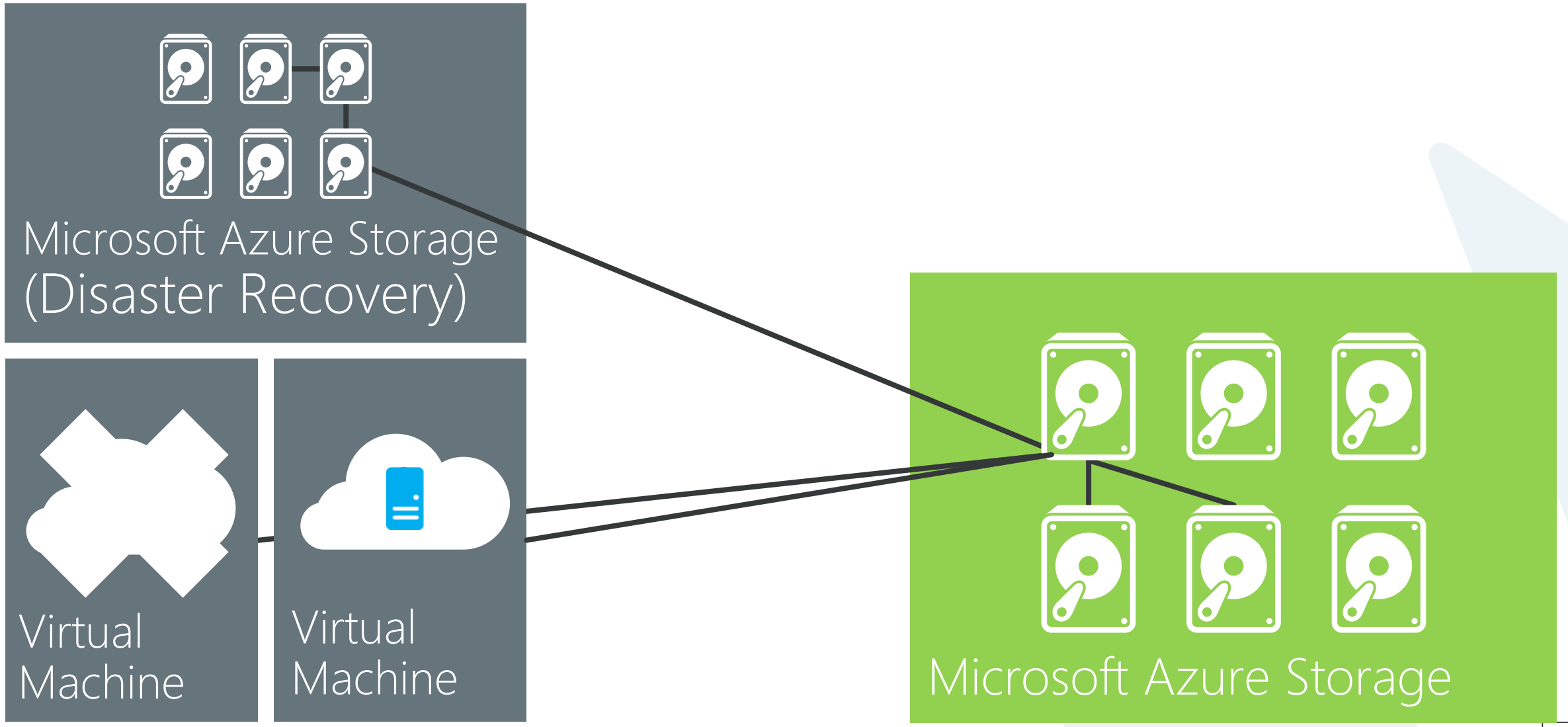
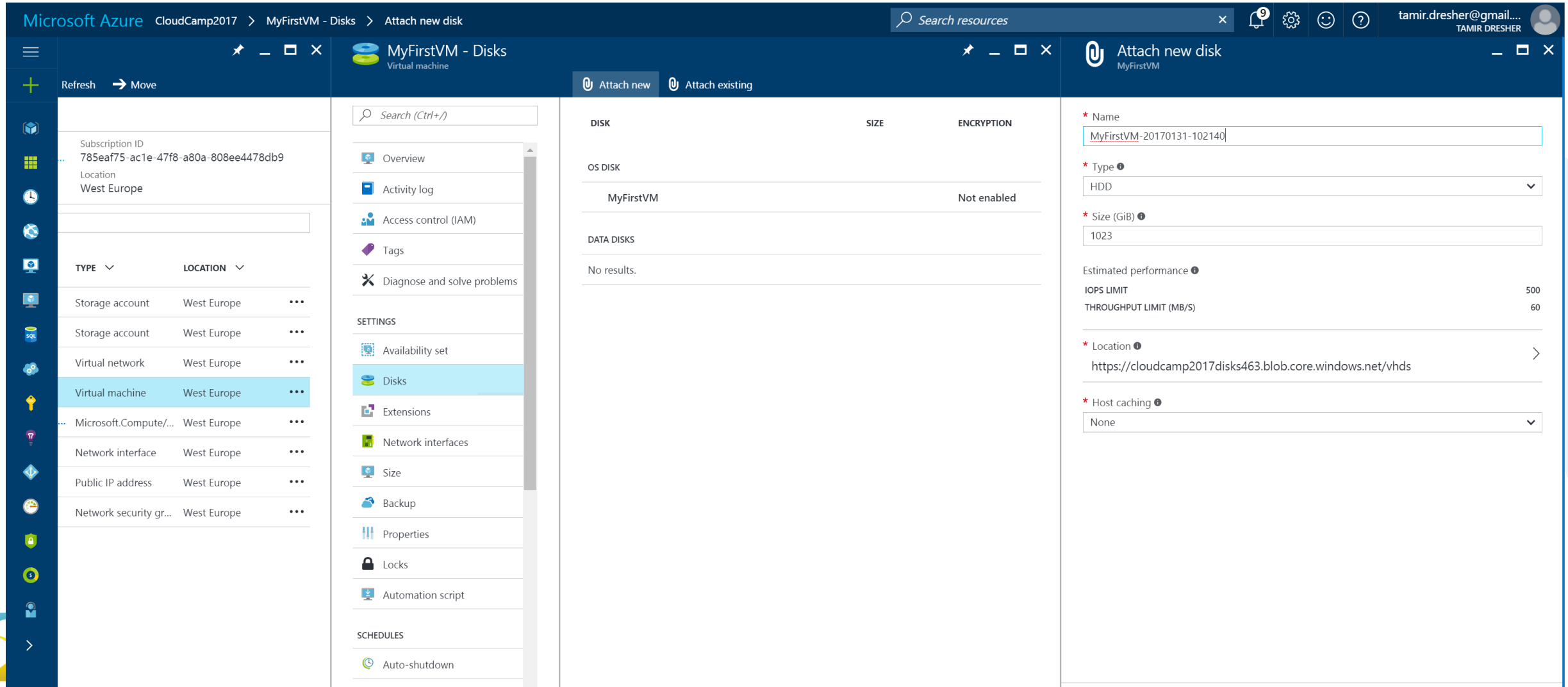
Persistent Disks and High Durability



https://github.com/CodeValue/AzureCloudCampFeb2017

Demo

Attach a disk



https://github.com/CodeValue/AzureCloudCampFeb2017

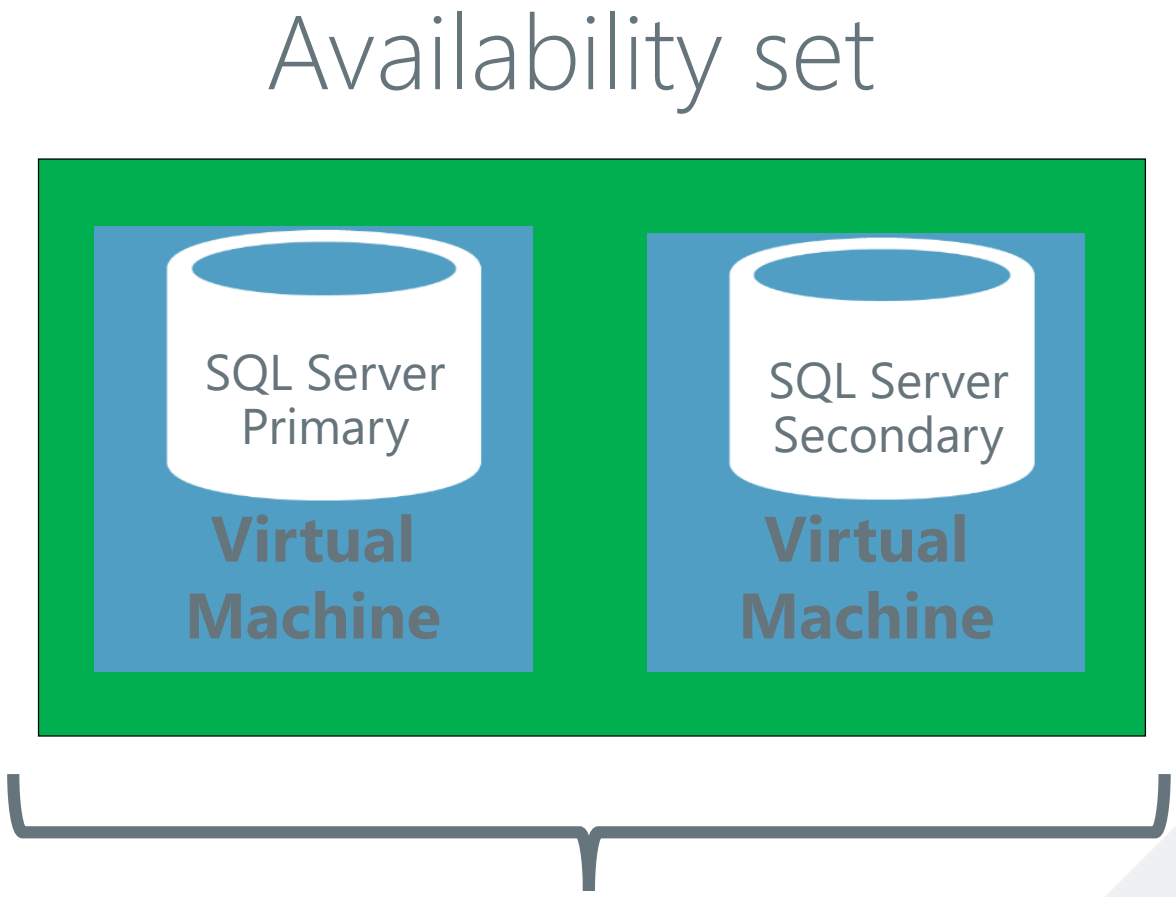
Demo

Creating a VM with Data Disks using PowerShell

SLA

- 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

Availability Sets



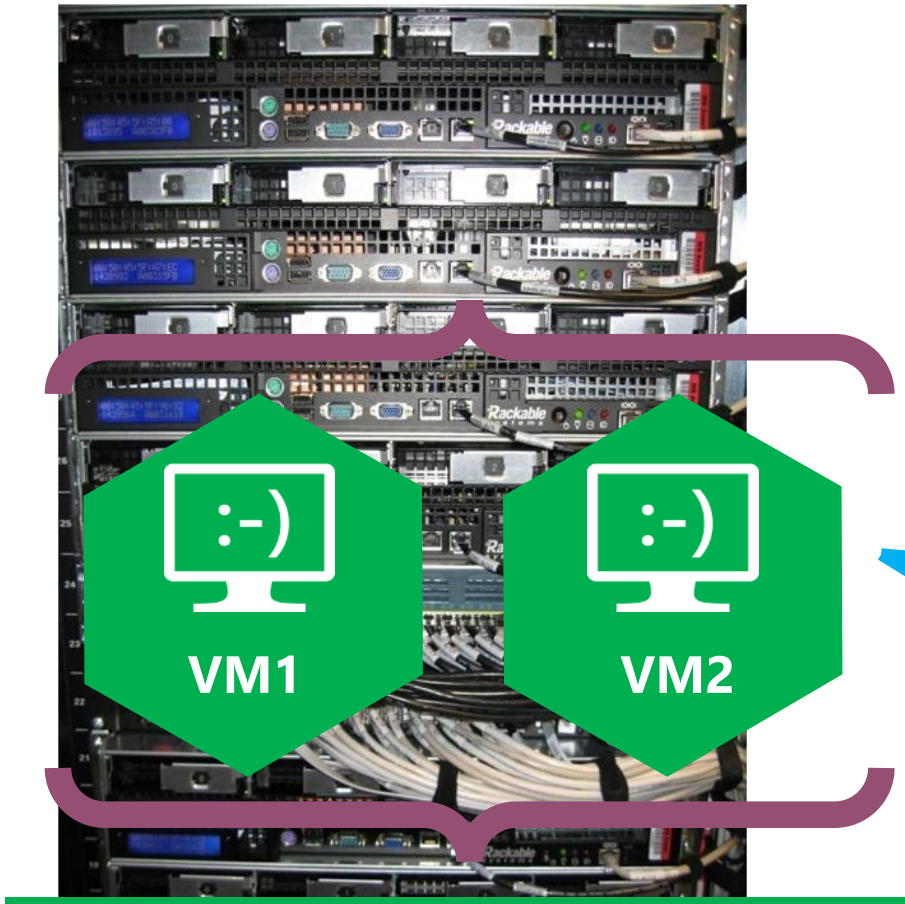
Availability Sets

Physical Machines

Power Unit
Rack Switch

https://github.com/CodeValue/AzureCloudCampFeb2017

Availability Sets



Availability Set

Physical Machines

Power Unit
Rack Switch

VM1

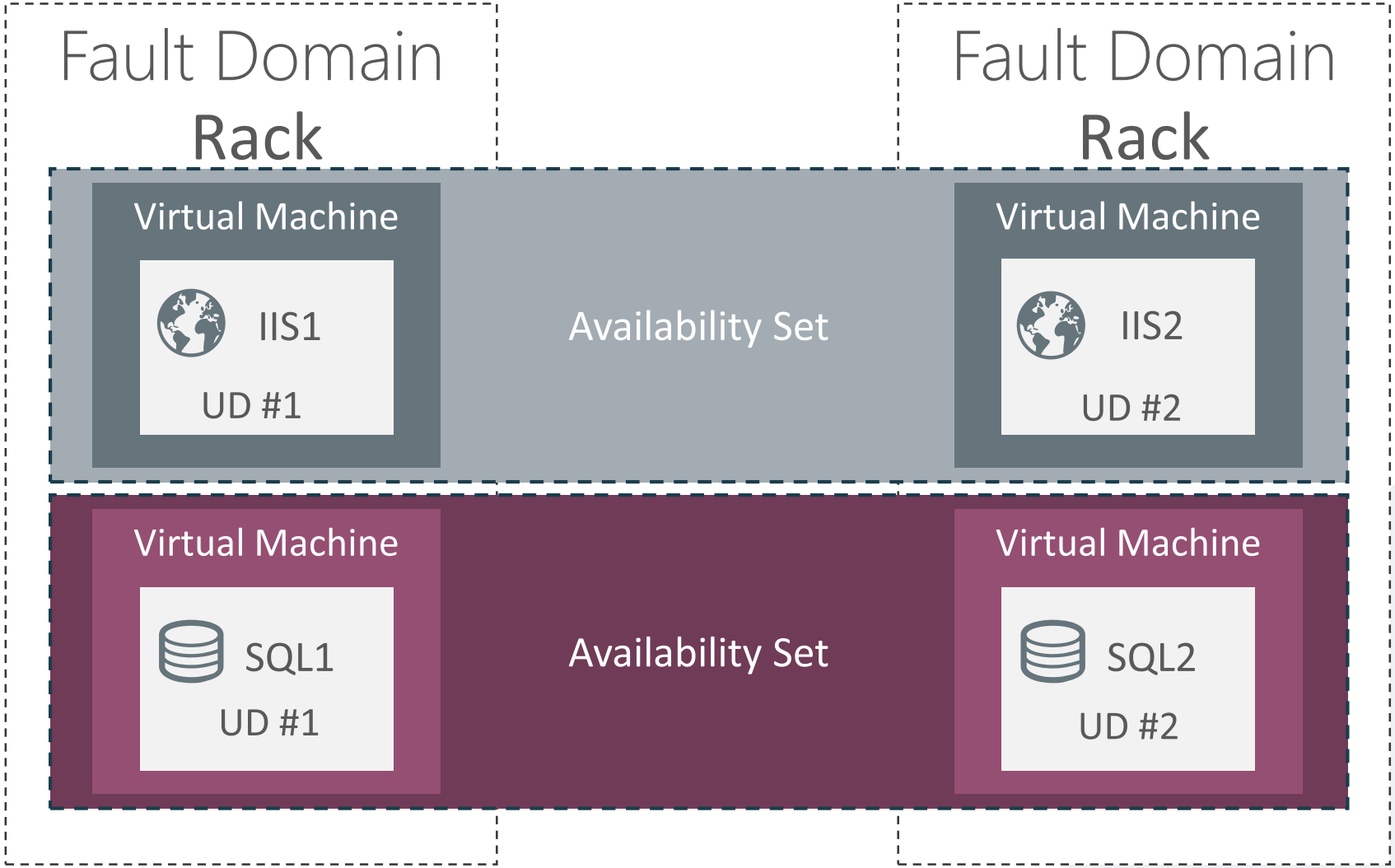
VM2

VM2

https://github.com/CodeValue/AzureCloudCampFeb2017

Virtual Machine Availability Sets

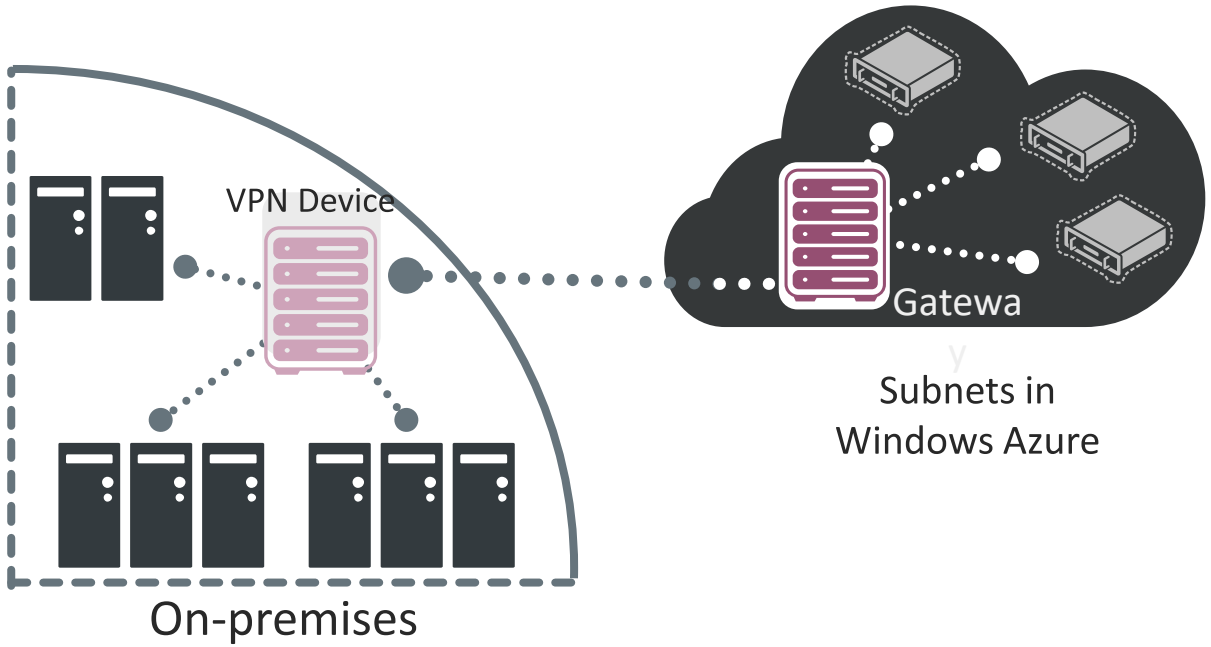
- **Update Domains are honored by host OS updates**



Virtual Networks & Connectivity

Azure Virtual Networks

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

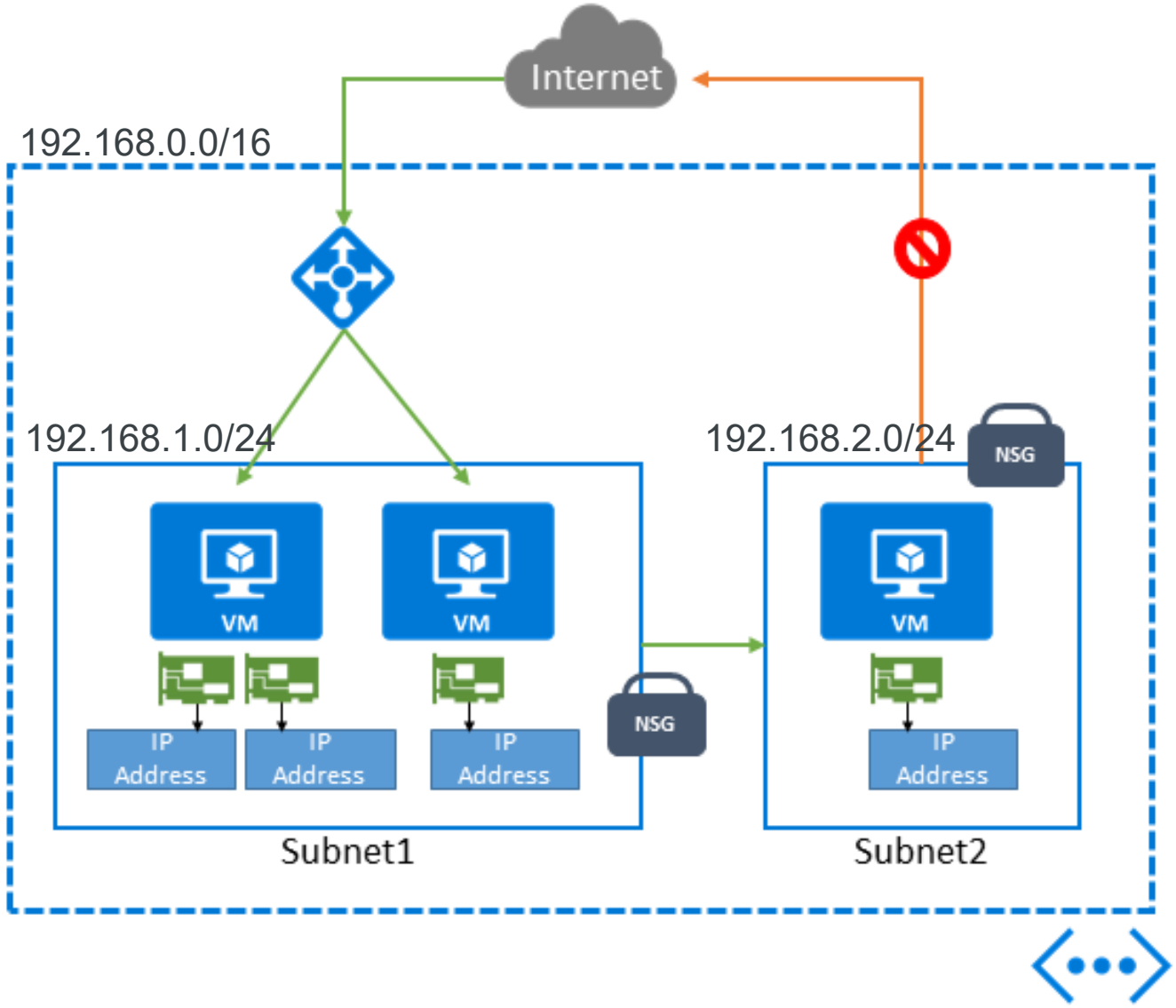


https://github.com/CodeValue/AzureCloudCampFeb2017

Azure Virtual Networks - Terminology

- **Subnet** a range of IP addresses within a virtual network. A VM must be placed in a subnet within the VNET.
- **IP address**
  - Public IP - can reached from the internet
  - Private IP - are non–Internet routable addresses used for communication with VMs and load balancers in the same VNET.
  - Dynamic - created only when the associated resource is started and released when stopped
  - Static - the IP address is assigned immediately and persists until deleted.
- **Load balancer** VMs are exposed to the Internet or other VMs in a VNET by using Azure load balancers. There are two types of load balancers:
  - **External load balancer** Used for exposing multiple VMs to the Internet in highly available manner.
  - **Internal load balancer** Used for exposing multiple VMs to other VMs in the same VNET in a highly available manner.
- **Network security group** A NSG allows you to create rules that control (approve or deny) inbound and outbound network traffic to network interface cards (NICs) of a VM or subnets.
- **NIC** Network Interface Card is the interconnection between a Virtual Machine (VM) and the underlying software network

Azure Virtual Network



https://github.com/CodeValue/AzureCloudCampFeb2017

Virtual Network Scenarios

- Hybrid Public/Private Cloud
  - Enterprise app in Microsoft Azure requiring connectivity to on-premise resources
- Enterprise Identity and Access Control
  - Manage identity and access control with on-premise resources (on-premises Active Directory)
- Monitoring and Management
  - Remote monitoring and trouble-shooting of resources running in Azure
- Advanced Connectivity Requirements
  - Cloud deployments requiring IP addresses and direct connectivity across services

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

Subnets

- Each Virtual Network can be segregated into multiple subnets with separate address ranges. E.g.:
  - 10.0.*.*
  - 10.1.*.*
  - Etc.
- Firewall rules for subnets can be configured via attached Network Security Groups

Network Interface Cards (NICs)

- NICs allow VMs to communicate with the world
- Each VM has at least one NIC attached
  - Can have more than one
- A single NIC is associated with a specific subnet
  - Receives a private IP address
  - Can be static or dynamic
- A single NIC can be associated with a public IP address
  - Not mandatory
  - A public IP is a separate entity
    - Can be static or dynamic
- Each NIC is associated with a Network Security Group

Network Security Groups

- Network Security Groups allow setting firewall rules
  - NICs
  - Subnets
- Specify inbound and outbound rules
- For each rule, specify:
  - Rule priority
  - Source and destination address ranges
  - Protocol (TCP/UDP)
  - Source and destination port ranges
- Can be used in combination with subnets to create constrained security environments
- A separate resource

https://github.com/CodeValue/AzureCloudCampFeb2017

Demo

Creating a Virtual Network using the Portal

VM Extensions

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
- https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-windows-extensions-features/

VM Scale Sets

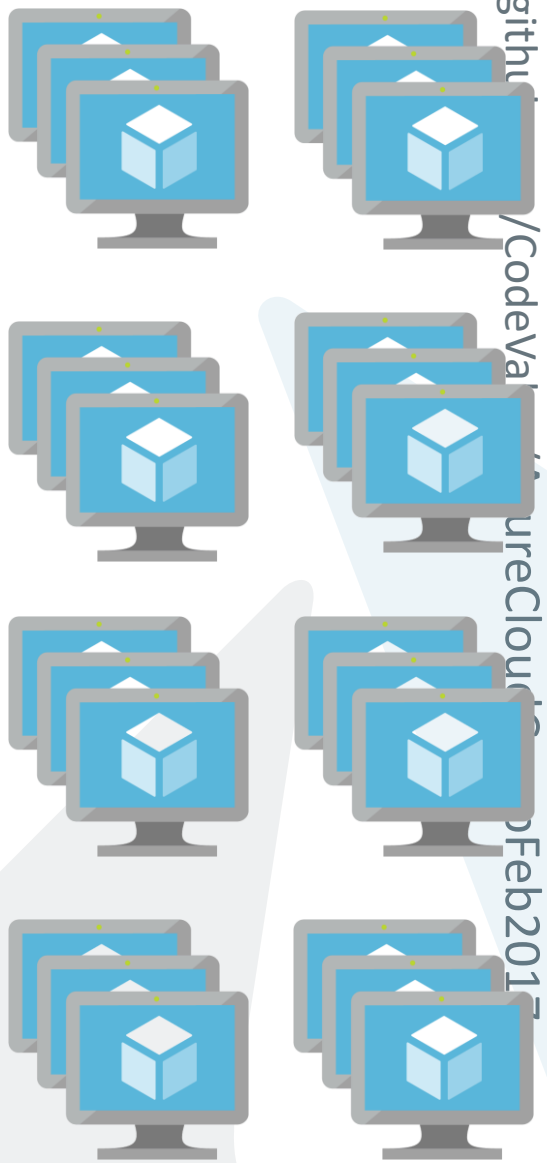
Cloud Scale Compute Patterns

- Pets: Named resources with unique characteristics
- Cattle: Numbered, inherently replaceable, interchangeable

"Future application architectures should use Cattle but Pets with strong configuration management are viable and still needed." – Gavin McCance (CERN)

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 (3 FD, 5 UD)
- 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



https://github.com/CodeValue/AzureCloudOpFeb2017

Summary

- Azure VMs can be provisioned on various tiers and sizes
- Data disks can be striped for extra performance
- Azure Files can be used for file share as a service
- Temporary disks are, well… temporary!
- NICs and Virtual Networks govern VM connectivity
- Network Security Groups can be used to configure network firewalls
- VM Scale Sets allow managing vast amount of VMs as one unit
  - Hyper scale computing
  - Foundation for PaaS services
  - Pets vs. Cattle

https://github.com/CodeValue/AzureCloudCampFeb2017

Thank You

https://github.com/CodeValue/AzureCloudCampFeb2017