

PRIYAM MITRA

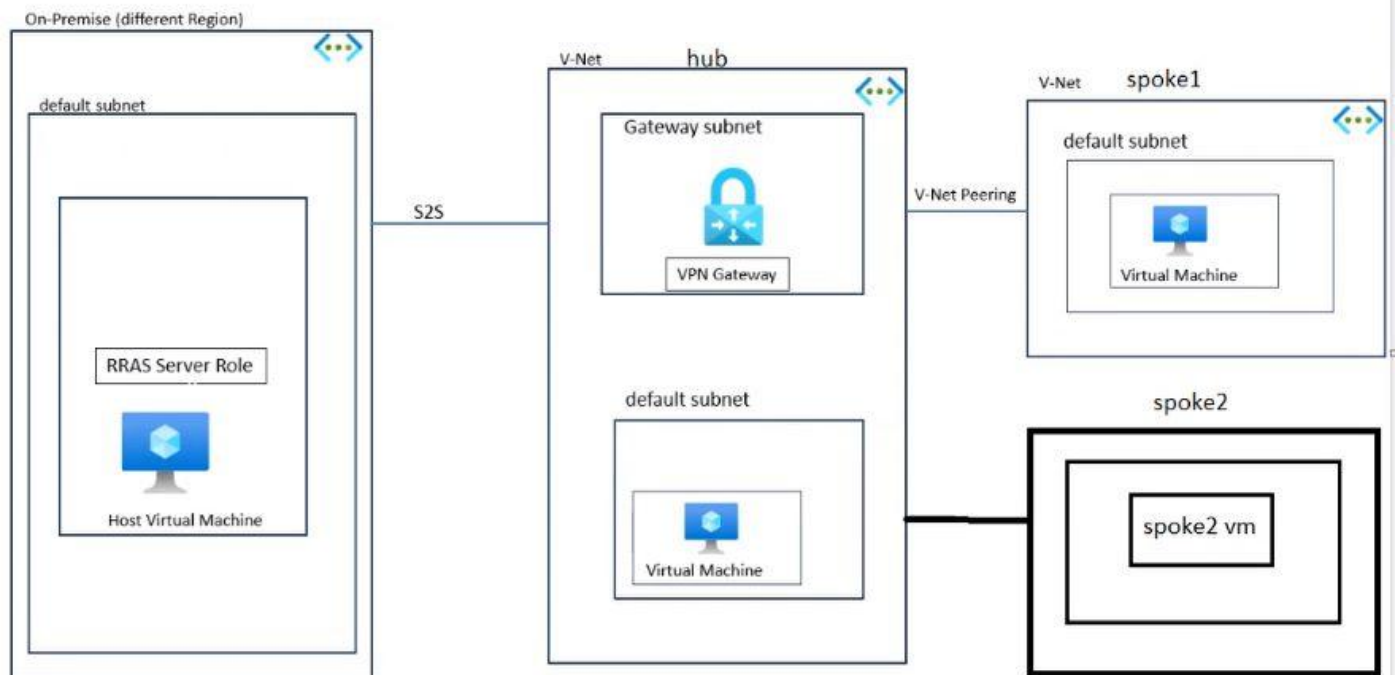
Aim: To implement a connection between on-premise Vm and Spoke Vm through a Hub network.

"In this project, I configured a hybrid network architecture connecting an on- premises network to Azure-Hub using Site-to-Site (S2S) tunneling. The architecture was designed using the Hub and Spoke topology, where the Hub VNet served as the central point for connecting multiple Spoke VNets. To achieve this, I deployed a Virtual Network Gateway (VNG) within the Hub VNet and set up Routing and Remote Access Service (RRAS) on an on-premises Virtual Machine (VM).

The on-premises VM was equipped with RRAS, acting as the VPN server for the on-premises network. By establishing a secure S2S connection between the RRAS VM and the Virtual Network Gateway in Azure-Hub, I enabled bidirectional communication between the on-premises network and both the Hub and Spoke VMs.

To ensure seamless connectivity between Spoke VNets, I used Transit VNet peering. This allowed the Hub VNet to serve as a transit hub, facilitating communication between the Spoke VNets without establishing direct connectivity between them and the on-premises VNet.

Upon successful implementation, the on-premises VM could ping the VM in the Hub and both Spoke VM's, achieving a fully functional hybrid network environment. The project's configuration allowed for secure data transfer and resource access between the on-premises network and Azure-Hub, leveraging the scalability and flexibility of cloud services while maintaining necessary security measures."



Step1: Create a VM for HUB

Microsoft Azure

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

Home > Virtual machines >

Create a virtual machine

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *

Azure subscription 1

Resource group *

(New) Hub-Spoke

[Create new](#)

Instance details

Virtual machine name *

Priyam-Hub-VM

Region *

(US) East US


Availability options

No infrastructure redundancy required

Security type

Standard

Image *

 Windows Server 2019 Datacenter - x64 Gen2

[See all images](#) | [Configure VM generation](#)

Review + create

< Previous

Next : Disks >

Step2: Create a VM for Spoke1 with different resource group and Vnet

[Home](#) > [Virtual machines](#) >

Create a virtual machine ...

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ	<div>Azure subscription 1</div>
Resource group * ⓘ	<div>(New) Spoke1-rg</div>
	Create new

Instance details

Virtual machine name * ⓘ	<div>Priyam-Spoke1-VM</div>
Region * ⓘ	<div>(US) East US</div>
Availability options ⓘ	<div>No infrastructure redundancy required</div>
Security type ⓘ	<div>Standard</div>
Image * ⓘ	<div> Windows Server 2019 Datacenter - x64 Gen2</div>
VM architecture ⓘ	<div><input type="radio"/> Arm64</div> <div><input checked="" type="radio"/> x64</div>

Arm64 is not supported with the selected image.

[Review + create](#)[< Previous](#)[Next : Disks >](#)

Step3: Create a VM for Spoke2 with different resource group and Vnet

Create a virtual machine

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Azure subscription 1

Resource group * ⓘ (New) Spoke2-rg

[Create new](#)


Instance details

Virtual machine name * ⓘ Priyam-Spoke2-VM ✓

Region * ⓘ (US) East US

Availability options ⓘ No infrastructure redundancy required

Security type ⓘ Standard

Image * ⓘ  Windows Server 2019 Datacenter - x64 Gen2

[See all images](#) | [Configure VM generation](#)

VM architecture ⓘ

☐ Arm64

☒ x64

 Arm64 is not supported with the selected image.

[Review + create](#)

[< Previous](#)

[Next : Disks >](#)

Step4: Create a VNG in the Hub Resource group .

Create virtual network gateway

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources. 

Subscription * Azure subscription 1

Resource group ⓘ Hub-Spoke (derived from virtual network's resource group)

Instance details

Name * Hub-Gateway ✓

Region * East US

Gateway type * ⓘ ☒ VPN ☐ ExpressRoute

VPN type * ⓘ ☒ Route-based ☐ Policy-based

SKU * ⓘ VpnGw1

Generation ⓘ Generation1

Virtual network * ⓘ Priyam-Hub-VM-vnet

[Create virtual network](#)

[Review + create](#)

[Previous](#)

[Next : Tags >](#)

[Download a template for automation](#)

Step5: Add peering between Spoke2 & HUB and Spoke1 & HUB through VNG

Microsoft Azure

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

[Home](#) > [Virtual networks](#) > [Priyam-Spoke2-VM-vnet | Peerings](#) >

Add peering

Priyam-Spoke2-VM-vnet

This virtual network

Peering link name *

Spoke2-Hub

Traffic to remote virtual network ⓘ

☒ Allow (default)

☐ Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

☒ Allow (default)

☐ Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

☐ Use this virtual network's gateway or Route Server

☒ Use the remote virtual network's gateway or Route Server

☐ None (default)

Remote virtual network

Peering link name *

Hub-Spoke2

Virtual network deployment model ⓘ

Add

Microsoft Azure

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

Home > Virtual networks > Priyam-Spoke1-VM-vnet | Peerings >

Add peering

Priyam-Spoke1-VM-vnet

This virtual network

Peering link name *

Spoke1-Hub

Traffic to remote virtual network ⓘ

☒ Allow (default)

☐ Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

☒ Allow (default)

☐ Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

☐ Use this virtual network's gateway or Route Server

☒ Use the remote virtual network's gateway or Route Server

☐ None (default)

Remote virtual network

Peering link name *

Hub-Spoke1

Virtual network deployment model ⓘ

Add

Step6: Both the Peerings have been added.

Microsoft Azure

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

priyammitra257@e
DEFAULT D

Home > Virtual networks > Priyam-Hub-VM-vnet

Virtual networks

Default Directory

+ Create Manage view ...

Filter for any field...

Name ↑↓

Priyam-Hub-VM-vnet ...

Priyam-OnPrem-VM-vnet ...

Priyam-Spoke1-VM-vnet ...

Priyam-Spoke2-VM-vnet ...

Priyam-Hub-VM-vnet | Peerings ☆ ...

Virtual network

Search

+ Add Refresh Sync

Filter by name... Peering status == all

Name ↑↓	Peering status ↑↓	Peer ↑↓	Gateway transit ↑↓
Hub-Spoke2	Connected	Priyam-Spoke2-VM-vnet	Enabled
Hub-Spoke1	Connected	Priyam-Spoke1-VM-vnet	Enabled

Page 1 of 1

Connected devices

Subnets

Bastion

DDoS protection

Firewall

Microsoft Defender for Cloud

Network manager

DNS servers

Peerings

Service endpoints

Private endpoints

Properties

Locks

Monitoring

Alerts

Metrics

Giv

Step7: Create a route table for Spoke1 and Spoke2

Microsoft Azure

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

[Home](#) > [Route tables](#) >

Create Route table

Basics

Tags

Review + create

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *

Azure subscription 1

Resource group *

Hub-Spoke

Create new

Instance details

Region *

East US

Name *

Spoke1RT

Propagate gateway routes *

☒ Yes

☐ No

Previous

Next

Review + create

Microsoft Azure

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

[Home](#) > [Route tables](#) >

Create Route table

Basics

Tags

Review + create

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *

Azure subscription 1

Resource group *

Hub-Spoke

Create new

Instance details

Region *

East US

Name *

Spoke2RT

Propagate gateway routes *

☒ Yes

☐ No

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Review + create

Step8: Add the route taking VNG as a nest hop for both Spoke1 & 2

Microsoft Azure

Search resources, services, and docs (G+)

Home > Route tables > Spoke1RT

Route tables

Default Directory

[+ Create](#) [Manage view](#) [...](#)

Filter for any field...

Name	...
Spoke1RT	...
Spoke2RT	...

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Configuration

Routes

Subnets

Properties

Locks

Monitoring

Alerts

Automation

Tasks (preview)

Spoke1RT | Routes

Route table

Search

[+ Add](#) [Refresh](#) [Give feedback](#)

Search routes

Name	Address prefix	Next hop type	Next hop address
No results.			

Add route

Spoke1RT

A user defined route (UDR) is a static route that overrides Azure's default route table. [Learn more](#)

Route name *

Spoke2-Traffic-Hub

Destination type *

IP Addresses

Destination IP addresses/CIDR ranges *

10.2.0.0/16

Next hop type *

Virtual network gateway

Next hop address

Add

Spoke2RT | Routes

Route table

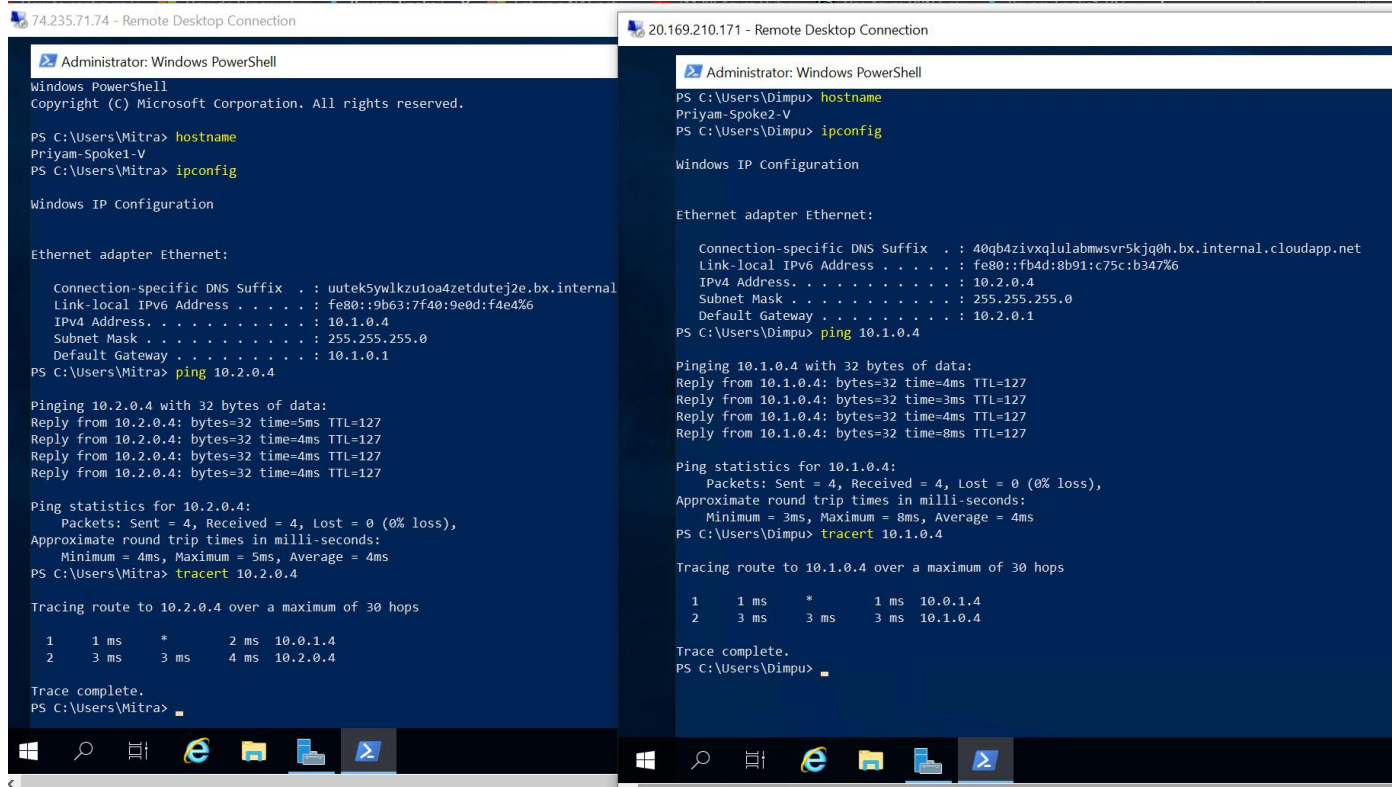
Search

[+ Add](#) [Refresh](#) [Give feedback](#)

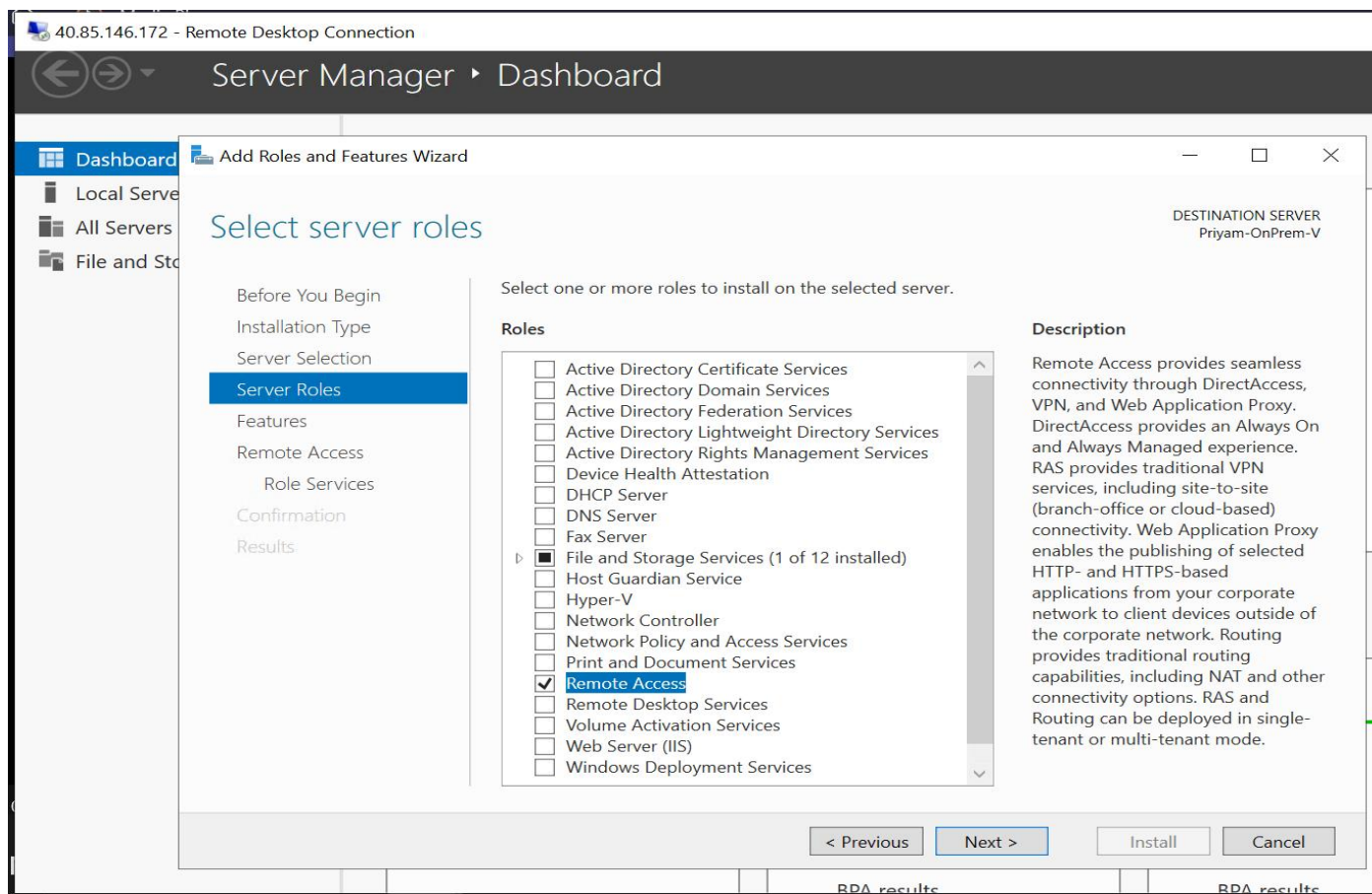
Search routes

Name	Address prefix	Next hop type
Spoke1-Traffic-Hub	10.1.0.0/16	VirtualNetworkGateway

Step9: Then open both Vm's of Spoke1&2 and in powercell ping the ip address and check the connectivity.



Step10: Then open the on-premise Vm and in add roles install RAAS



Select role services

Before You Begin

Installation Type

Server Selection

Server Roles

Features

Remote Access

Role Services

Web Server Role (IIS)

Role Services

Confirmation

Results

Select the role services to install for Remote Access

Role services

- ☒ DirectAccess and VPN (RAS)
- ☒ **Routing**
- ☐ Web Application Proxy

Description

Routing provides support for NAT Routers, LAN Routers running BGP, RIP, and multicast capable routers (IGMP Proxy).

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Install

Cancel

Step11: Create a local network gateway to connect the Hub and on-premise vm through VNG

Microsoft Azure

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

Home > Local network gateways >

Create local network gateway ...

A local network gateway is a specific object that represents an on-premises location (the site) for routing purposes. [Learn more](#)

Project details

Subscription *

Azure subscription 1

Resource group *

Hub-Spoke

[Create new](#)

Instance details

Region *

East US

Name *

LNG

Endpoint ⓘ

IP address

FQDN

IP address * ⓘ

40.85.146.172

Address Space(s) ⓘ

10.3.0.0/16

✓

✕ ...

Add additional address range

Review + create

Previous

Next : Advanced >

Step12: Now Create a S2S connection between on-premise VM and HUB VM

Microsoft Azure

Search resources, services, and docs (G+)

Home > Virtual network gateways > Hub-Gateway | Connections >

Create connection

Basics

Settings

Tags

Review + create

Create a secure connection to your virtual network by using VPN Gateway or ExpressRoute.
[Learn more about VPN Gateway](#)
[Learn more about ExpressRoute](#)

Project details

Subscription *

Azure subscription 1

Resource group *

Hub-Spoke

Create new

Instance details

Connection type * ⓘ

Site-to-site (IPsec)

Name *

S2S

Region *

East US

Review + create

Previous

Next : Settings >

Download a template for automation

Microsoft Azure

Search resources, services, and docs (G+)

Home > NoMarketplace-20230721130254 | Overview >

S2S

Connection

Search

Refresh

Move

Download configuration

Delete

Overview

Activity log

Access control (IAM)

Tags

Settings

Authentication Type

Essentials

Resource group (move) : [Hub-Spoke](#)

Status : Unknown

Location : East US

Subscription (move) : [Azure subscription 1](#)

Subscription ID : 0d0c78f5-1b8c-4893-8be4-1adc12a78d78

Tags (edit) : [Click here to add tags](#)

Data in : 0 B

Data out : 0 B

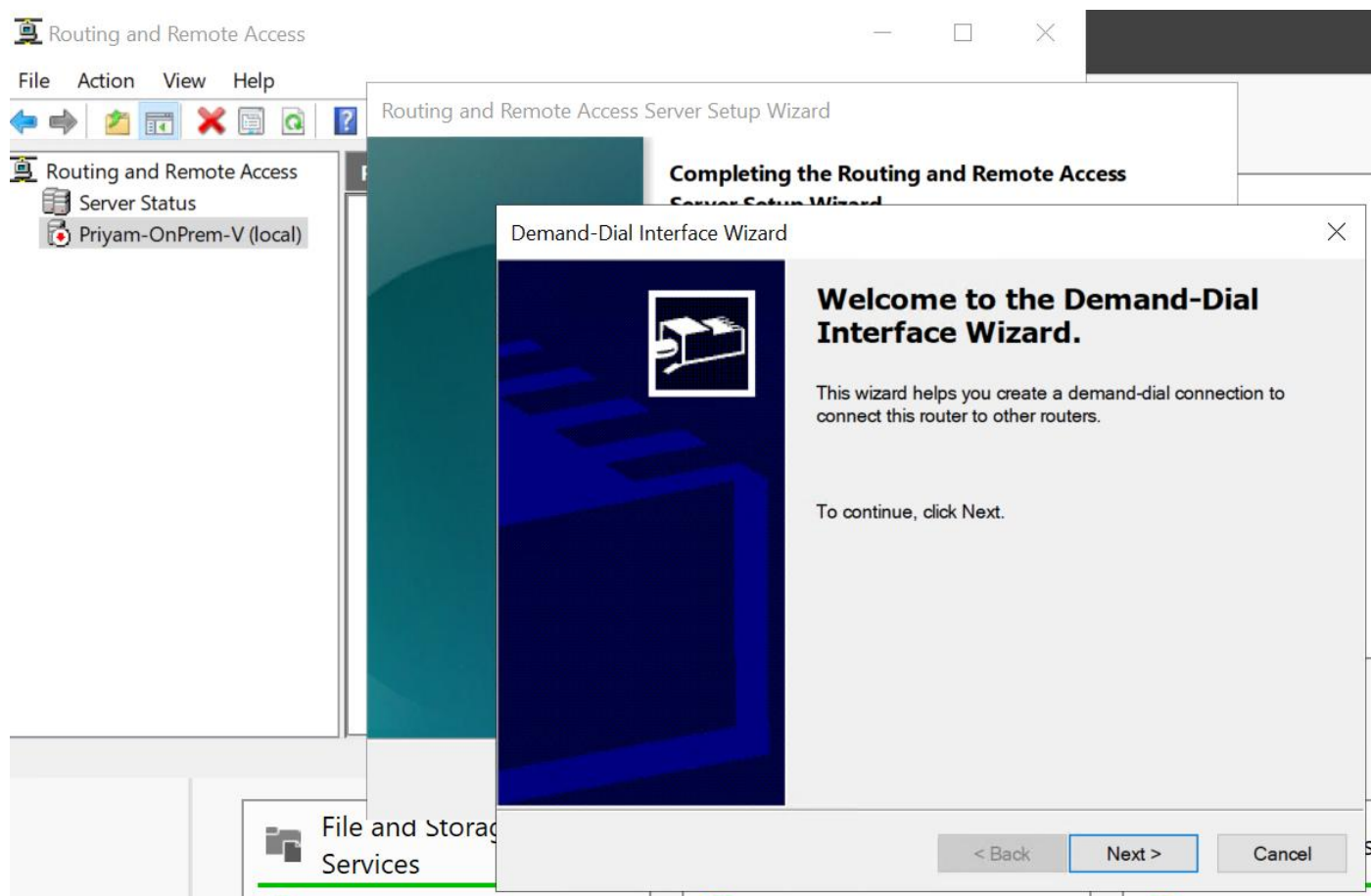
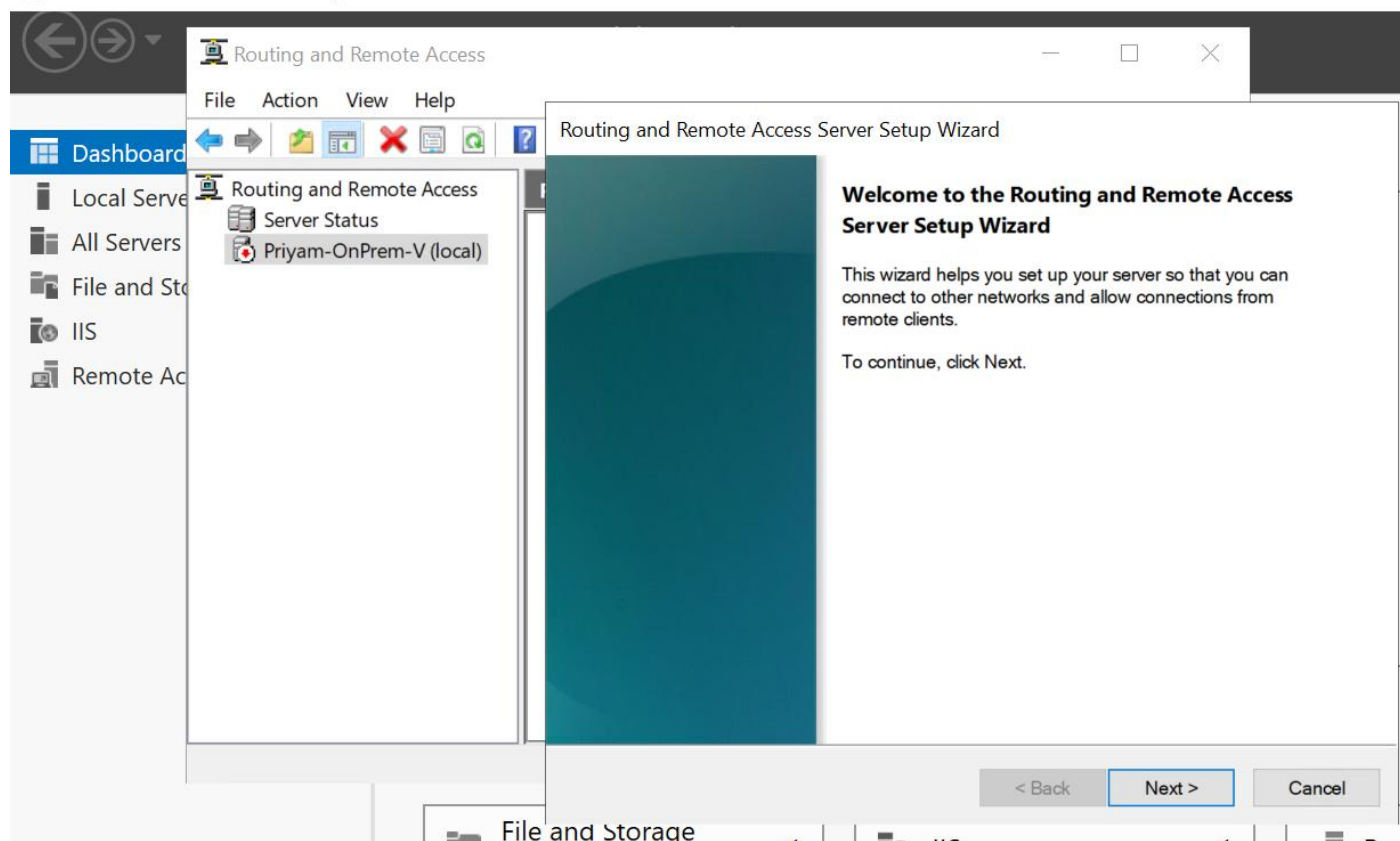
Virtual network : [Priyam-Hub-VM-vnet](#)

Virtual network gateway : [Hub-Gateway](#)

Local network gateway : [LNG \(40.85.146.172\)](#)

Step13: Configure the setting inside the on-premise ans establish the S2S connection.

40.85.146.172 - Remote Desktop Connection



Completing the Routing and Remote Access Server Setup Wizard

Demand-Dial Interface Wizard

VPN Type

Select the type of VPN connection you want to create.

- ☐ Automatic selection
- ☐ Point to Point Tunneling Protocol (PPTP)
- ☐ Layer 2 Tunneling Protocol (L2TP)
- ☒ IKEv2

< Back

Next >

Cancel

Completing the Routing and Remote Access Server Setup Wizard

Demand-Dial Interface Wizard

Destination Address

What is the name or address of the remote router?

Enter the name or IP address of the router you are connecting to.

Host name or IP address (such as microsoft.com or 157.54.0.1 or 3ffe:1234::1111):

172.174.24.213

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Next >

Cancel

Demand-Dial Interface Wizard



Static Routes for Remote Networks

A static route is a manually defined, permanent route between two networks.



To activate this demand-dial connection, you must add a static route to the network. Specify the IP address of the remote networks this network will communicate with.

Static Routes:

Destination	Network Mask/Prefix length	Metric
10.0.0.0	255.255.0.0	25

Add

Remove

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Next >

Cancel

Routing and Remote Access

File Action View



Routing and Remote Access

Server Status

Priyam-OnPrem

Network Interface

Ports

Remote Access

IPv4

IPv6

General

Static Routes

S2S Properties



General Options Security Networking

Type of VPN:

IKEv2

Advanced Settings

Data encryption:

Require encryption (disconnect if server declines)

Authentication

☐ Use Extensible Authentication Protocol (EAP)

Properties

☐ Use machine certificates

☐ Verify the Name and Usage attributes of the server's certificate

☒ Use preshared key for authentication

Key:

1234

OK

Cancel

Step14: Check if the S2S connection has been connected in the HUB Gateway

way

Hub-Gateway | Connections

Virtual network gateway

Search Add Refresh

Search connections

Name	↑↓ Status	↑↓ Connection type	↑↓ Peer
S2S	Connected	Site-to-site (IPsec)	LNG

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

Settings

- Configuration
- Connections
- Point-to-site configuration
- Properties
- Locks

Monitoring

- Logs
- Alerts
- Metrics
- BGP peers

Step15: Open on-prem Vm and Hub Vm and ping to test the connection between them.

40.85.146.172 - Remote Desktop Connection

Recycle Bin

Administrator: Windows PowerShell

```
PS C:\Users\Priyam2> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : mau0flie3mmexo5qveu5qknp.c.d
    Link-local IPv6 Address . . . . . : fe80::495d:669b:8cea:9f19%6
    IPv4 Address. . . . . : 10.3.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.3.0.1

PPP adapter S2S:

    Connection-specific DNS Suffix  . :
    Autoconfiguration IPv4 Address. . : 169.254.0.27
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . :

PS C:\Users\Priyam2> ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:
Reply from 10.0.0.4: bytes=32 time=149ms TTL=127
Reply from 10.0.0.4: bytes=32 time=84ms TTL=127
Reply from 10.0.0.4: bytes=32 time=72ms TTL=127
Reply from 10.0.0.4: bytes=32 time=72ms TTL=127

Ping statistics for 10.0.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 72ms, Maximum = 149ms, Average = 94ms
PS C:\Users\Priyam2> tracert 10.0.0.4

Tracing route to 10.0.0.4 over a maximum of 30 hops

  1  <1 ms  <1 ms  <1 ms  Priyam-OnPrem-V.mau0flie3mmexo5qveu5qknp.c.d
  2  72 ms  72 ms  73 ms  10.0.0.4

Trace complete.
```

4.246.160.171 - Remote Desktop Connection

Administrator: Windows PowerShell

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\Priyam> hostname
Priyam-Hub-VM
PS C:\Users\Priyam> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : ppj4b5pt3b4upaj2mzk3js1hvh.bx.internal.cloudapp.net
    Link-local IPv6 Address . . . . . : fe80::5c42:e6bc:6416:229e%6
    IPv4 Address. . . . . : 10.0.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.0.0.1

PS C:\Users\Priyam> ping 10.3.0.4

Pinging 10.3.0.4 with 32 bytes of data:
Reply from 10.3.0.4: bytes=32 time=72ms TTL=127
Reply from 10.3.0.4: bytes=32 time=72ms TTL=127
Reply from 10.3.0.4: bytes=32 time=73ms TTL=127
Reply from 10.3.0.4: bytes=32 time=72ms TTL=127

Ping statistics for 10.3.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 72ms, Maximum = 73ms, Average = 72ms
PS C:\Users\Priyam> tracert 10.3.0.4

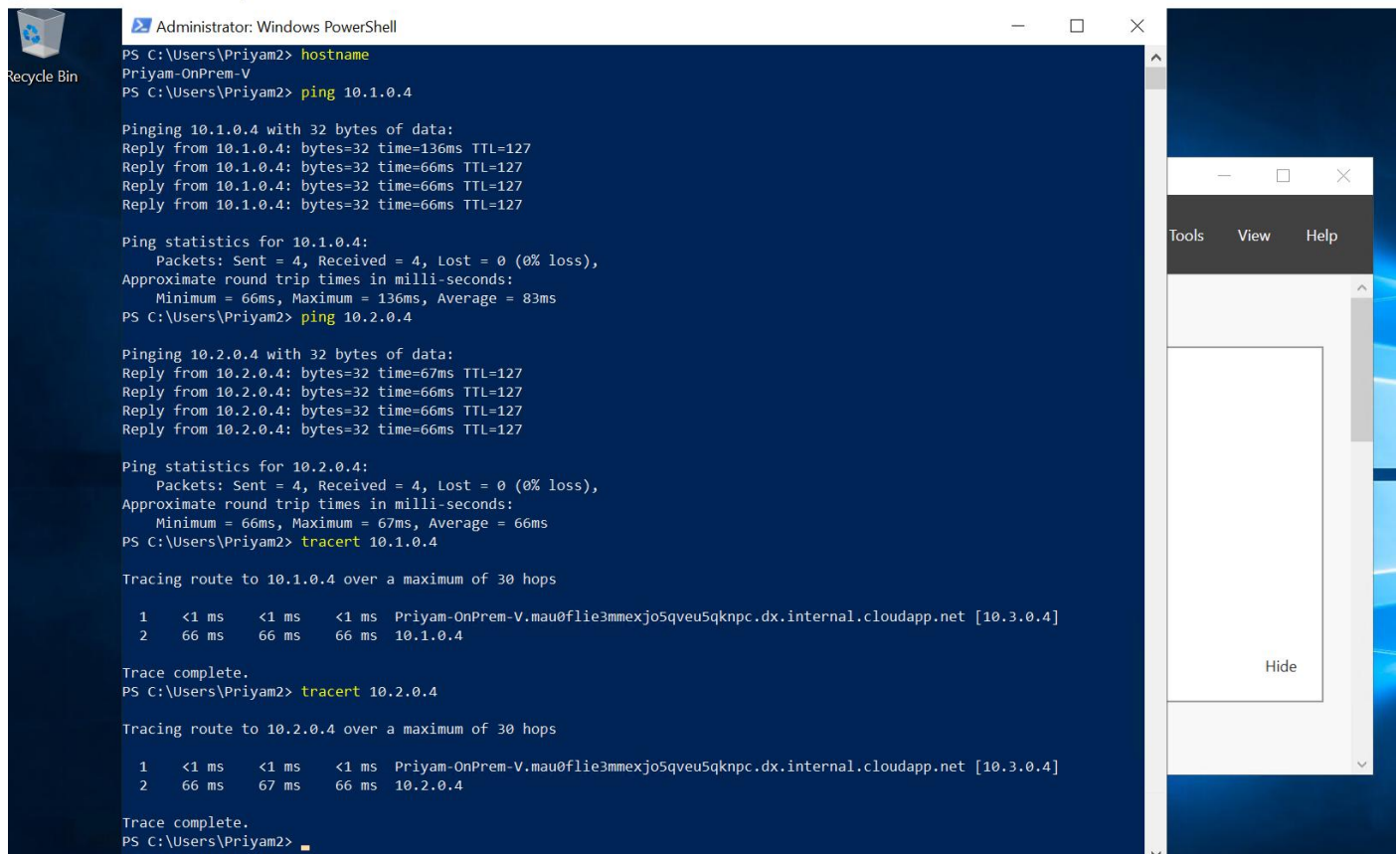
Tracing route to 10.3.0.4 over a maximum of 30 hops

  1  73 ms  72 ms  72 ms  169.254.0.27
  2  72 ms  72 ms  72 ms  10.3.0.4

Trace complete.
```

Step16: On on-prem Vm test the connection if the traffic is flowing to spoke1&spoke2 through the Hub.

40.85.146.172 - Remote Desktop Connection



```
PS C:\Users\Priyam2> hostname
Priyam-OnPrem-V
PS C:\Users\Priyam2> ping 10.1.0.4

Pinging 10.1.0.4 with 32 bytes of data:
Reply from 10.1.0.4: bytes=32 time=136ms TTL=127
Reply from 10.1.0.4: bytes=32 time=66ms TTL=127
Reply from 10.1.0.4: bytes=32 time=66ms TTL=127
Reply from 10.1.0.4: bytes=32 time=66ms TTL=127

Ping statistics for 10.1.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 66ms, Maximum = 136ms, Average = 83ms
PS C:\Users\Priyam2> ping 10.2.0.4

Pinging 10.2.0.4 with 32 bytes of data:
Reply from 10.2.0.4: bytes=32 time=67ms TTL=127
Reply from 10.2.0.4: bytes=32 time=66ms TTL=127
Reply from 10.2.0.4: bytes=32 time=66ms TTL=127
Reply from 10.2.0.4: bytes=32 time=66ms TTL=127

Ping statistics for 10.2.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 66ms, Maximum = 67ms, Average = 66ms
PS C:\Users\Priyam2> tracert 10.1.0.4

Tracing route to 10.1.0.4 over a maximum of 30 hops:

  1  <1 ms  <1 ms  <1 ms  Priyam-OnPrem-V.mau0flie3mmexjo5qveu5qknp.c.internal.cloudapp.net [10.3.0.4]
  2   66 ms   66 ms   66 ms   10.1.0.4

Trace complete.
PS C:\Users\Priyam2> tracert 10.2.0.4

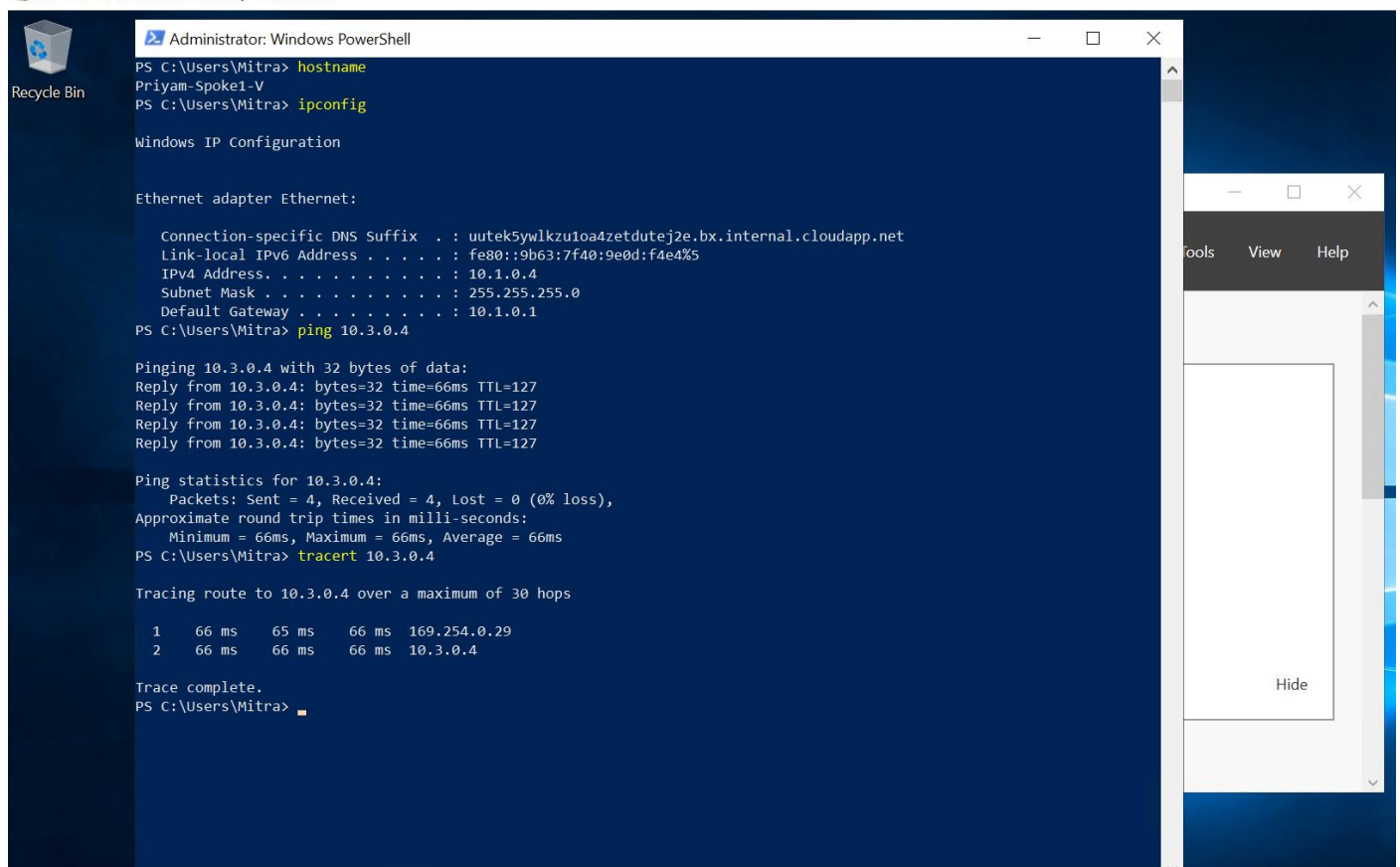
Tracing route to 10.2.0.4 over a maximum of 30 hops:

  1  <1 ms  <1 ms  <1 ms  Priyam-OnPrem-V.mau0flie3mmexjo5qveu5qknp.c.internal.cloudapp.net [10.3.0.4]
  2   66 ms   67 ms   66 ms   10.2.0.4

Trace complete.
PS C:\Users\Priyam2>
```

Step17: Open Spoke1 Vm and check the connection by pinging to on-premise VM

74.235.71.74 - Remote Desktop Connection



```
PS C:\Users\Mitra> hostname
Priyam-Spoke1-V
PS C:\Users\Mitra> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : uutek5ywlkzu1oa4zetdutej2e.bx.internal.cloudapp.net
    Link-local IPv6 Address . . . . . : fe80::9b63:7f40:9e0d:f4e4%5
    IPv4 Address. . . . . : 10.1.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.1.0.1
PS C:\Users\Mitra> ping 10.3.0.4

Pinging 10.3.0.4 with 32 bytes of data:
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127

Ping statistics for 10.3.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 66ms, Maximum = 66ms, Average = 66ms
PS C:\Users\Mitra> tracert 10.3.0.4

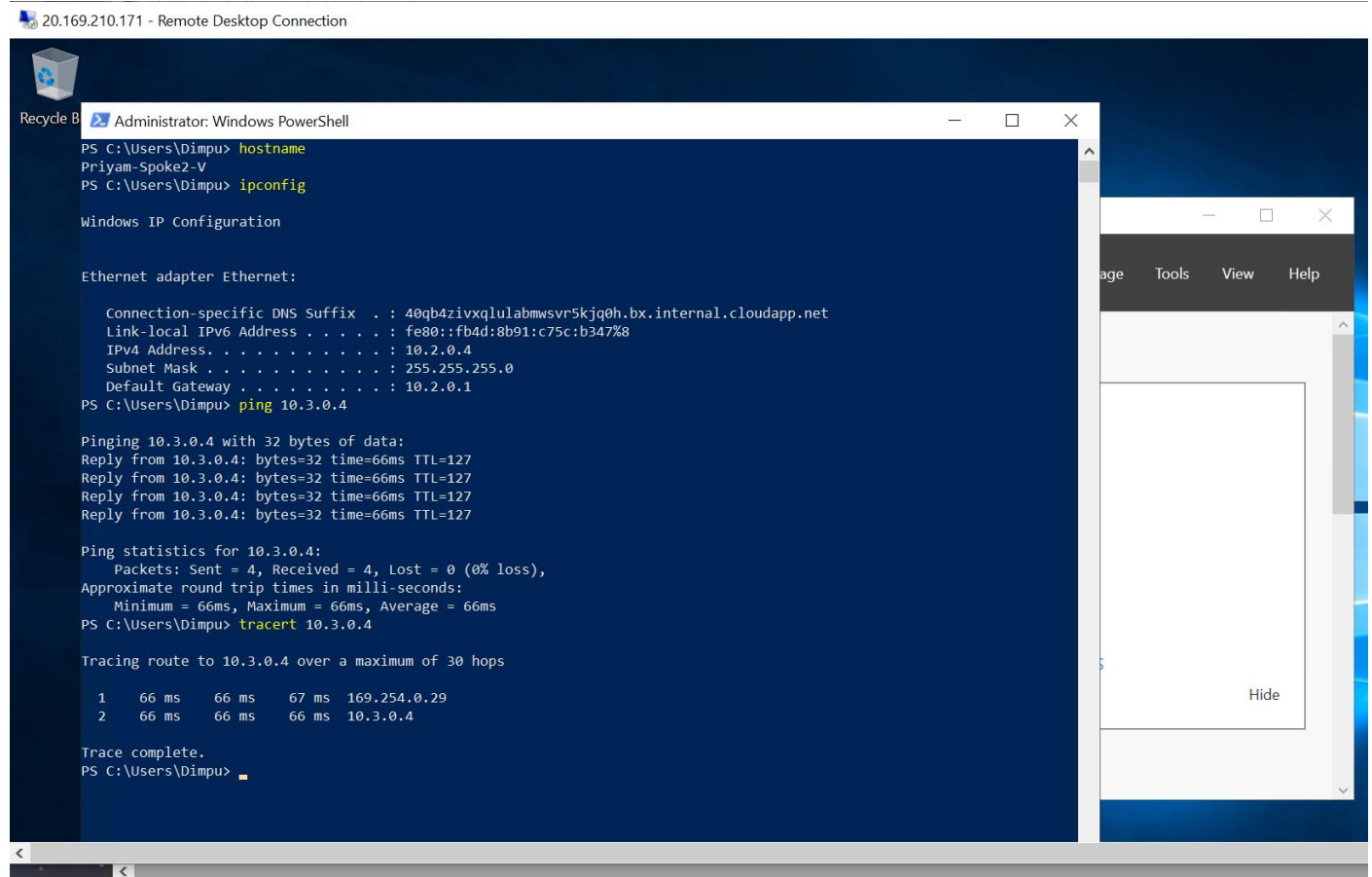
Tracing route to 10.3.0.4 over a maximum of 30 hops:

  1   66 ms   65 ms   66 ms  169.254.0.29
  2   66 ms   66 ms   66 ms  10.3.0.4

Trace complete.
PS C:\Users\Mitra>
```

Step18: Finally open the spoke2 Vm and check the connection by pinging to on-premise connection.

20.169.210.171 - Remote Desktop Connection



```
Administrator: Windows PowerShell
PS C:\Users\Dimpu> hostname
Priyam-Spoke2-V
PS C:\Users\Dimpu> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix  . : 40qb4zivxqlulabmwsvr5kjq0h.bx.internal.cloudapp.net
    Link-local IPv6 Address . . . . . : fe80::fb4d:8b91:c75c:b347%8
    IPv4 Address. . . . . : 10.2.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.2.0.1
PS C:\Users\Dimpu> ping 10.3.0.4

Pinging 10.3.0.4 with 32 bytes of data:
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127
Reply from 10.3.0.4: bytes=32 time=66ms TTL=127

Ping statistics for 10.3.0.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 66ms, Maximum = 66ms, Average = 66ms
PS C:\Users\Dimpu> tracert 10.3.0.4

Tracing route to 10.3.0.4 over a maximum of 30 hops

  0  66 ms  66 ms  67 ms  169.254.0.29
  1  66 ms  66 ms  66 ms  10.3.0.4
  2  66 ms  66 ms  66 ms  10.3.0.4

Trace complete.
PS C:\Users\Dimpu>
```

CONCLUSION:

For organizations looking to integrate their current infrastructure with the cloud, the link between an on-premise VM and a Spoke VM through an Azure Hub offers a reliable and adaptable option. It makes it possible for enterprises to profit from cloud computing while maintaining a stable network environment by enabling seamless connectivity, improved security, and optimal performance.