

AZURE 104



Implement Infrastructure

Virtual Networking

3 Key Goals of Virtual Networks

1

Isolated Network in Azure

Your own private, secure network in the cloud. By default, it is isolated from other customer virtual networks.

2

Private Network Access for Resources

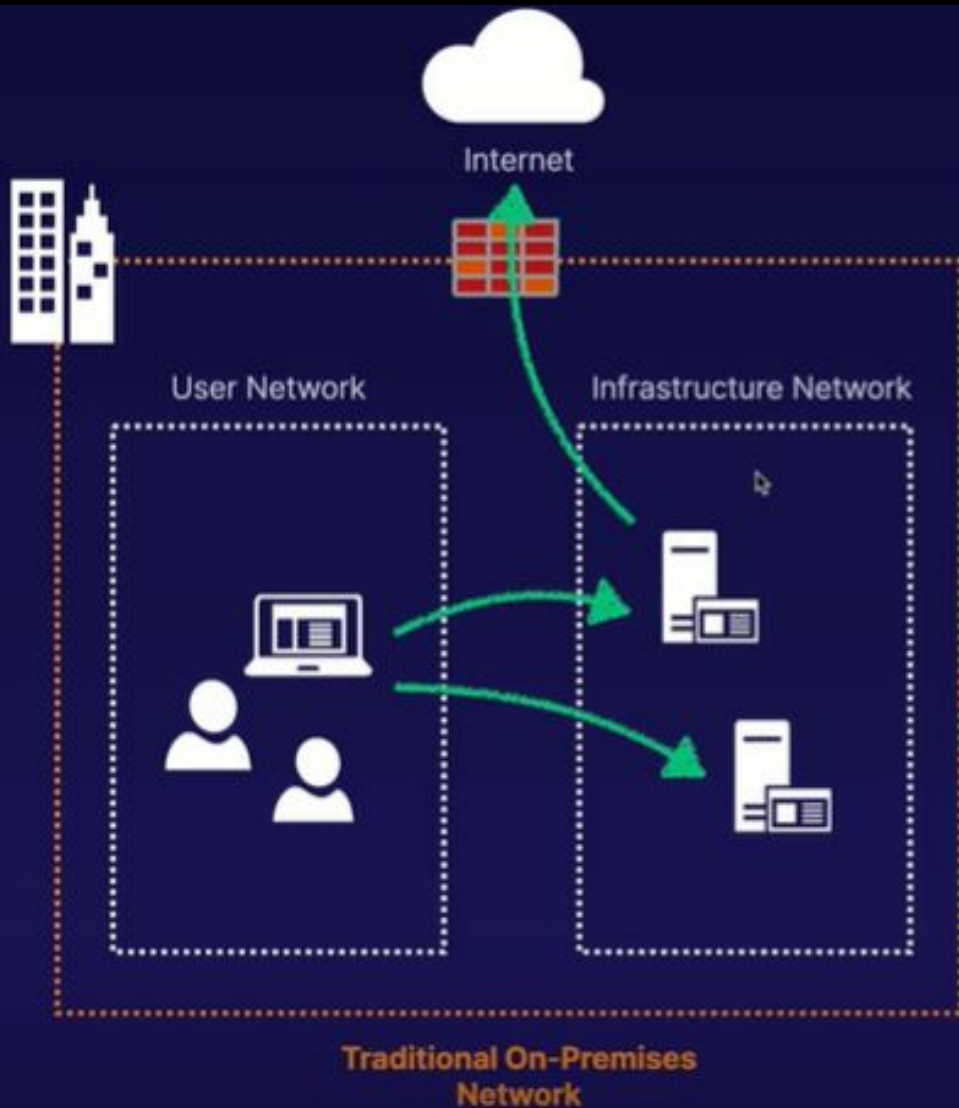
Several services can be deployed directly to a virtual network (e.g., virtual machines, specific database and app services, and more).

3

Network Integration

Virtual Networks support a range of integrated and hybrid connectivity with Azure services and remote networks.

The purpose of a Network



Communication: **Connectivity** **between resources.**

Networks are crucial; they help users access resources that exist somewhere other than their personal devices.

For example:

- Users in an office accessing files on a server
- Remote staff accessing a web server
- Application servers accessing data on the Internet

The purpose of a Network



Virtual Network (VNet)

The VNet is an isolated container within Azure, which provides network connectivity for resources.



Subnet

A virtual network has one or more subnets. Resources that require network connectivity must reside in a subnet.



Address Space

Virtual networks require one or more address spaces to provide private IP addresses to resources.



Virtual Networks in Azure

← → ↻ 🔒 https://portal.azure.com/#@cac408e9-f460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/virtualNetworks/vmdemo-rg-vnet/overview

Microsoft Azure Search resources, services, and docs (G+)

Home > Virtual networks > vmdemo-rg-vnet

Virtual networks

JAZ Lab

+ Add ⚙️ Manage view ⌵ ⋮

Filter by name...

Name ↑

- ↔️ vmdemo-rg-vnet ⋮
- ↔️ vnstdemo ⋮

Virtual network

Search (Cmd + /)

Refresh → Move Delete

Resource group (change) : vmdemo-rg

Location : Australia Southeast

Subscription (change) : JAZ Lab Production Subscription

Subscription ID : 2ed17b0d-359f-4220-be01-60080a67bb22

Tags (change) : Click here to add tags

Address space : 10.1.0.0/24

DNS servers : Azure provided DNS service

Settings

- ↔️ Address space
- ↗️ Connected devices
- ↔️ Subnets
- 🛡️ DDoS protection
- 🔥 Firewall
- 🛡️ Security
- 🌐 DNS servers

Connected devices

Search connected devices

Device	Type	IP Address	Subnet
vmdemo1870	Network interface	10.1.0.4	default

Virtual Networks in Azure

vmdemo-rg-vnet | Subnets - Microsoft Azure

https://portal.azure.com#@cac468e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/virtualNetworks/vmdemo-rg-vnet/subnets

Microsoft Azure

Home > Virtual networks > vmdemo-rg-vnet | Subnets

Virtual networks

IAZ Lab

+ Add Manage view

Filter by name...

Name ↑

- vmdemo-rg-vnet
- vnetdemo

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

- Address space
- Connected devices
- Subnets
- DDoS protection
- Firewall
- Security
- DNS servers

vmdemo-rg-vnet | Subnets

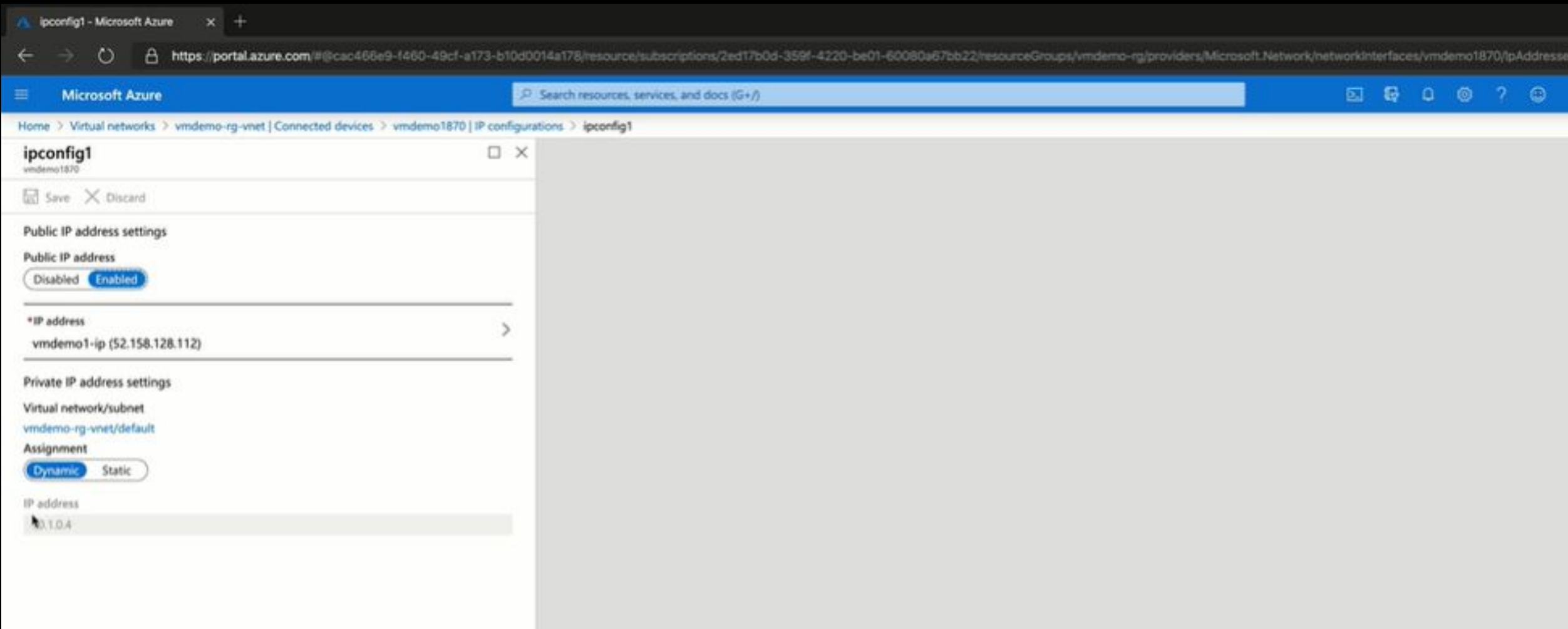
Virtual network

Search (Cmd+/) + Subnet + Gateway subnet Refresh

Search subnets

Name	Address range	IPv4 available addresses	Delegated to	Security
default	10.1.0.0/24	250	-	-

Virtual Networks in Azure | Subnets



Virtual Networks in Azure | ipconfig

1

Default Connectivity

After creating a virtual network, some connectivity is enabled by default (e.g., Internet access, inter-subnet access).

4

DNS and DHCP

Custom DNS can be configured for your VNet. DHCP is built-in, however, and custom DHCP cannot be deployed.

2

Address Range Restrictions

Private IP address ranges (as per RFC 1918) are allowed. The smallest allowed VNet/subnet is /29, and the largest is /8.

5

Supported Protocols

VNets support TCP, UDP, and ICMP TCP/IP protocols. Some common protocols such as multicast and GRE are blocked.

3

Reserved IP Addresses

5 IP addresses are reserved in each subnet. This includes the first three and last one (e.g. x.x.x.0-3, x.x.x.255).

6

Integrated Connectivity

VNets are also built for various forms of integration, including ExpressRoute, Private Link, VPN, and more.

Important Considerations

```
$rgName = "vnet1-rg"
$location = "Australia Southeast"

# Create a resource group
New-AzResourceGroup -Name $rgName -Location $location

# Create the virtual network
$vnet1 = New-AzVirtualNetwork -Name "vnet1" `
    -ResourceGroupName $rgName `
    -Location $location `
    -AddressPrefix "10.1.0.0/16"

# Create a subnet, and add it to the new virtual network
Add-AzVirtualNetworkSubnetConfig -Name "subnet1" `
    -AddressPrefix "10.1.1.0/24" `
    -VirtualNetwork $vnet1

Set-AzVirtualNetwork -VirtualNetwork $vnet1
```



Configuring Virtual Networks

Microsoft Azure portal interface showing the configuration of a resource group named **vnet1-rg**.

Resource groups overview:

- Subscription (change): JAZ Lab Production Subscription
- Subscription ID: 2ed17b0d-359f-4220-be01-60080a67bb22
- Tags (change): Click here to add tags
- Deployments: No deployments

Resource group details:

- Subscription (change): JAZ Lab Production Subscription
- Subscription ID: 2ed17b0d-359f-4220-be01-60080a67bb22
- Tags (change): Click here to add tags

Resource group settings:

- Subscription (change): JAZ Lab Production Subscription
- Subscription ID: 2ed17b0d-359f-4220-be01-60080a67bb22
- Tags (change): Click here to add tags

Resource group overview table:

Name	Type	Location
No resources to display		

The resources are currently filtered and not all resources may be displayed, such as hidden resources.

PowerShell commands and output:

```
PS /home/admin> $rgName = "vnet1-rg"
PS /home/admin> $rgName
vnet1-rg
PS /home/admin> $location = "Australia Southeast"
PS /home/admin>
PS /home/admin> New-AzResourceGroup -Name $rgName -Location $location

ResourceGroupName : vnet1-rg
Location           : australianseasouth
ProvisioningState  : Succeeded
Tags               :
ResourceId         : /subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vnet1-rg
```

Configuring Virtual Networks

Microsoft Azure portal interface showing the configuration of a Virtual Network (vnet1) within a Resource Group (vnet1-rg).

Resource groups overview:

- Subscription (change): JAZ Lab Production Subscription
- Subscription ID: 2ed17b0d-359f-4220-be01-60080a67bb22
- Tags (change): Click here to add tags
- Deployments: No deployments

Virtual Network (vnet1) details:

Name	Type	Location
vnet1	Virtual network	Australia Southeast

PowerShell commands and output:

```
PS /home/admin> $rgName = "vnet1-rg"
PS /home/admin> $rgName
vnet1-rg
PS /home/admin> $location = "Australia Southeast"
PS /home/admin> New-AzResourceGroup -Name $rgName -Location $location

ResourceGroupName : vnet1-rg
Location           : australiasoutheast
ProvisioningState  : Succeeded
Tags               :
ResourceId         : /subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vnet1-rg

PS /home/admin> $vnet1 = New-AzVirtualNetwork -Name "vnet1" -
```

Configuring Virtual Networks

← → ↺ <https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vnet1-rg/providers/Microsoft.Network/virtualNetworks/vnet1/subnets> Guest

Microsoft Azure Search resources, services, and docs (G+/f)

Home > Resource groups > vnet1-rg > vnet1 | Subnets

Export to CSV Assign tags Delete Export template Feedback

Deployments : No deployments

Add filter No grouping

vnet1 | Subnets Virtual network

Search (Cmd+J)

+ Subnet + Gateway subnet Refresh

Search subnets

Name	Address range	IPv4 available addresses
subnet1	10.1.1.0/24	251

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

Settings

- Address space
- Connected devices
- Subnets
- DDoS protection

PowerShell

```
},  
"IpConfigurations": [],  
"ServiceAssociationLinks": [],  
"ResourceNavigationLinks": [],  
"ServiceEndpoints": [],  
"ServiceEndpointPolicies": [],  
"PrivateEndpoints": [],  
"ProvisioningState": "Succeeded",  
"PrivateEndpointNetworkPolicies": "Enabled",  
"PrivateLinkServiceNetworkPolicies": "Enabled"  
}  
VirtualNetworkPeerings : []  
EnableDdosProtection : false
```

Configuring Virtual Networks



System Routes

Default routes configured by Azure to allow specific connectivity to work automatically.



Custom Routes

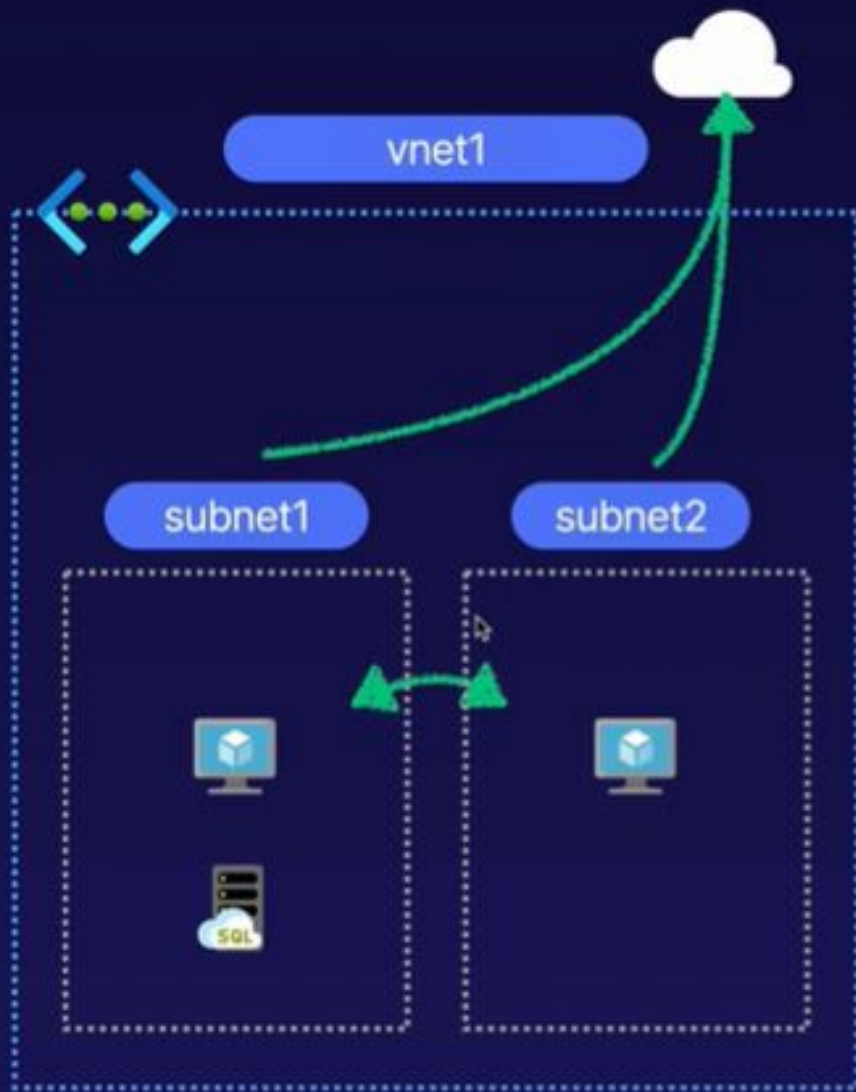
User-defined routes which allow custom paths of communication to be enforced or blocked.



Considerations

Important scenarios to consider with respect to virtual network routing.

Virtual Networks Routing And Connectivity



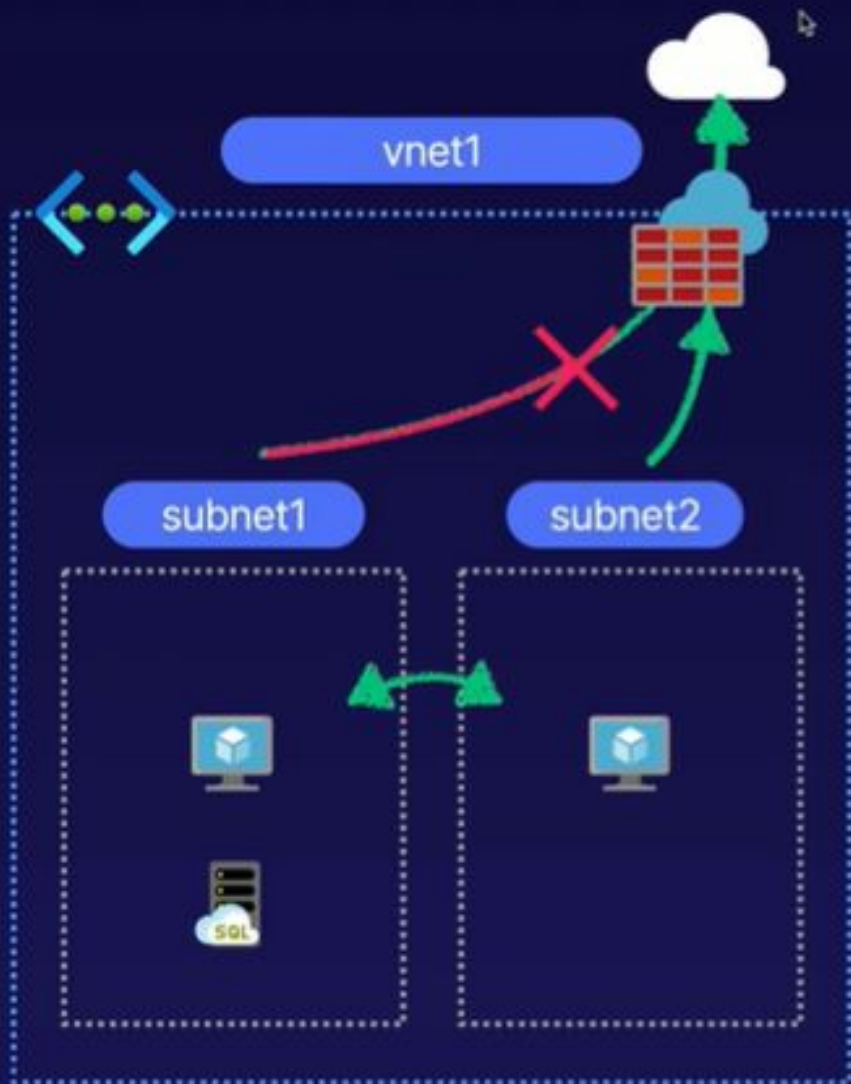
Default Connectivity

Virtual Networks come pre-configured with a range of “paths” already allowed.

The following routes are allowed:

- Outbound access to the Internet
- Subnet to subnet connectivity
- Other default routes to support advanced connectivity (e.g., peering)

Virtual Networks Routing And Connectivity



Custom Routes

Custom Routes allow us to change the default routing behavior.

For example:

- Blocking all access to the Internet
- Forcing traffic via another address (e.g., all traffic via a network virtual appliance, or Azure Firewall)

Virtual Networks Routing And Connectivity

vmdemo-rg-vnet | Diagram - M... x

https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/virtualNetworks/vmdemo-rg-vnet/diagram

Guest

Microsoft Azure

Search resources, services, and docs (G+I)

adm.jlee@jazlab1.onmic... JAZ LAB

Home > All resources > vmdemo-rg-vnet | Diagram

All resources JAZ Lab

+ Add Manage view

Filter by name...

Name ↑

- cs110032000aa046128
- vmdemo-rg-vnet
- vmdemo1
- vmdemo1-ip
- vmdemo1-nsg
- vmdemo1870
- vmdemo1_disk1_2092562cc55541c797e...
- vmdemorgdiag287
- vnet1
- vnetdemo

Access control (IAM)

- Tags
- Diagnose and solve problems

Settings

- Address space
- Connected devices
- Subnets
- DDoS protection
- Firewall
- Security
- DNS servers
- Peerings
- Service endpoints
- Private endpoints
- Properties
- Locks
- Export template

Monitoring

- Dagnostic settings
- Logs
- Connection monitor
- Diagram

vmdemo-rg-vnet | Diagram

Search (Cmd + /)

Download topology

Subscription JAZ Lab Production Subscription

Resource Group vmdemo-rg

Virtual Network vmdemo-rg-vnet

The diagram illustrates the network topology for the vmdemo-rg-vnet. At the top, the vmdemo-rg-vnet is connected to a default virtual network. This default network is then connected to a central virtual machine, vmdemo1870. From vmdemo1870, three separate connections lead to subnets: vmdemo1, vmdemo1-nsg, and vmdemo1-ip.

Virtual Networks Routing And Connectivity

vmdemo1870 | Effective routes

https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/networkInterfaces/vmdemo1870/effectiveRoutes

Microsoft Azure

Search resources, services, and docs (G+/f)

adm.jlee@jazlab1.onmic... JAZ LAB

Home > All resources > vmdemo-rg-vnet | Diagram > vmdemo1870 | Effective routes

vmdemo1870 | Effective routes

Network interface

Search (Cmd + /)

Download Refresh

Showing only top 200 records, click Download above to see all.

Scope: Network interface (vmdemo1870)

Associated route table: -

Effective routes

Source	State	Address Prefixes	Next Hop Type	Next Hop Type IP Address	User Defined Route Name
Default	Active	10.1.0.0/24	Virtual network	-	-
Default	Active	0.0.0.0/0	Internet	-	-
Default	Active	10.0.0.0/8	None	-	-
Default	Active	100.64.0.0/10	None	-	-
Default	Active	192.168.0.0/16	None	-	-

Default VNet connectivity (this VNet address range is 10.1.0.0/24)

Virtual Networks Routing And Connectivity

vmdemo1870 | Effective routes

https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/networkInterfaces/vmdemo1870/effectiveRoutes

Microsoft Azure

Home > All resources > vmdemo-rg-vnet | Diagram > vmdemo1870 | Effective routes

vmdemo1870 | Effective routes
Network interface

Search (Cmd+J)

Download Refresh

Showing only top 200 records, click Download above to see all.

Scope: Network interface (vmdemo1870)

Associated route table: -

Effective routes

Source	State	Address Prefixes	Next Hop Type	Next Hop Type IP Address	User Defined Route Name
Default	Active	10.1.0.0/24	Virtual network	-	-
Default	Active	0.0.0.0/0	Internet	-	-
Default	Active	10.0.0.0/8	None	-	-
Default	Active	100.64.0.0/10	None	-	-
Default	Active	192.168.0.0/16	None	-	-

Default Internet connectivity

Virtual Networks Routing And Connectivity

vmdemo1870 | Effective routes

Home > All resources > vmdemo-rg-vnet | Diagram > vmdemo1870 | Effective routes

vmdemo1870 | Effective routes

Network interface

Search (Cmd+J)

Download Refresh

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Scope: Network interface (vmdemo1870)

Associated route table: -

Effective routes

Source	State	Address Prefixes	Next Hop Type	Next Hop Type IP Address	User Defined Route Name
Default	Active	10.1.0.0/24	Virtual network	-	-
Default	Active	0.0.0.0/0	Internet	-	-
Default	Active	10.0.0.0/8	None	-	-
Default	Active	100.64.0.0/10	None	-	-
Default	Active	192.168.0.0/16	None	-	-

E.g. www.google.com (172.217.25.164) matches 0.0.0.0/0

Effective routes

vmdemo1870 | Effective routes

https://portal.azure.com#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/networkInterfaces/vmdemo1870/effectiveRoutes

Microsoft Azure

Search resources, services, and docs (G+/f)

adm.jlee@jazlab1.onmic

Home > All resources > vmdemo-rg-vnet | Diagram > vmdemo1870 | Effective routes

vmdemo1870 | Effective routes

Network interface

Search (Cmd+J)

Download Refresh

Showing only top 200 records, click Download above to see all.

Scope Network interface (vmdemo1870)

Associated route table: -

Effective routes

Source	State	Address Prefixes	Next Hop Type	Next Hop Type IP Address	User Defined Route Name
Default	Active	10.1.0.0/24	Virtual network	-	-
Default	Active	0.0.0.0/0	Internet	-	-
Default	Active	10.0.0.0/8	None	-	-
Default	Active	100.64.0.0/10	None	-	-
Default	Active	192.168.0.0/16	None	-	-

E.g. Google DNS (8.8.8.8) matches 0.0.0.0/0

Effective routes

block-internet-route - Microsoft

https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourcegroups/vnetdemo-rg/providers/Microsoft.Network/routeTables/block-internet-route/overview

Guest

Microsoft Azure

Search resources, services, and docs (G+J)

adm.jee@jazlab1.onmic... JAZ LAB

Home > block-internet-route

block-internet-route
Route table

Search (Cmd+J)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Configuration

Routes

Subnets

Properties

Locks

Export template

Support + troubleshooting

Effective routes

New support request

Move Delete Refresh

Resource group (change) : vnetdemo-rg

Location : Australia Southeast

Subscription (change) : JAZ Lab Production Subscription

Subscription ID : 2ed17b0d-359f-4220-be01-60080a67bb22

Tags (change) : Click here to add tags

Associations : 0 subnet associations

Routes

Search routes

Name	Address prefix	Next hop
No results.		

Subnets

Search subnets

Name	Address range	Virtual network	Security group
No results.			

Create a custom route table

Add route - Microsoft Azure

https://portal.azure.com/#@cac466e9-f460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceg

Microsoft Azure

Search resources, services, and docs (G+)

Home > block-internet-route | Routes > Add route

Add route

block-internet-route

Route name *

block-internet ✓

Address prefix * ⓘ

0.0.0.0/0 ✓

Next hop type ⓘ

None ▼

Next hop address ⓘ

Create a new route

Associate subnet - Microsoft Azure

https://portal.azure.com/#@cac466e9-f460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourcegroups/vnetdemo-rg/providers/Microsoft.Network/routeTables/block-internet-route/subnets

Microsoft Azure

Search resources, services, and docs (G+J)

adm.jlee@jazlab1.onmic... JAZ LAB

Home > block-internet-route | Subnets

block-internet-route | Subnets

Route table

Search (Cmd+J)

+ Associate

Search subnets

Name ↑↓	Address range ↑↓	Virtual network ↑↓
No results.		

Overview

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Diagnose and solve problems

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Subnets

Properties

Locks

Export template

Support + troubleshooting

Effective routes

New support request

Associate subnet

block-internet-route

*** Saving route table for subnet
Saving route table for subnet 'default'...

8:47 AM

Virtual network

vmdemo-rg-vnet

Subnet

default

Associate subnet to the new route

Add route - Microsoft Azure

https://portal.azure.com/#@cac466e9-f460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4...

Microsoft Azure

Search resources, services, and docs (G+ /)

Home > block-internet-route | Routes > Add route

Add route

block-internet-route

Route name *

via-firewall ✓

Address prefix * ⓘ

8.8.8.8/32 ✓

Next hop type ⓘ

Virtual appliance ✓

Next hop address * ⓘ

10.1.0.250 ✓

ⓘ Ensure you have IP forwarding enabled on your virtual appliance. You can enable this by navigating to the respective network interface's IP address settings.

Adding a new route to a virtual appliance

block-internet-route | Routes - x +

← → ↻ 🔒 https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourcegroups/vnetdemo-rg/providers/Microsoft.Network/routeTables/block-internet-route/routes Guest 92

Microsoft Azure Search resources, services, and docs (G+)

Home > block-internet-route | Routes

black-internet-route | Routes
Route table

Search (Cmd + /) + Add

Overview
Activity log
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Diagnose and solve problems

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Routes
Subnets
Properties
Locks
Export template

Search routes

Name	Address prefix	Next hop
block-internet	0.0.0.0/0	None
via-firewall	8.8.8.8/32	10.1.0.250

*** Adding route
Adding route 'via-firewall' to route table 'block-internet-route'... 8:51 AM

Adding a new route to a virtual appliance

vmdemo1870 | Effective routes

https://portal.azure.com/#@cac466e9-1460-49cf-a173-b10d0014a178/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vmdemo-rg/providers/Microsoft.Network/networkInterfaces/vmdemo1870/effectiveRo

Microsoft Azure

Home > Virtual machines > vmdemo1 > Networking > vmdemo1870 | Effective routes

vmdemo1870 | Effective routes
Network interface

Search (Cmd + /)

Download Refresh

Showing only top 200 records, click Download above to see all.

Scope: Network interface (vmdemo1870)

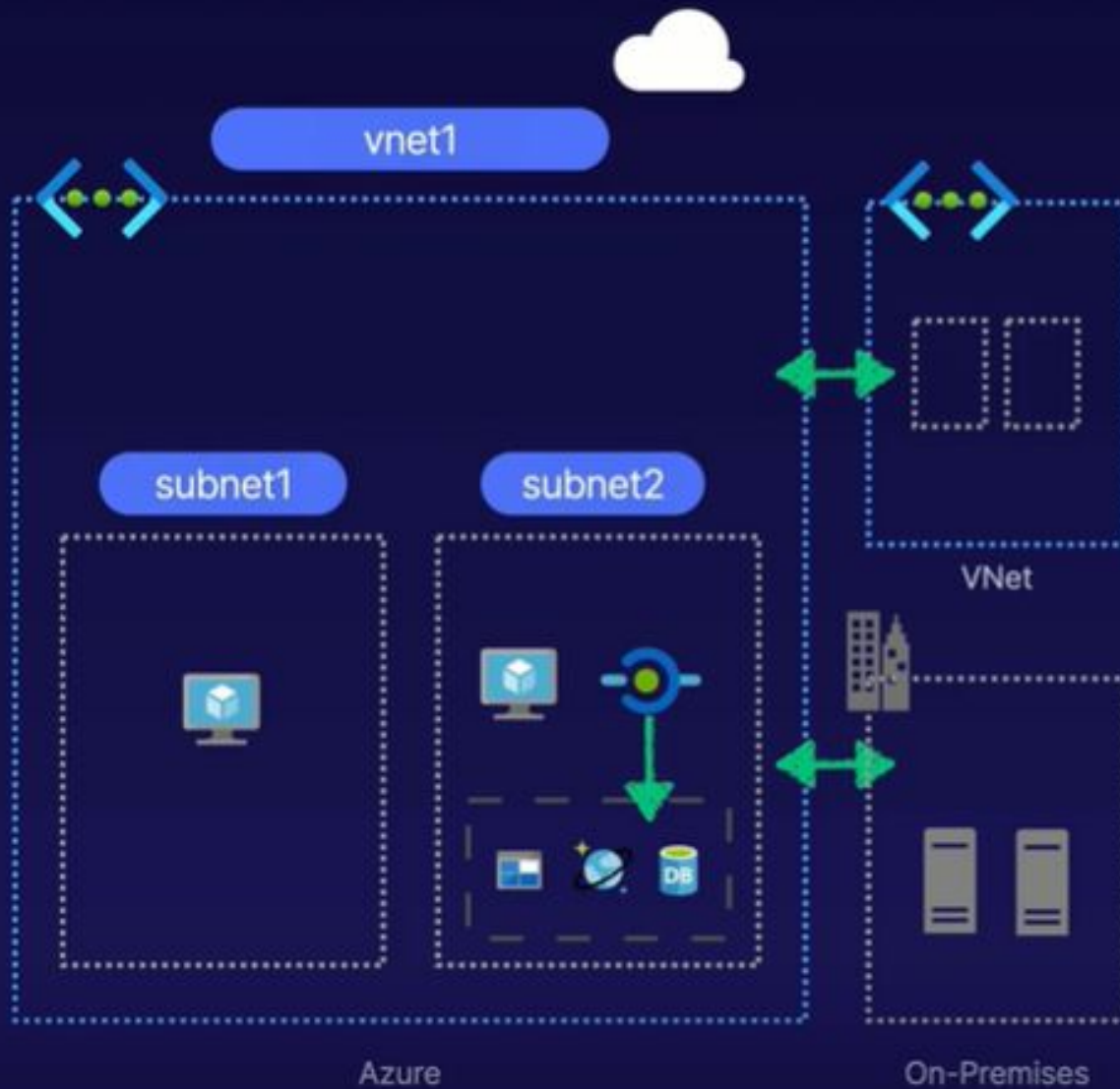
Associated route table: block-internet-route

Effective routes

Source	State	Address Prefixes	Next Hop Type	Next Hop Type IP Address	User Defined Route Name
Default	Active	10.1.0.0/24	Virtual network	-	-
Default	Invalid	0.0.0.0/0	Internet	-	-
Default	Active	10.0.0.0/8	None	-	-
Default	Active	100.64.0.0/10	None	-	-
Default	Active	192.168.0.0/16	None	-	-
User	Active	0.0.0.0/0	None	-	block-internet
User	Active	8.8.8.8/32	None	10.1.0.250	via-firewall

Updated effective routes in my VM

E.g: a 10.0.0.0/32 will match more closely than 10.0.0.0/24



Special Circumstances

It is important to understand that there are scenarios where Azure may automatically introduce new routes.

For example:

- Additional **system routes**, such as:
 - With VNet Peering.
 - With Service Endpoints.
- Through BGP (e.g., with ExpressRoute)

Route Priority:

When there are multiple routes, the following order is used:

Custom > BGP > System.

Important considerations

Virtual Machines

Purpose of Virtual Machines

1

Windows and Linux Compute

Deploy virtualized Windows or Linux virtual machines.

2

Migrate Existing Workloads

Migrate existing compute workloads to Azure, where other services are not yet viable.

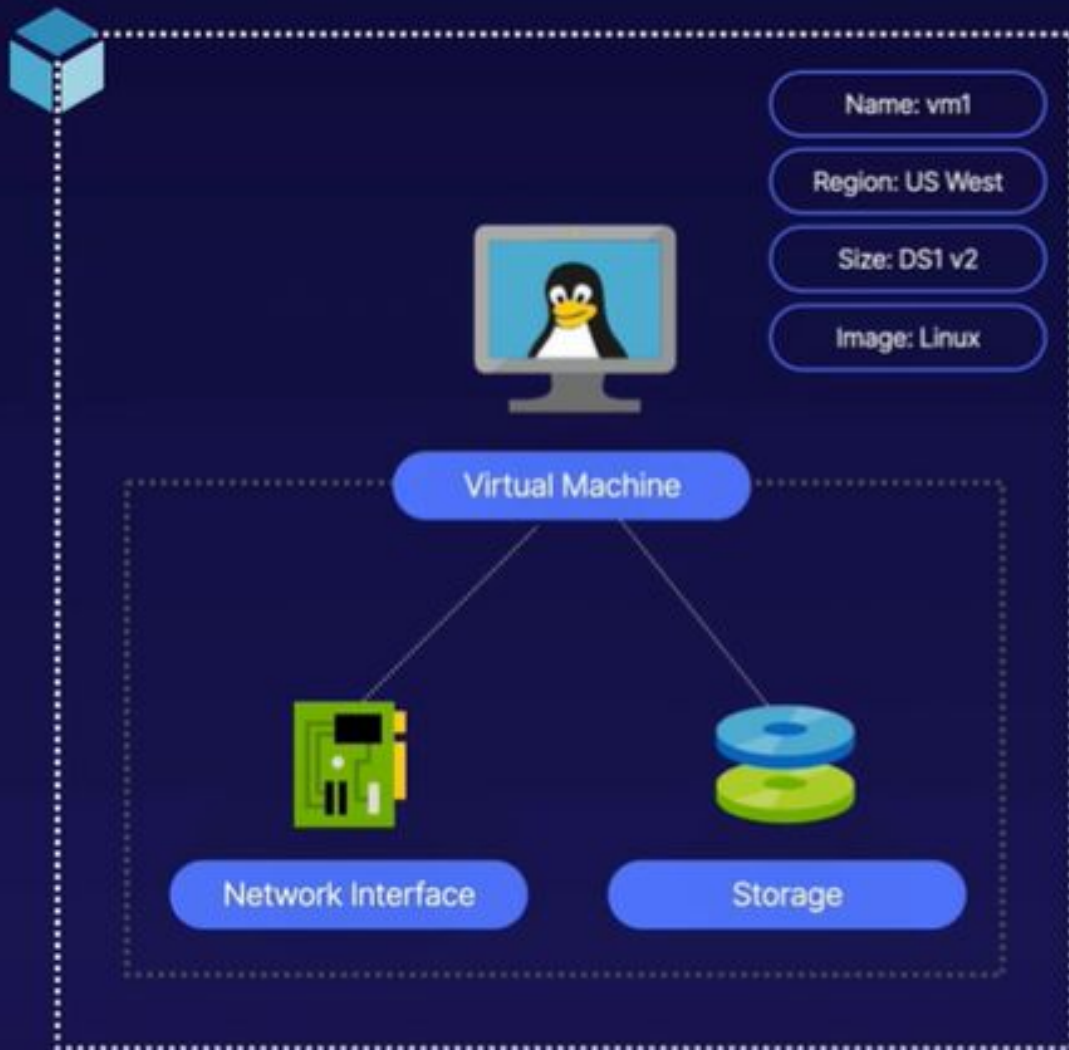
3

Deploy Advanced Compute Solutions

Virtual Machines provide a foundation for advanced solutions such as high performance compute, decoupled, and scalable applications.



Purpose of Virtual Machines



Key Components

A virtual machine has a number of important properties and related resources.

Virtual Machine Properties:

- Belongs to a resource group
- Created in a specific location
- Is configured with a given size
- Built from an image (operating system)

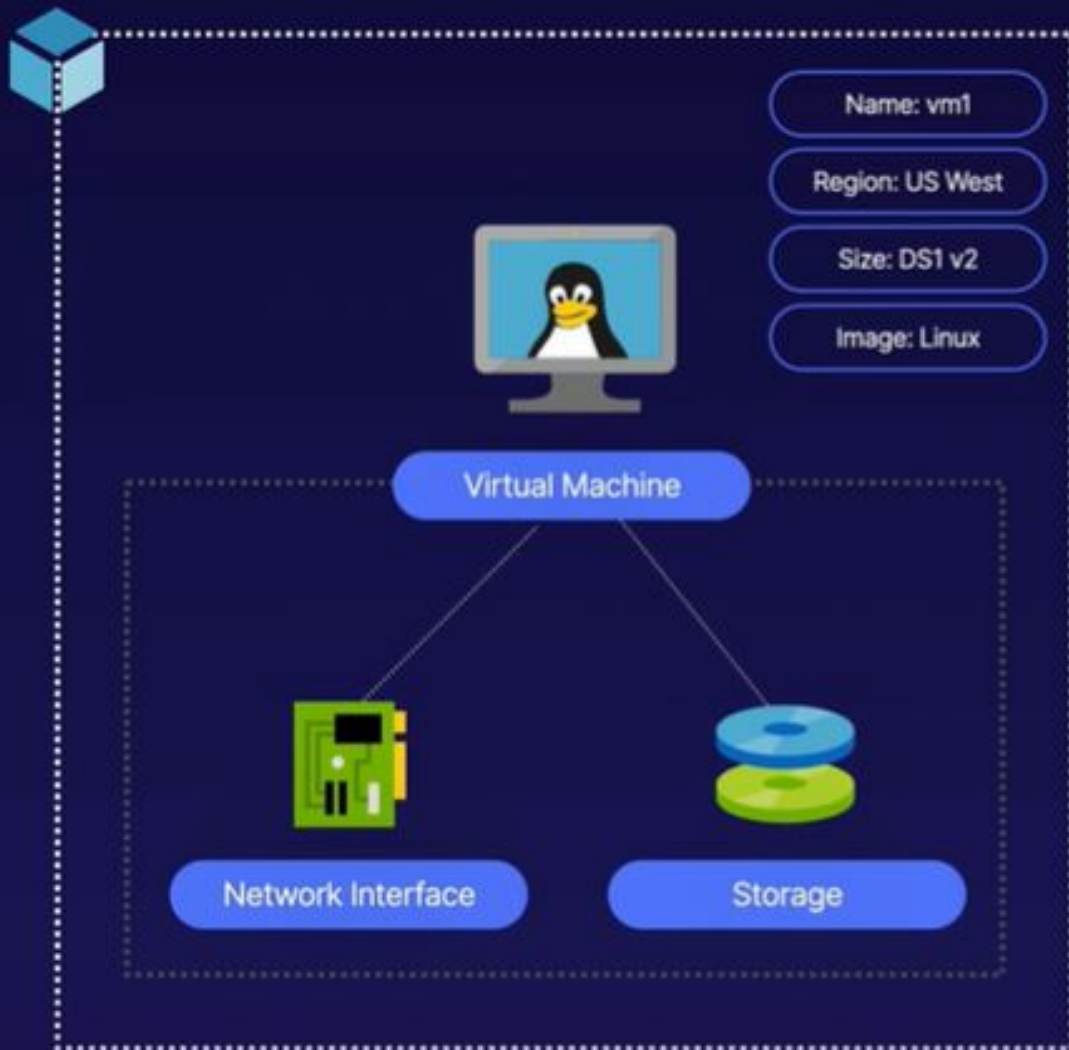
Related Resources:

- Network Interface(s)
- Storage (disks)

Advanced Deployments:

We will cover in more detail in upcoming lessons, for example: automated deployments, VM Scale Sets, etc.

Creating a Virtual Machine



Key Components

A virtual machine has a number of important properties and related resources.

Virtual Machine Properties:

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- Is configured with a given size
- Built from an image (operating system)

Related Resources:

- Network Interface(s)
- Storage (disks)

Advanced Deployments:

We will cover in more detail in upcoming lessons, for example: automated deployments, VM Scale Sets, etc.

Creating a Virtual Machine

Microsoft Azure

Search resources, services, and docs (G+ /)

Home > New > Create a virtual machine

Create a virtual machine

Virtual machine name *

vm01

Region *

(Asia Pacific) Australia Southeast

Availability options

No infrastructure redundancy required

Image *

Windows Server 2019 Datacenter

[Browse all public and private images](#)

Azure Spot instance

☐ Yes ☒ No

Size *

Standard DS1 v2

1 vcpu, 3.5 GiB memory (\$140.32/month)

[Change size](#)

Administrator account

Username *

adm-jlee

Password *

✗ Password must have 3 of the following: 1 lower case character, 1 upper case character, 1 number, and 1 special character.

✗ The value must be between 12 and 123 characters long.

Confirm password *

Inbound port rules

Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

Public inbound ports *

☐ None ☒ Allow selected ports

Select inbound ports *

RDP (3389)

This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.

Creating a Virtual Machine

Microsoft Azure

Search resources, services, and docs (G+ /)

Home > New > Create a virtual machine

Create a virtual machine

Virtual machine name *

vm01

Region *

(Asia Pacific) Australia Southeast

Availability options

No infrastructure redundancy required

Image *

Windows Server 2019 Datacenter

[Browse all public and private images](#)

Azure Spot instance

☐ Yes ☒ No

Size *

Standard DS1 v2

1 vcpu, 3.5 GiB memory (\$140.32/month)

[Change size](#)

Administrator account

Username *

adm-jlee

Password *

✖ Password must have 3 of the following: 1 lower case character, 1 upper case character, 1 number, and 1 special character.

✖ The value must be between 12 and 123 characters long.

Confirm password *

Inbound port rules

Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

Public inbound ports *

☐ None ☒ Allow selected ports

Select inbound ports *

RDP (3389)

⚠ This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab to create rules to limit inbound traffic to known IP addresses.

Creating a Virtual Machine

Microsoft Azure

Search resources, services, and docs (G + /)

adm.jlee@jazlab1.onmic...JAZ LAB

Home > CreateVm-MicrosoftWindowsServer.WindowsServer-201-20200405092906 | Overview

CreateVm-MicrosoftWindowsServer.WindowsServer-201-20200405092906 | Overview

Deployment

Search (Cmd+ /)

DeleteCancelRedeployRefresh

*** Your deployment is underway

Deployment name: CreateVm-MicrosoftWindowsServer.WindowsS...
Subscription: JAZ Lab Production Subscription
Resource group: vm01-rg

Start time: 4/5/2020, 9:32:39 AM
Correlation ID: 0596f794-19a8-4d57-8c03-427e3693e894

Deployment details (Download)

Resource	Type	Status	Operation details
No results.			

Security Center

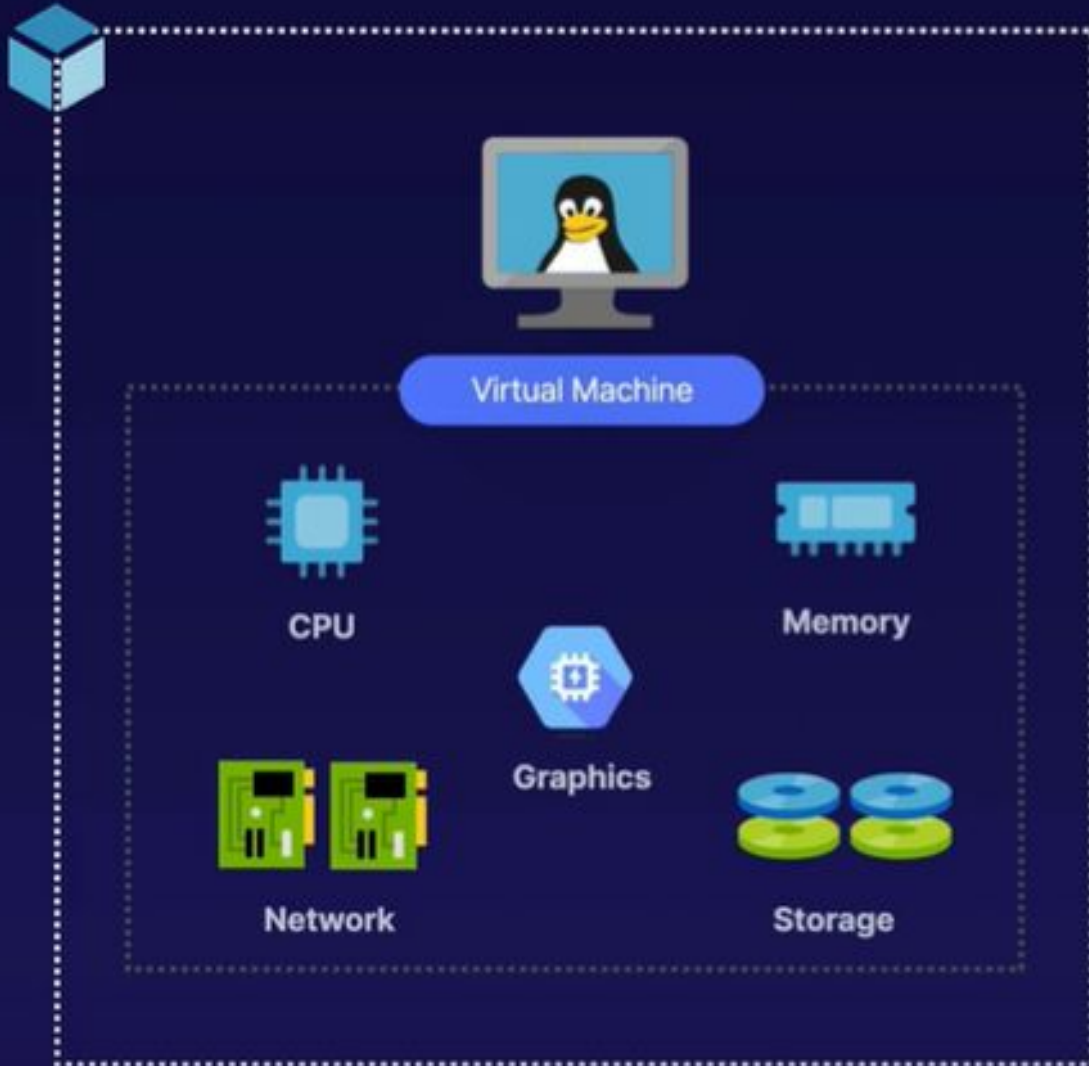
Secure your apps and infrastructure
[Go to Azure security center >](#)

Free Microsoft tutorials
[Start learning today >](#)

Work with an expert

*** Deployment in progress... 9:32 AM
Deployment to resource group 'vm01-rg' is in progress.

Creating a Virtual Machine



Virtual Machine Size

The size of a virtual machine influences several characteristics.

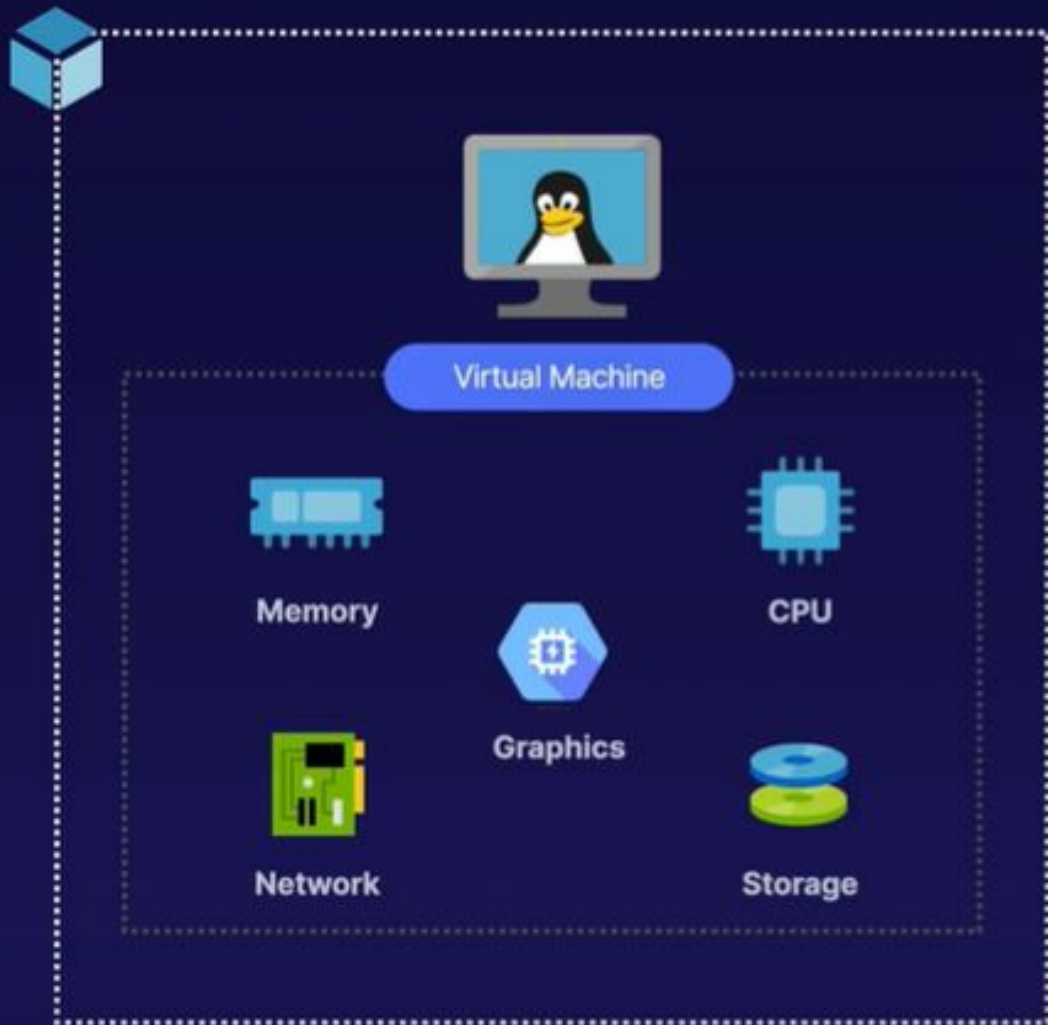
Important Considerations:

- CPU resource allocation
- Available total memory
- Graphics capabilities
- Network interface card (NIC) performance
- Storage (Azure Disks) performance
- Influences limits (maximum NICs, disks)

Configuring Virtual Machine Size:

- Can be configured at time of creation
- Can be changed (requires a restart)
- Available sizes depends on:
 - Whether the virtual machine is running
 - The location of the virtual machine

Virtual Machine Size



VM Size Type	Description
General Purpose	Balanced CPU-to-memory ratio. Ideal for testing and development, small to medium databases, and low to medium traffic web servers.
Compute Optimized	High CPU-to-memory ratio. Good for medium traffic web servers, network appliances, batch processes, and application servers.
Memory Optimized	High memory-to-CPU ratio. Great for relational database servers, medium to large caches, and in-memory analytics.
Storage Optimized	High disk throughput and IO ideal for Big Data, SQL, NoSQL databases, data warehousing and large transactional databases.
GPU	Specialized virtual machines targeted for heavy graphic rendering and video editing, as well as model training and inferencing (ND) with deep learning. Available with single or multiple GPUs.
HPC	Our fastest and most powerful CPU virtual machines with optional high-throughput network interfaces (RDMA).

Creating a Virtual Machine

vm01 - Microsoft Azure

https://portal.azure.com/#@jazlab1.com/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vm01-rg/providers/Microsoft.Compute/virtualMachines/vm01/overview

Microsoft Azure Search resources, services, and docs (G+/)

Home > Virtual machines > vm01 | Size

Virtual machines

JAZ Lab

+ Add ⌚ Reservations ...

Filter by name...

- ☐ Name ↑↓
- ☐ vm01 ...
- ☐ vmdemo1 ...

vm01 | Size

Virtual machine

Search (Cmd + /)

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

Settings

- Networking
- Connect
- Disks
- Size**
- Security
- Extensions
- Continuous delivery
- Availability set
- Configuration
- Identity
- Properties
- Locks
- Export template

Operations

- Bastion
- Auto-shutdown

Connect ▶ Start ↺ Restart ◻ Stop 📷 Capture 🗑 Delete ↻ Refresh

Advisor (1 of 3): Use availability sets for improved fault tolerance →

Resource group (change)	vm01-rg	Azure Spot	N/A
Status	Running	Public IP address	20.190.119.186
Location	Australia Southeast	Private IP address	10.1.1.4
Subscription (change)	JAZ Lab Production Subscription	Public IP address (IPv6)	-
Subscription ID	2ed17b0d-359f-4220-be01-60080a67bb22	Private IP address (IPv6)	-
Computer name	vm01	Virtual network/subnet	vnet1/subnet1
Operating system	Windows (Windows Server 2019 Datacenter)	DNS name	Configure
Size	Standard D51 v2 (1 vcpus, 3.5 GiB memory)		
Tags (change)	Click here to add tags		

Show data for last: 1 hour 6 hours 12 hours 1 day 7 days 30 days

CPU (average)

Percentage CPU (Avg) vm01

55.56%

Network (total)

Network In Total (Sum) vm01

5.5 MB

Network Out Total (Sum) vm01

1.39 MB

Disk bytes (total)

Disk Read Bytes (Sum) vm01

1.28 GB

Disk Write Bytes (Sum) vm01

947.35 MB

Virtual Machine size

vm01 | Size

Virtual machine

Search (Cmd+J)

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Networking

Connect

Disks

Size

Security

Extensions

Continuous delivery

Availability set

Configuration

Identity

Properties

Locks

Export template

Operations

Bastion

Auto-shutdown

Backup

Search by VM size...

Restore default filters

Add filter

Showing 132 VM sizes

Subscription: JAZ Lab Production Subscription

Region: Australia Southeast

Current size: Standard_DS1_v2

Documentation

VM Size ↑↓	Offering ↑↓	Family ↑↓	vCPUs ↑↓	RAM (GiB) ↑↓	Data disks ↑↓	Max IOPS ↑↓	Temporary storage (GiB) ↑↓	Premium disk support ↑↓	Cost/month (estimated) ↑↓
A7	Standard	General purpose	8	56	16	16x500		No	\$1,399.20
A8_v2	Standard	General purpose	8	16	16	16x500	80	No	\$701.60
A8m_v2	Standard	General purpose	8	64	16	16x500	80	No	\$1,193.73
B12ms	Standard	General purpose	12	48	16	4320	96	Yes	\$683.56
B16ms	Standard	General purpose	16	64	32	4320	128	Yes	\$911.08
B1ls	Standard	General purpose	1	0.5	2	160	4	Yes	\$11.23
B1ms	Standard	General purpose	1	2	2	640	4	Yes	\$30.47
B1s	Standard	General purpose	1	1	2	320	4	Yes	\$17.24
B20ms	Standard	General purpose	20	80	32	4320	160	Yes	\$1,139.60
B2ms	Standard	General purpose	2	8	4	1920	16	Yes	\$114.26
B2s	Standard	General purpose	2	4	4	1280	8	Yes	\$60.94
B4ms	Standard	General purpose	4	16	8	2880	32	Yes	\$227.52
B8ms	Standard	General purpose	8	32	16	4320	64	Yes	\$456.04
D1	Standard	General purpose	1	3.5	4	4x500	50	No	\$156.36
D1_v2	Standard	General purpose	1	3.5	4	4x500	50	No	\$140.32
D11	Standard	Memory optimized	2	14	8	8x500	100	No	\$306.70
D11_v2	Standard	Memory optimized	2	14	8	8x500	100	No	\$295.68
D11_v2	Promo (Exp...	Memory optimized	2	14	8	8x500	100	No	\$295.68
D12	Standard	Memory optimized	4	28	16	16x500	200	No	\$613.40

Virtual Machine size

← → ↺ 🔒 https://portal.azure.com/#create/Microsoft.VirtualMachine

Microsoft Azure 🔍 Search resources, services, and docs (G+/f)

adm.jlee@jazlab1.onmic... IAZ LAB

Home > Virtual machines > Create a virtual machine > Select a VM size

Select a VM size

Browse available virtual machine sizes and their features

🔍 Search by VM size... Clear all filters

Family: 2 selected 🗕 Add filter

Showing 52 of 268 VM sizes. | Subscription: IAZ Lab Production Subscription | Region: South Central US | Current size: Standard_D2s_v3 | Image: Ubuntu Server 18.04 LTS

VM Size ↑↓	Offering ↑↓	Family ↑↓	vCPUs ↑↓	RAM (GiB) ↑↓	Data disks ↑↓	Max IOPS	↑↓	Temporary storage (GiB)	↑↓	Premium disk support	↑↓	Cost/month (estimated)	↑↓
H8	Standard	High performanc...	8	56	32	32x500		1000		No		\$877.00	
H8_Promo	Promo	High performanc...	8	56	32	32x500		1000		No		\$526.20	
H8m	Standard	High performanc...	8	112	32	32x500		1000		No		\$1,174.68	
H8m_Promo	Promo	High performanc...	8	112	32	32x500		1000		No		\$705.61	
NC6_Promo	Promo	GPU	6	56	24	20000		380		No		\$476.09	
NV4as_v4	Standard	GPU	4	14	8	6000		88		Yes		\$280.64	
NV6_Promo	Promo	GPU	6	56	24	20000		380		No		\$691.58	
NV8as_v4	Standard	GPU	8	28	16	12000		176		Yes		\$560.28	
A10 🕒	Standard	High performanc...	8	56	32	32x500				No		\$701.60	
A11 🕒	Standard	High performanc...	16	112	64	64x500				No		\$1,403.21	
A8 🕒	Standard	High performanc...	8	56	32	32x500				No		\$877.00	
A9 🕒	Standard	High performanc...	16	112	64	64x500				No		\$1,754.01	
H16 🕒	Standard	High performanc...	16	112	64	64x500		2000		No		\$1,753.01	
H16_Promo 🕒	Promo	High performanc...	16	112	64	64x500		2000		No		\$1,052.40	
H16m 🕒	Standard	High performanc...	16	224	64	64x500		2000		No		\$2,348.37	
H16m_Prom...	Promo	High performanc...	16	224	64	64x500		2000		No		\$1,410.22	
H16mr 🕒	Standard	High performanc...	16	224	64	64x500		2000		No		\$2,582.90	
H16mr_Pro...	Promo	High performanc...	16	224	64	64x500		2000		No		\$1,551.54	
H16r 🕒	Standard	High performanc...	16	112	64	64x500		2000		No		\$1,928.41	
H16r_Prom...	Promo	High performanc...	16	112	64	64x500		2000		No		\$1,157.64	

Quotas for Virtual Machine Sizes

Microsoft Azure

Search resources, services, and docs (G+J)

adm.jee@jazlab1.onmic...
JAZ LAB

Home > Subscriptions > JAZ Lab Production Subscription | Usage + quotas

Subscriptions

JAZ Lab

+ Add

Showing subscriptions in JAZ Lab. Don't see a subscription?
[Switch directories](#)

My role ⓘ Status ⓘ

8 selected ▼ 3 selected ▼

Apply

Showing 1 of 1 subscriptions global

Show only subscriptions selected in the subscriptions filter ⓘ

Search to filter items...

Subscription na... ↑↓

Subscription ID ↑

JAZ Lab Production ... 2ed17b0d-359f-422

JAZ Lab Production Subscription | Usage + quotas

Subscription

Search (Cmd+J)

Refresh

You can use each Microsoft Azure resource up to its quota. Each subscription has separate quotas and usage is tracked per subscription. If you reach a quota cap, you can request an increase via [Help + Support](#). [Learn more](#)

All service quotas ▼ Select a Provider ▼ All locations ▼ Show only items with usage ▼

Filter items...

Quota

Provider

Location

Usage

No quotas are available.
Select the Provider in the dropdown above to view quotas.

Request Increase

Quotas for Virtual Machine Sizes

Unmanaged

- Not a top-level resource.
- Requires manual management of storage accounts.
- Limited support for high availability.
- Limited functionality.

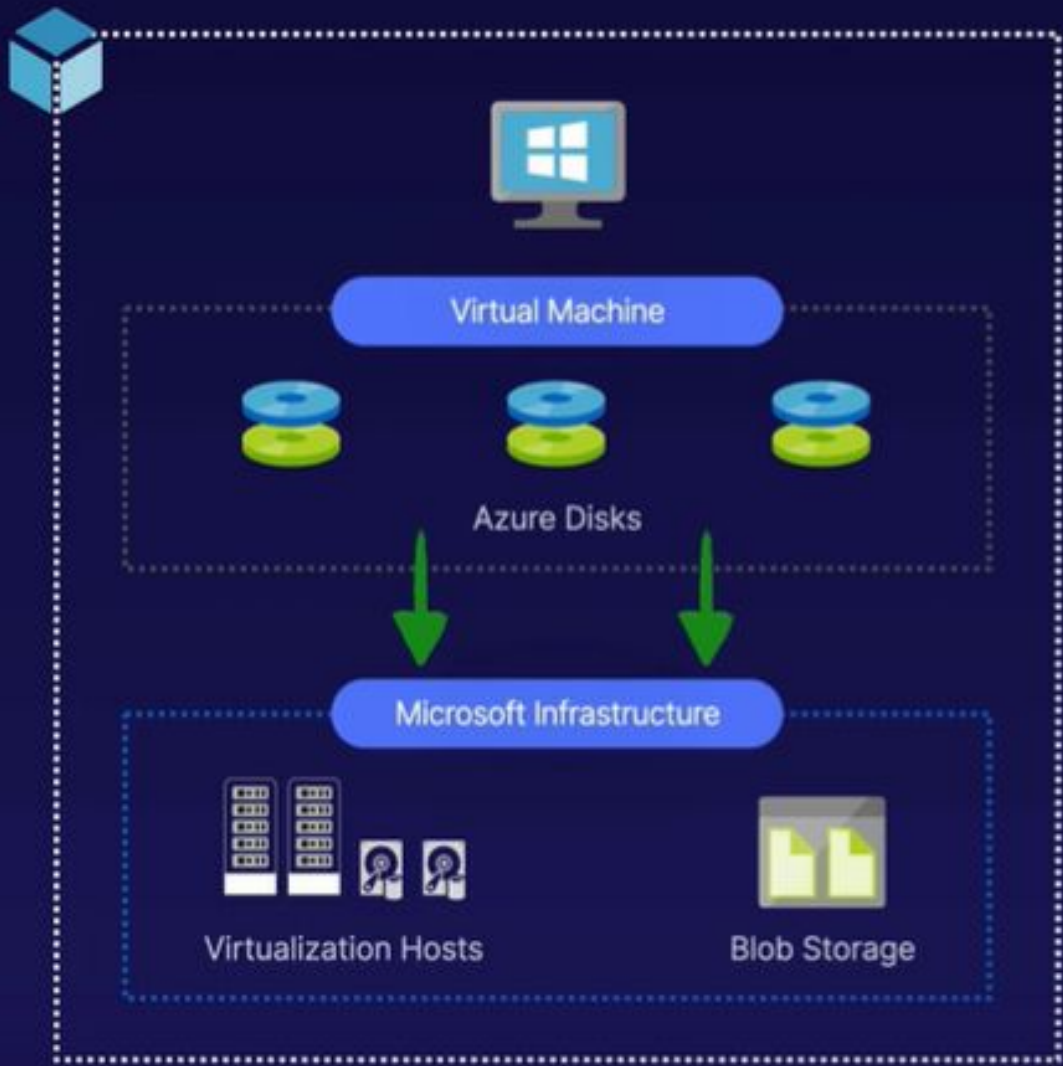
VS

Managed

- Top-level resource.
- You're not responsible for configuring storage accounts.
- Support for high availability.
- Functionality regularly improved.

**Virtual Machine
storage**

Unmanaged vs Managed Disks



Disk Type	Description
OS Disk	Required by all virtual machines, the OS disk is built from an image containing a pre-installed operating system (OS). OS disks are a default disk.
Temporary Disk	A local disk (local to the underlying Microsoft host infrastructure which is hosting the virtual machine) that is NOT persistent. Temporary disks are a default disk.
Data Disk	A disk used to store information persistently, such as application data, etc.
Ephemeral OS Disk	A special type of OS Disk which contains an operating system installation, but where data cannot be changed.

Disk Types

```
# Add a data disk to an existing VM using Azure CLI
```

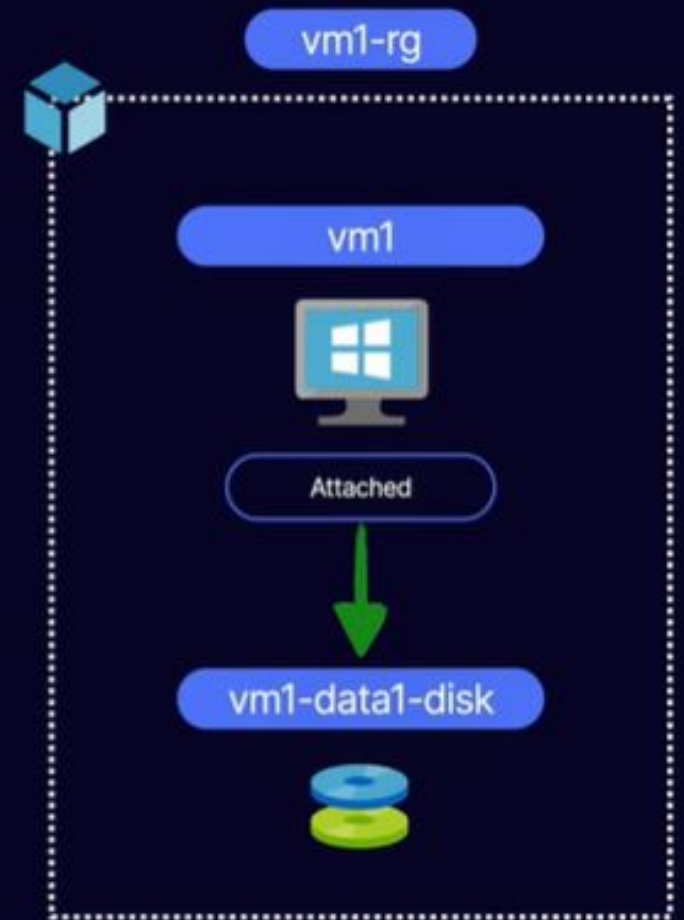
```
rgName="vm1-rg"  
vmName="vm1"  
diskName="vm1-data1-disk"
```

```
# Create a new disk
```

```
az disk create --name "vm1-data1-disk" \  
  --resource-group $rgName \  
  --location "Australia Southeast" \  
  --size-gb 10
```

```
# Add disk to existing VM
```

```
az vm disk attach --vm-name $vmName \  
  --name $diskName \  
  --resource-group $rgName
```



Adding a Data Disk to a VM

← → ↻ 🔒 https://portal.azure.com/#@jzlab1.com/resource/subscriptions/2ed17b0d-359f-4220-be01-60080a67bb22/resourceGroups/vm01-rg/providers/Microsoft.Compute/virtualMachines/vm01/disks

Microsoft Azure 🔍 Search resources, services, and docs (G+)

Home > Resource groups > vm01-rg > vm01 | Disks

vm01 | Disks

Virtual machine

🔍 Search (Cmd+ /) ⌵

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

Settings

- Networking
- Connect
- Disks**
- Size
- Security

Edit ↻ Refresh 🔒 Encryption ↕ Swap OS Disk

📘 Ultra Disk compatibility is not available for this location.

Disk settings

Enable Ultra Disk compatibility ⓘ

☐ Yes ☒ No

OS disk

Name	Size	Storage account type	Encryption
vm01_OsDisk_1_758b22416a934e18bd69231c1a854ef7	127 GiB	Premium SSD	Not enabled

Data disks

None

+ Add data disk

Bash ⌵ 🔌 ? ⚙️ 📄 📁 {} 📄

Requesting a Cloud Shell.**Succeeded.**
Connecting terminal...

```
admin@Azure:~$ rgName="vm01-rg"
admin@Azure:~$ vmName="vm01"
admin@Azure:~$ diskName="vm01-data1-disk"
admin@Azure:~$
admin@Azure:~$ az disk create --name $diskName \
> --resource-group $rgName \
> --location "Australia Southeast" \
> --size-gb 10
```

Adding a Data Disk to a VM

Microsoft Azure portal interface showing the overview of a disk named **vm01-data1-disk**. The disk is currently **Unattached**. The interface includes a left sidebar with navigation options like Overview, Activity log, Access control (IAM), Tags, Settings, Configuration, Encryption, Disk Export, Properties, Locks, and Export template. The main area displays disk details such as Resource group (vm01-rg), Location (Australia Southeast), Subscription (JAZ Lab Production Subscription), and Disk Configuration (10 GiB (Premium SSD)). A message states: "Disk must be attached to a VM to view metrics".

```
Bash
{
  "location": "australiasoutheast",
  "managedBy": null,
  "name": "vm01-data1-disk",
  "osType": null,
  "provisioningState": "Succeeded",
  "resourceGroup": "vm01-rg",
  "sku": {
    "name": "Premium_LRS",
    "tier": "Premium"
  },
  "tags": {},
  "timeCreated": "2020-04-06T01:22:37.625757+00:00",
  "type": "Microsoft.Compute/disks",
  "uniqueId": "27aa018c-739c-4704-8926-6af2f3f155c7",
}
```

Adding a Data Disk to a VM

Microsoft Azure portal interface showing the configuration for a virtual machine (vm01) under the 'Disks' tab. The interface includes a search bar, navigation pane, and a table of disks.

Disks Table:

Name	Size	Storage account type	Encryption	Host caching
vm01_OsDisk_1_758b22416a934e18bd69231c1a854ef7	127 GiB	Premium SSD	Not enabled	Read/write

Data disks Table:

LUN	Name	Size	Storage account type	Encryption	Host caching
0	vm01-data1-disk	10 GiB	Premium SSD	Not enabled	None

Buttons: Edit, Refresh, Encryption, Swap OS Disk, + Add data disk

```
Bash
"osType": null,
"provisioningState": "Succeeded",
"resourceGroup": "vm01-rg",
"sku": {
  "name": "Premium_LRS",
  "tier": "Premium"
},
"tags": {},
"timeCreated": "2020-04-06T01:22:37.625757+00:00",
"type": "Microsoft.Compute/disks",
"uniqueId": "27aa018c-739c-4704-8926-6af2f3f155c7",
"zones": null
}
admin@Azure:~$ az vm disk attach --vm-name $vmName \
```

Adding a Data Disk to a VM



Disk Caching

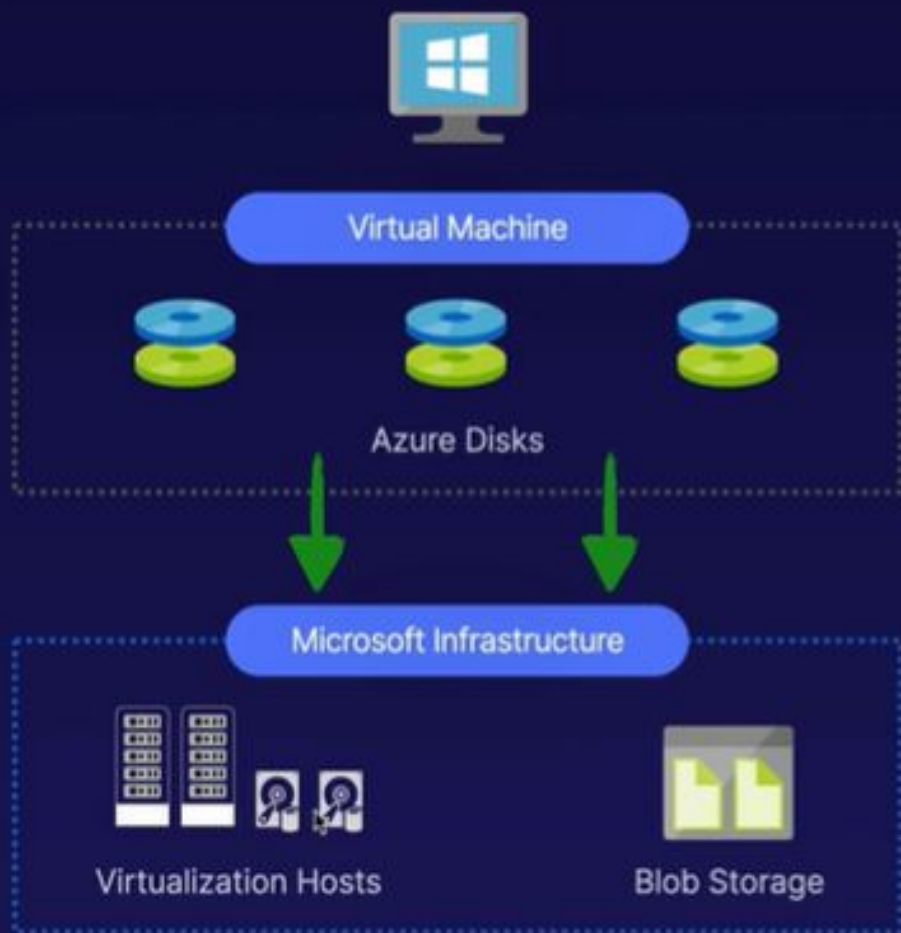
Leverages virtualization host infrastructure to improve read and write performance.



Performance Tiers

Determines the underlying infrastructure performance characteristics.

Azure Disk Performance



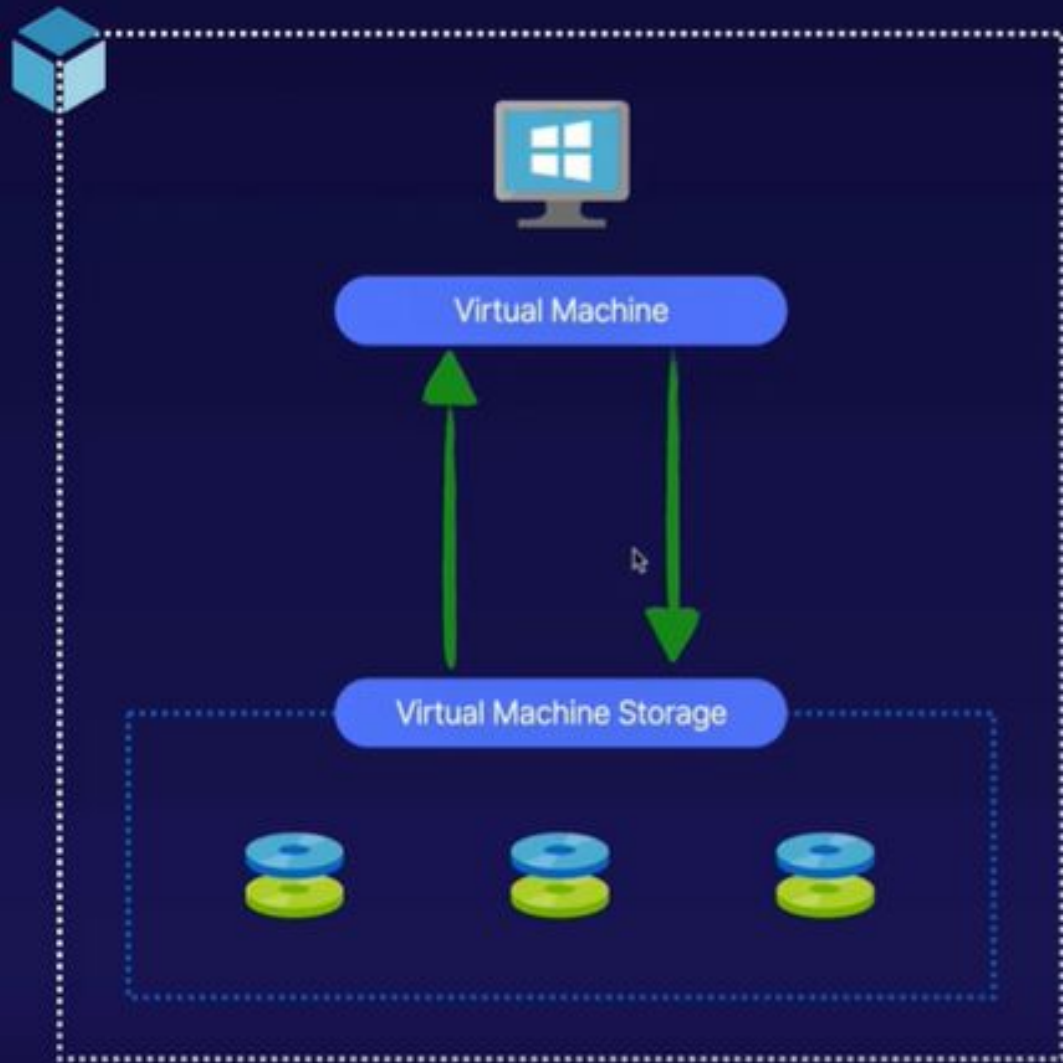
Disk Caching

Disk caching (also referred to as **host caching**) is a feature that leverages specialised high-performance (read and write) storage systems to ensure data can be accessed **very fast**.

BlobCache

Disk caching in Azure leverages a technology referred to as BlobCache, which uses a combination of host SSDs and memory to provide each to virtual machines.

Disk Caching



Cache Option	Description
Read/Write	Leverages a cache for both reads and writes. This MUST have proper support from applications on the VM to ensure data is correctly persisted from cache to storage. This type of cache is often referred to as "write-back caching". Note: this option is enabled by default for OS disks, and also supports Data disks.
Read-Only	Improves read performance (throughput and latency) by reading data from the cache, with all writes going direct to storage. This is often referred to as "read-through caching".
None	Both read and write operations do not use a cache and are instead directed to the storage backend.

Disk Caching

Azure Disk Performance Tiers

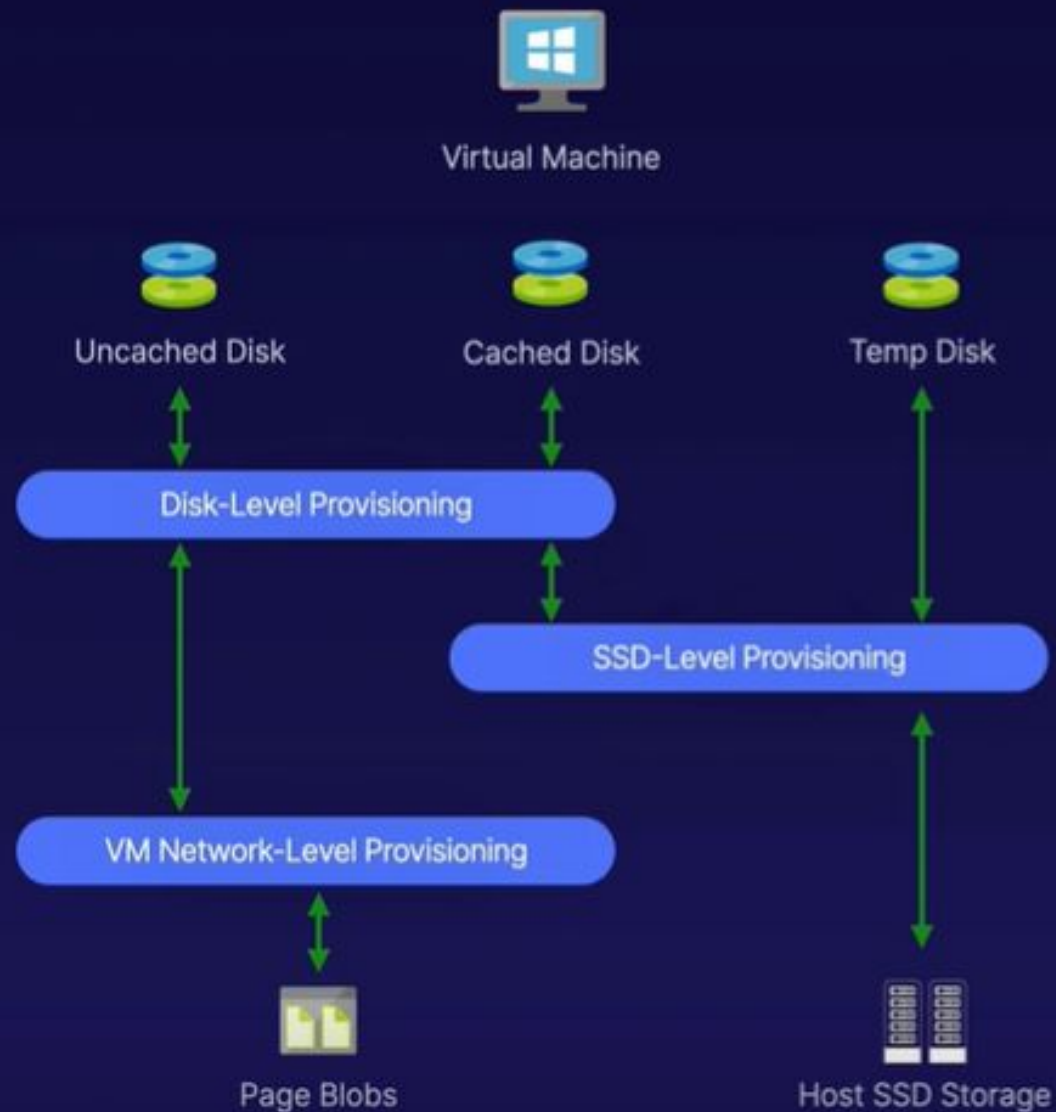
Microsoft provide several options to cater to the various performance requirements of different workloads.

Important Considerations:

- Different performance have different:
 - Maximum disk sizes.
 - Maximum throughput.
 - Maximum IOPS.
- Note, not all VM sizes support all performance tiers

Tier	Description
Ultra	Designed for extremely input/output intensive workloads (for example, SAP HANA, top-tier databases, etc.).
Premium SSD	Intended for production workloads with high-performances requirements.
Standard SSD	Built for light-usage applications, or development and testing workloads.
Standard HDD	Only intended for backup or non-critical workloads.

Disk Caching



Tier	Description
Ultra	Designed for extremely input/output intensive workloads (for example, SAP HANA, top-tier databases, etc.).
Premium SSD	Intended for production workloads with high-performances requirements.
Standard SSD	Built for light-usage applications, or development and testing workloads.
Standard HDD	Only intended for backup or non-critical workloads.

Performance Tiers

Microsoft Azure

Search resources, services, and docs (G+/I)

adm.jlee@jazlab1.onmic...

JAZ LAB

Home > vm01 | Disks > Create managed disk

Create managed disk

Create a new disk to store applications and data on your VM. Disk pricing varies based on factors including disk size, storage type, and number of transactions.

Disk name *

Resource group *

vm01-rg

Create new

Location

Australia Southeast

Availability zone

None

Source type

None

Size *

1024 GiB

Premium SSD

Change size

Encryption type *

(Default) Encryption at rest with a platform-managed key

Select a disk size

Browse available disk sizes and their features.

Storage type

Premium SSD

Standard HDD

Standard SSD

Premium SSD

16 GiB	P3	120	25
32 GiB	P4	120	25
64 GiB	P6	240	50
128 GiB	P10	500	100
256 GiB	P15	1100	125
512 GiB	P20	2300	150
1024 GiB	P30	5000	200
2048 GiB	P40	7500	250
4096 GiB	P50	7500	250
8192 GiB	P60	16000	500
16384 GiB	P70	18000	750
32767 GiB	P80	20000	900

Create a custom size

Enter the size of the disk you would like to create. You will be charged the same rate for your provisioned disk, regardless of how much of the disk space is being used. For example, a 200 GiB disk is provisioned on a 256 GiB disk, so you would be billed for the 256 GiB provisioned.

Custom disk size (GiB) *

1024

Performance Tiers

← → ↻ 🔒 https://portal.azure.com/#@jazlab1.com/resource/subscriptions/2ed17b0d-359f-4220-be01-80080a67bb22/resourceGroups/vm01-rg/providers/Microsoft.Compute/virtualMachines/vm01/disks Guest ...

Microsoft Azure Search resources, services, and docs (G+)

Home > vm01 | Disks

vm01 | Disks
Virtual machine

Search (Cmd+/) Save Discard Refresh Encryption Swap OS disk

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

Settings
Networking
Connect
Disks
Size
Security
Extensions
Continuous delivery
Availability set
Configuration
Identity
Properties
Locks
Export template

Operations
Bastion

Managed disks created since June 10, 2017 are encrypted at rest with Storage Service Encryption (SSE). You may also want to enable Azure Disk Encryption.

Ultra Disk compatibility is not available for this location.

Disk settings
Enable Ultra Disk compatibility
☐ Yes ☒ No

OS disk

Name	Size	Storage account type	Encryption	Host caching
vm01_OsDisk_1_758b22416a934e18bd69231c1a854ef7	127 GiB	Premium SSD	Not enabled	Read/write

Data disks

LUN	Name	Size	Storage account type	Encryption	Host caching
0	vm01-data1-disk	10 GiB	Premium SSD	Not enabled	None

+ Add data disk

Host caching
None
None
Read-only
Read/write

Disk Caching

Thank You