

ACKNOWLEDGEMENT

I would like to express my sincere gratitude and appreciation to "Celebal Technology" for providing me with the opportunity to undertake a valuable and enriching summer internship in the "Cloud Infrastructure & Security" domain. This experience has been instrumental in shaping my professional growth and has given me invaluable insights into the dynamic world of cloud technologies and security.

First and foremost, I am deeply thankful to the management and leadership team at "Celebal Technology" for entrusting me with significant responsibilities and fostering an environment of continuous learning. Their guidance and support have been pivotal in enhancing my understanding of cloud infrastructure and security principles.

I would also like to extend my heartfelt thanks to my supervisor, Sanskar Pareek, for their mentorship and continuous encouragement throughout my internship. Their expertise in the field and willingness to share knowledge has been instrumental in my personal and professional development.

Additionally, I am indebted to the entire "Cloud Infrastructure & Security" team for their warm welcome and willingness to engage with me as a valuable member of the team. Their collaborative spirit and willingness to answer my questions have been immensely beneficial in improving my technical skills and industry knowledge.

I must acknowledge the support and assistance provided by my fellow interns, whose camaraderie and shared experiences have made this internship even more enjoyable and rewarding.

Thanks,

Mohommadsafik Shaikh
(20IT141)

ABSTRACT

During my summer internship at "Celebal Technology" with a focus on "Cloud Infrastructure & Security" in collaboration with the cloud technology provider "Microsoft Azure," I had the opportunity to delve into the world of cloud computing and gain valuable insights into its practical applications. Throughout the internship, I acquired in-depth knowledge and hands-on experience in various essential concepts, including "Vnet Peering," "Local Network Gateway," "Virtual Network Gateway," and "Site-to-Site Connection."

The internship commenced with an extensive introduction to Microsoft Azure's cloud platform, its architecture, and its various services. As I progressed, I dived into the intricacies of "Vnet Peering," understanding its significance in connecting virtual networks and facilitating seamless communication between them. This concept broadened my understanding of cloud networking and enhanced my proficiency in designing scalable and interconnected infrastructures.

Furthermore, the exploration of "Local Network Gateway" and "Virtual Network Gateway" proved to be crucial in comprehending secure network connectivity, extending on-premises networks to the cloud, and establishing a robust framework for data transmission. Working on practical use cases, I learned how to configure and manage these gateways effectively, ensuring secure and efficient communication.

One of the highlights of my internship was the hands-on experience with "Site-to-Site Connection," a fundamental feature that enables secure and encrypted connections between on-premises infrastructure and the Azure cloud. Understanding the complexities of establishing and maintaining these connections provided valuable insights into safeguarding sensitive data and achieving seamless hybrid cloud integration.

DESCRIPTION OF COMPANY

Celebal Technology is a leading technology company specializing in Cloud Computing services, offering a wide array of solutions to transform businesses into efficient and agile entities. With a robust work flow encompassing planning, design, development, and maintenance, Celebal Technology is at the forefront of delivering cutting-edge cloud solutions to its clients worldwide.

- **Planning**

- At Celebal Technology, the journey towards successful cloud implementation starts with meticulous planning. Our team of skilled professionals works closely with clients to understand their unique requirements, challenges, and goals.

- **Design**

- Once the planning phase is complete, our expert architects and engineers step in to design a tailor-made cloud environment. Leveraging their extensive knowledge of cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, our team crafts robust and secure cloud architectures.

- **Development**

- With a solid design in place, Celebal Technology's development team takes the reins to create customized cloud solutions. Our agile development approach ensures rapid deployment and continuous iteration, allowing businesses to embrace cloud capabilities swiftly and adapt to evolving needs.

- **Different Services Provided**

- Cloud Migration
 - Cloud Security
 - Cloud Automation
 - Cloud Backup and Disaster Recovery

Table Of Contents

Acknowledgement.....	i
Abstract.....	ii
Description of Company/Organization.....	iii
Table of content	iv
Chapter 1 Introduction.....	1
1.1 Training Definition.....	2
1.2 Description.....	2
1.3 Task Requirements.....	2
Chapter 2 Account Setup.....	3
2.1 Requirements.....	4
2.2 What is Subscription Account.....	4
2.3 Steps to Create a Account.....	5
Chapter 3 Create a VM in a Virtual Network.....	6
3.1 Description.....	7
3.2 Screenshot	8
Chapter 4 Create 2 VM in different VNet & perform VNet peering....	11
4.1 Description	12
4.2 Screenshot	12
Chapter 5 Create Site to Site Connections	16
5.1Description.....	17
5.2 Screenshot	17
Chapter 6 Project Definition	23
6.1 Screenshot	24

Chapter 7 Outcomes	34
7.1 Outcomes	34
Chapter 8 Conclusion	36
8.1 Conclusion	37
Chapter 9 Reference	38

Chapter – 1 : Introduction

1.1 Training Definition

Microsoft Azure offers a range of training programs to help individuals and businesses understand and leverage the power of cloud computing. The training focuses on various aspects of Azure, equipping participants with the knowledge and skills needed to deploy, manage, and optimize cloud-based solutions effectively.

1.2 Description

IaaS: Microsoft Azure's Infrastructure as a Service offers virtualized computing resources, including virtual machines, storage, and networking components. Users can provision, manage, and scale these resources as needed, without the complexities of managing physical infrastructure.

PaaS: Platform as a Service in Azure enables developers to build, deploy, and manage applications without worrying about underlying infrastructure. Azure's PaaS offerings include application hosting, databases, and development frameworks, streamlining the application development and deployment process.

SaaS: Microsoft Azure's Software as a Service model delivers software applications over the internet, eliminating the need for installation and maintenance. Users can access these applications directly through a web browser, enhancing productivity and reducing the burden of software management.

1.3 Task Requirement

- Knowledge of Cloud Computing
- Need one Cloud Platform for Development (Microsoft Azure)
- Need one Subscription account for Deployment resource in Cloud.

Chapter – 2 : Account Setup

2.1 Requirement

- **Access to Services:** An Azure account grants you access to a wide range of cloud computing services provided by Microsoft. These services include virtual machines, storage, databases, machine learning, networking, and more.
- **Resource Management:** Having an Azure account allows you to create and manage cloud resources efficiently. You can provision virtual machines, set up databases, create storage accounts, and deploy various applications and services in the cloud.
- **Billing and Usage Tracking:** Azure accounts are associated with billing and payment information. With an account, you can track your cloud usage and understand the costs incurred by your cloud resources.
- **Security and Identity Management:** An Azure account plays a crucial role in securing your cloud resources. It serves as an identity for you and your team members, allowing you to control access to resources and set permissions.
- **Compliance and Support:** Microsoft Azure provides various compliance certifications, ensuring that your cloud infrastructure meets industry and regulatory standards. Having an Azure account allows you to leverage these compliant services and build applications that adhere to specific regulations.
- **Integration with Developer Tools:** An Azure account seamlessly integrates with various developer tools and services. It enables you to use Azure DevOps for continuous integration and continuous deployment (CI/CD), access Azure APIs and SDKs, and collaborate with other developers using Azure services.

2.2 What is Subscription Account ?

In Microsoft Azure, a "subscription" is an agreement between a customer and Microsoft that provides access to Azure services and resources. It is the fundamental billing unit in Azure, and each subscription is associated with a unique Azure tenant.

- Billing and Usage

- Resource Isolation
- Resource Quotas
- Resource Groups
- Management and Permissions
- Azure Policy and Governance
- Azure Resource Manager (ARM)

2.3 Creating a Microsoft Azure Student subscription account

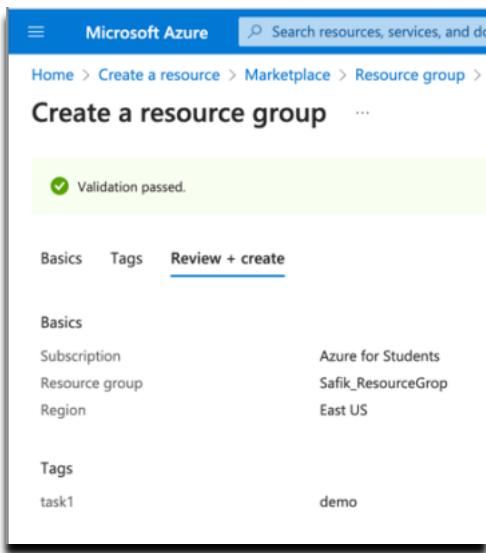
- Sign up for Azure for Students
- Sign in with Microsoft Account
- Verify Your Status as a Student
- Complete Verification and Get Access
- Access Azure Portal
- Activate Azure for Students Offer
- Start Exploring Azure

Chapter – 3 : Create a VM in a Virtual Network

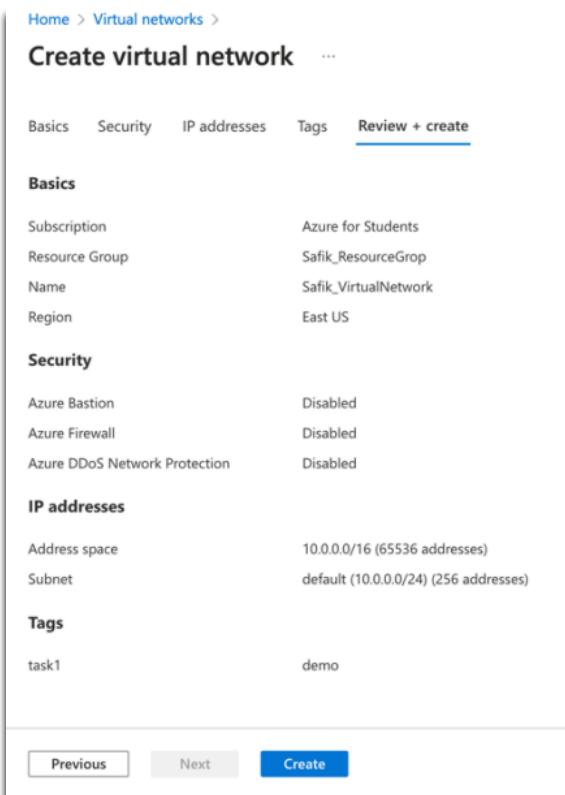
3.1 Description

- **Resource Group :**
 - A resource group is a container that holds related resources for an Azure solution. The resource group can include all the resources for the solution, or only those resources that you want to manage as a group. You decide how you want to allocate resources to resource groups based on what makes the most sense for your organization. Generally, add resources that share the same lifecycle to the same resource group so you can easily deploy, update, and delete them as a group.
- **Virtual Network :**
 - Azure Virtual Network is the fundamental building block for your private network in Azure. A virtual network enables many types of Azure resources, such as Azure Virtual Machines (VM), to securely communicate with each other, the internet, and on-premises networks. A virtual network is similar to a traditional network that you'd operate in your own data center. An Azure Virtual Network brings with it extra benefits of Azure's infrastructure such as scale, availability, and isolation.
- **Virtual Machine :**
 - Azure virtual machines are one of several types of on-demand, scalable computing resources that Azure offers. Typically, you choose a virtual machine when you need more control over the computing environment than the other choices offer. An Azure virtual machine gives you the flexibility of virtualization without having to buy and maintain the physical hardware that runs it. However, you still need to maintain the virtual machine by performing tasks, such as configuring, patching, and installing the software that runs on it.

3.2 Screenshot



1. Create resource-group.



2. Create Virtual network.

3. Create Virtual machine.

4. Dashboard of Virtual-Machine.

20IT141

Create 2 VM in different VNet & perform
VNet peering

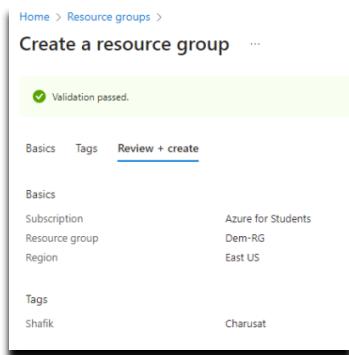
Chapter – 4 : Create 2 VM in different VNet & perform VNet peering

4.1 Description

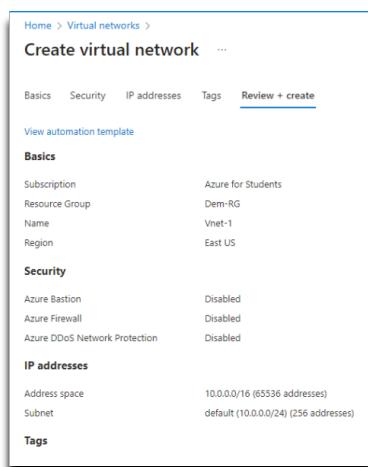
- **Azure Peering :**

- Azure Peering Service is a networking service that enhances the connectivity to Microsoft cloud services such as Microsoft 365, Dynamics 365, software as a service (SaaS) services, Azure, or any Microsoft services accessible via the public internet.

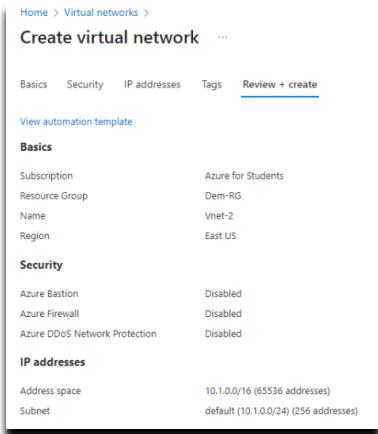
4.2 Screenshot



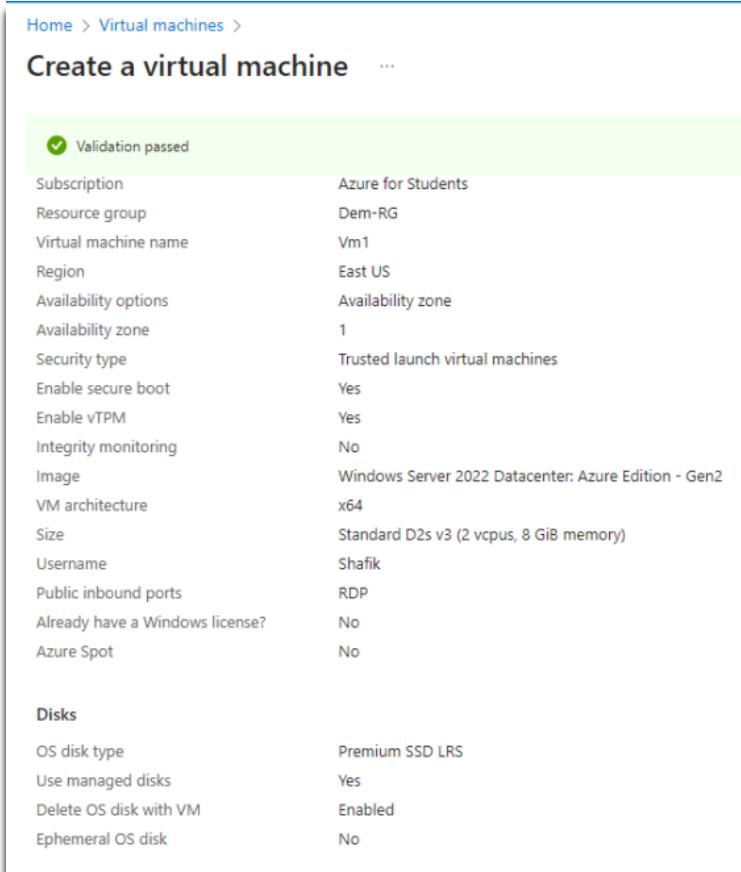
1. Create Resource Group.



2. Create Virtual Network.



3. Create Second VNet.



4. Create Virtual machine with Vnet-1.

Home > Virtual machines >

Create a virtual machine

✓ Validation passed

Subscription	Azure for Students
Resource group	Dem-RG
Virtual machine name	Vm2
Region	East US
Availability options	Availability zone
Availability zone	1
Security type	Trusted launch virtual machines
Enable secure boot	Yes
Enable vTPM	Yes
Integrity monitoring	No
Image	Windows Server 2022 Datacenter: Azure Edition - Gen2
VM architecture	x64
Size	Standard D2s v3 (2 vcpus, 8 GiB memory)
Username	Shafik2
Public inbound ports	RDP
Already have a Windows license?	No
Azure Spot	No
Disk	
OS disk type	Premium SSD LRS
Use managed disks	Yes
Delete OS disk with VM	Enabled
Ephemeral OS disk	No

5. Create VM-2 with Vnet-2.

Home > Vnet-1 | Peering >

Add peering

Vnet-1

! For peering to work, two peering links must be created. By selecting remote virtual network, Azure will create both peering links.

This virtual network

Peering link name *

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 *

Virtual network deployment model

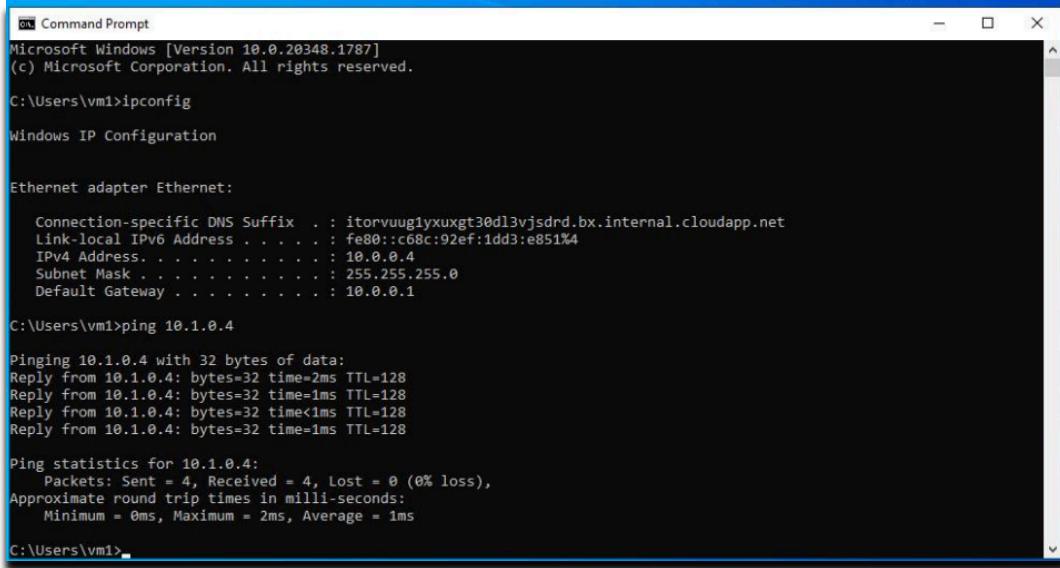
Resource manager

Classic

I know my resource ID

Add

6. Create Vnet-Peering between Vnet-1 and Vnet-2.



```

cmd Command Prompt
Microsoft Windows [Version 10.0.20348.1787]
(c) Microsoft Corporation. All rights reserved.

C:\Users\vm1>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

  Connection-specific DNS Suffix . : itorvuug1yxuxgt30dl3vjsdrd.bx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::c08c:92ef:1dd3:e851%4
  IPv4 Address . . . . . : 10.0.0.4
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.0.0.1

C:\Users\vm1>ping 10.1.0.4

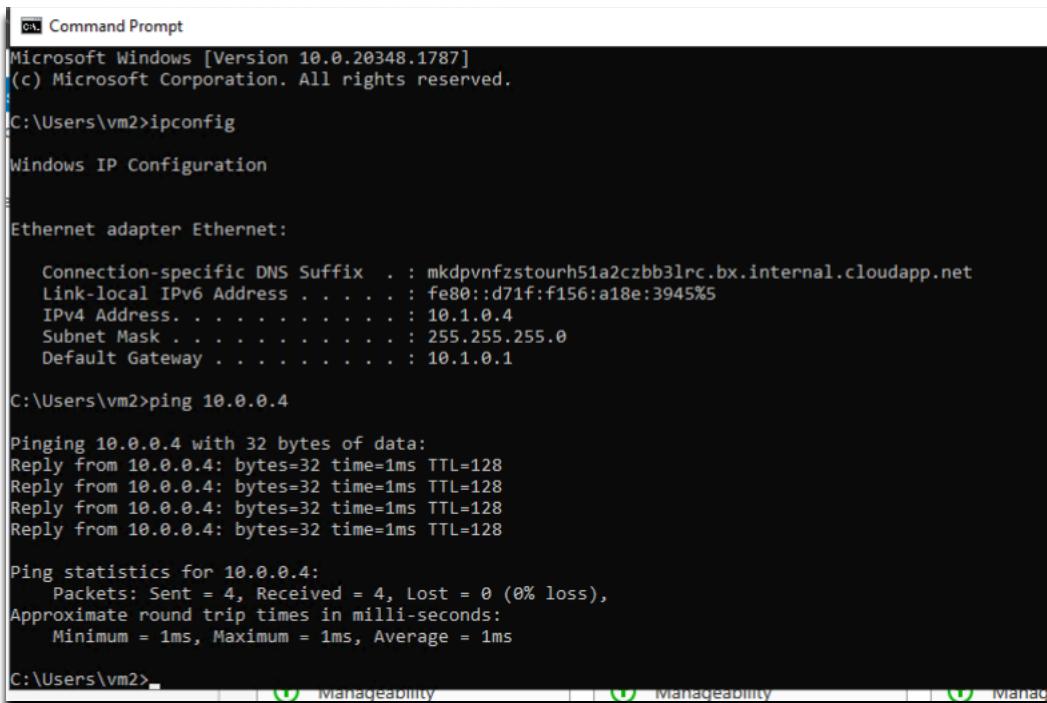
Pinging 10.1.0.4 with 32 bytes of data:
Reply from 10.1.0.4: bytes=32 time=2ms TTL=128
Reply from 10.1.0.4: bytes=32 time=1ms TTL=128
Reply from 10.1.0.4: bytes=32 time<1ms TTL=128
Reply from 10.1.0.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.1.0.4:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 1ms

C:\Users\vm1>

```

7. Pinging Vm1 to Vm2 with use of Vnet peering.



```

cmd Command Prompt
Microsoft Windows [Version 10.0.20348.1787]
(c) Microsoft Corporation. All rights reserved.

C:\Users\vm2>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

  Connection-specific DNS Suffix . : mkdpvnfzstourh51a2czbb3lrc.bx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::d71f:f156:a18e:3945%5
  IPv4 Address . . . . . : 10.1.0.4
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.1.0.1

C:\Users\vm2>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:
Reply from 10.0.0.4: bytes=32 time=1ms TTL=128

Ping statistics for 10.0.0.4:
  Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
  Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\vm2>

```

8. Pinging Vm2 to Vm1 with use of Vnet peering.

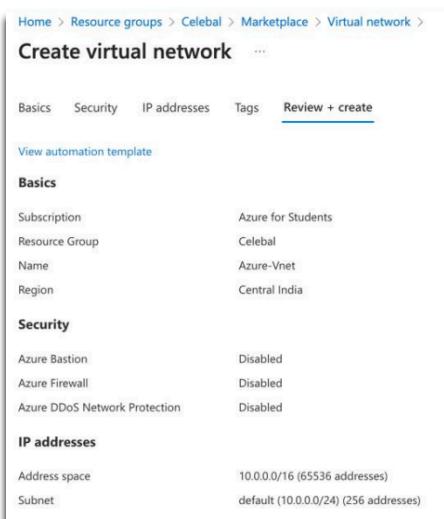
Chapter – 5 : Create Site to Site Connections

5.1 Description

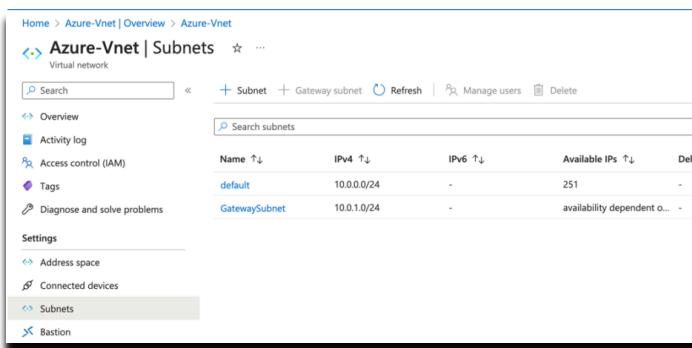
- **Azure Site to Site Connections :**

- Site-to-Site (S2S) Connection is a networking feature in Microsoft Azure that enables the secure connection between an on-premises network and a virtual network (VNet) in Azure. It allows organizations to extend their on-premises network to the cloud, creating a hybrid network architecture.

5.2 Screenshot



1. Create Vnet in central-india region.



2. In Vnet add GatewaySubnets

Home > Virtual network gateways >

Create virtual network gateway

Validation passed

Basics Tags **Review + create**

Basics

Subscription	Azure for Students
Resource group	Celebal
Name	Vnet-GW
Region	Central India
SKU	VpnGw1
Generation	Generation1
Virtual network	Azure-Vnet
Subnet	GatewaySubnet (10.0.1.0/24)
Gateway type	Vpn
VPN type	RouteBased
Enable active-active mode	Disabled
Configure BGP	Disabled
Public IP address	Vnet-Public-Ip

3. Create Virtual network Gateway.

Home > Virtual networks >

Create virtual network

Basics Security IP addresses Tags **Review + create**

[View automation template](#)

Basics

Subscription	Azure for Students
Resource Group	Onprem-RG
Name	OnPrem-Vnet
Region	Central India

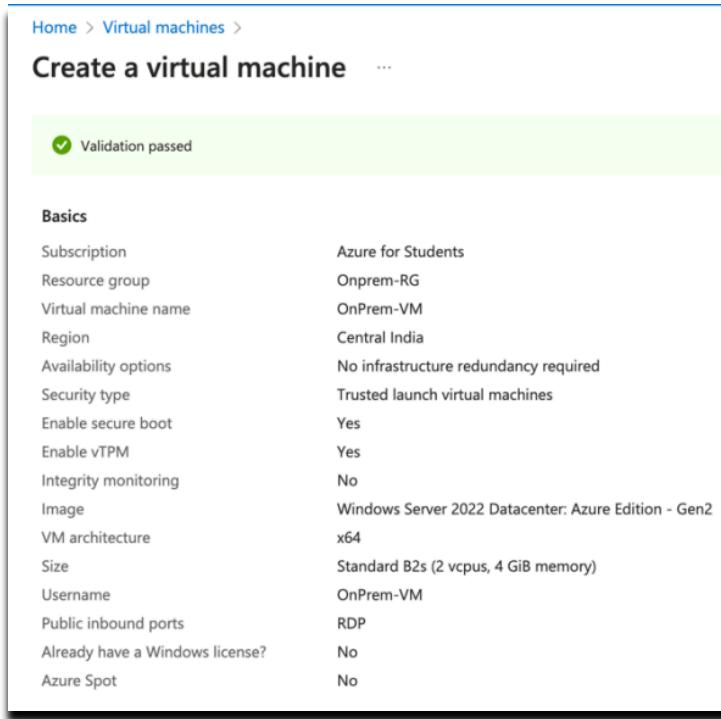
Security

Azure Bastion	Disabled
Azure Firewall	Disabled
Azure DDoS Network Protection	Disabled

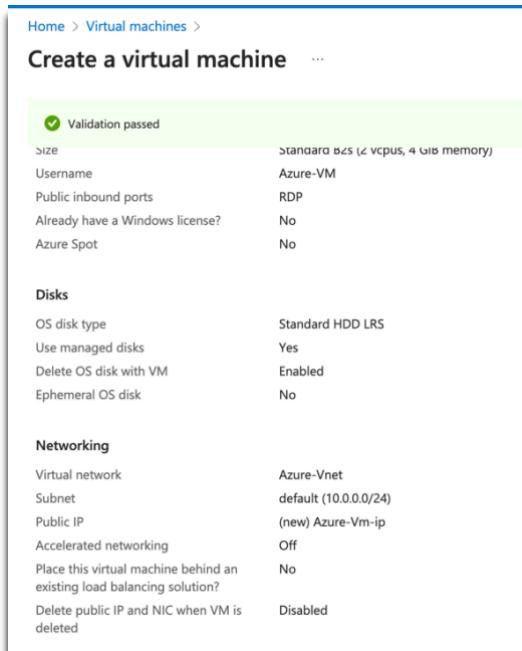
IP addresses

Address space	10.1.0.0/16 (65536 addresses)
Subnet	default (10.1.0.0/24) (256 addresses)

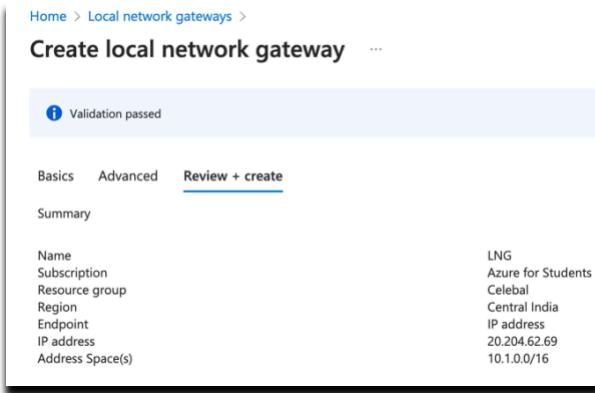
4. Create second Vnet in Onprem-RG.



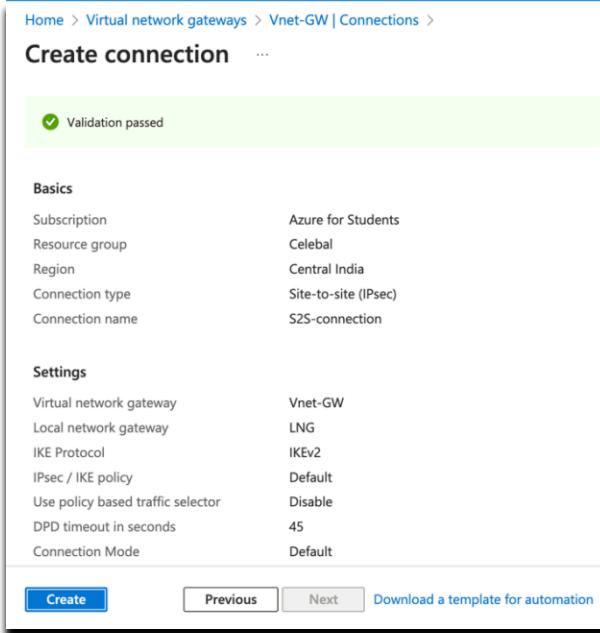
5. Create Virtual Machine in OnPrem-RG.



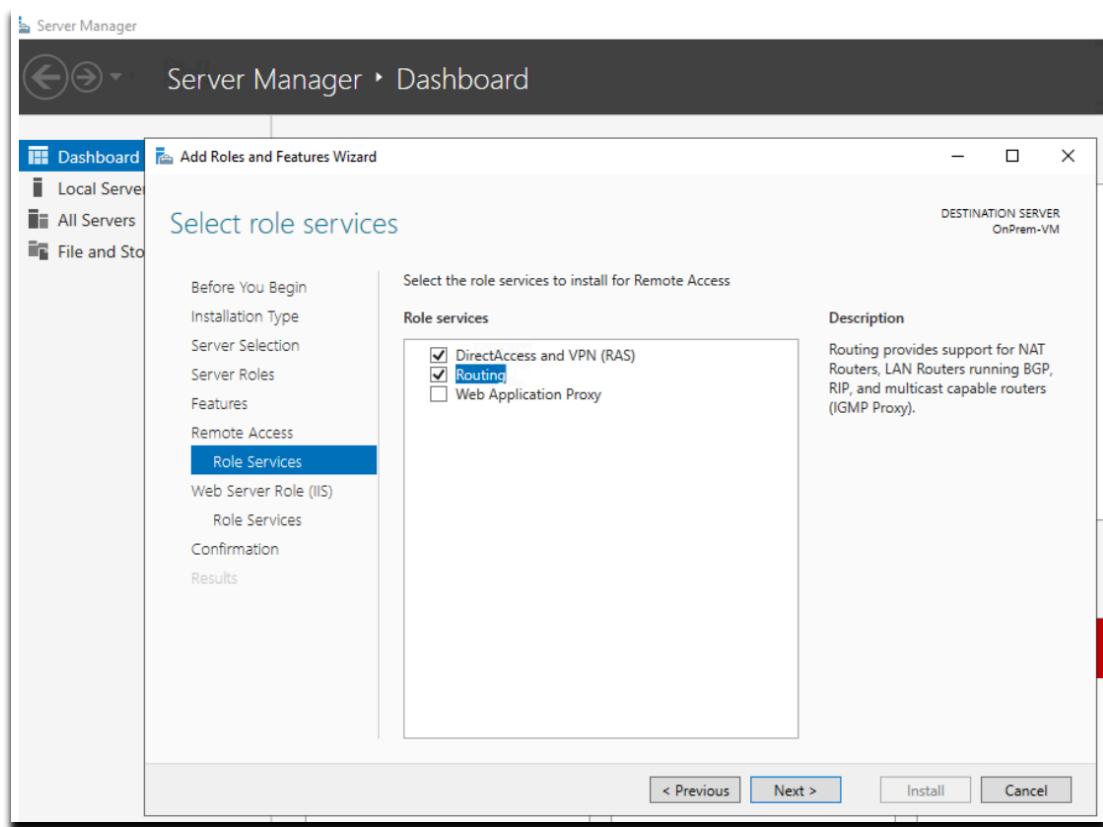
6. Create second VM for Azure.



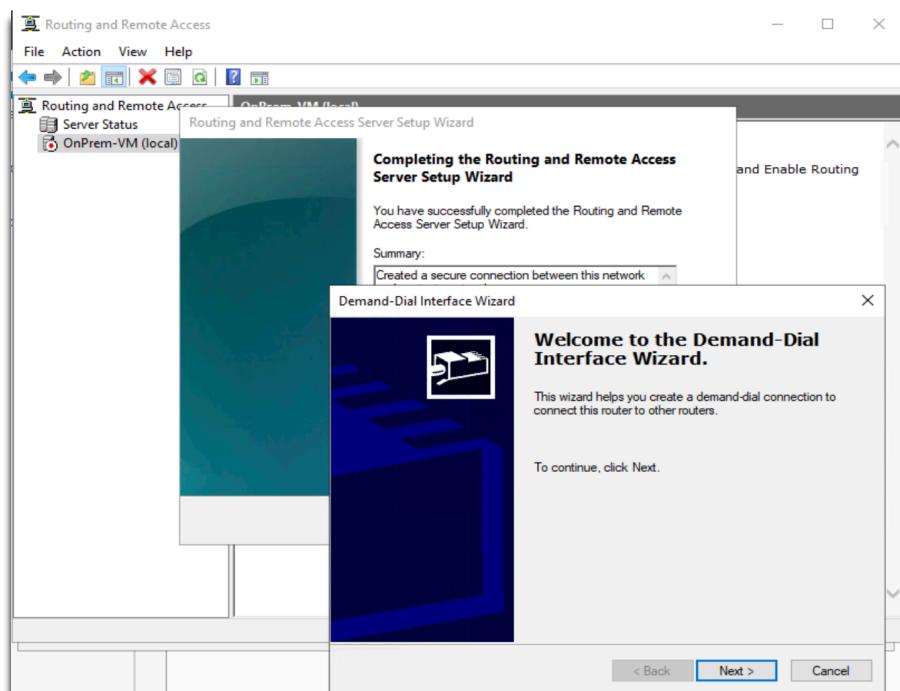
7. Create Local Virtual gateway.



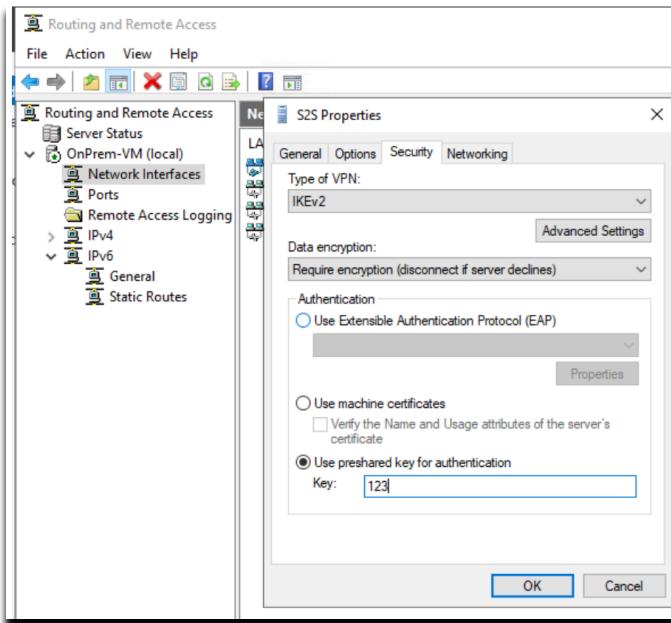
8. Create Site-to-Site Connection.



9. Start Onprem-VM and add Role Services.



10. Configure RRAS Network in OnPrem-Vm.



11. Configure S2S Properties.

```

20.219.153.48 - Remote Desktop Connection
Administrator: Command Prompt
C:\Users\Azure-VM>hostname
Azure-VM

C:\Users\Azure-VM>ipconfig
Windows IP Configuration

Ethernet adapter Ethernet:

  Connection-specific DNS Suffix . : 0rgkzwcmbyvhj0z3ryueuqsae.rx.int
  Link-local IPv6 Address . . . . . : fe80::680:5437:9cc2:eec7%6
  IPv4 Address . . . . . : 10.0.0.4
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.0.0.1

C:\Users\Azure-VM>ping 10.1.0.4

Pinging 10.1.0.4 with 32 bytes of data:
Reply from 10.1.0.4: bytes=32 time=1ms TTL=127
Reply from 10.1.0.4: bytes=32 time=2ms TTL=127
Reply from 10.1.0.4: bytes=32 time=2ms TTL=127
Reply from 10.1.0.4: bytes=32 time=2ms 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 = 1ms, Maximum = 2ms, Average = 1ms
C:\Users\Azure-VM>

20.204.62.69 - Remote Desktop Connection
Administrator: Command Prompt
Recycle Bin

Ethernet adapter Ethernet:

  Connection-specific DNS Suffix . : a20etq2i0sjeteyluddqt5y4nd.rnai.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::118a:7bda:d825:a07d%6
  IPv4 Address . . . . . : 10.1.0.4
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.1.0.1

PPP adapter S2S:

  Connection-specific DNS Suffix . :
  Autoconfiguration IPv4 Address . . . . . : 169.254.0.26
  Subnet Mask . . . . . : 255.255.0.0
  Default Gateway . . . . . :

C:\Users\OnPrem-VM>ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:
Reply from 10.0.0.4: bytes=32 time=5ms TTL=127
Reply from 10.0.0.4: bytes=32 time=2ms TTL=127
Reply from 10.0.0.4: bytes=32 time=2ms TTL=127
Reply from 10.0.0.4: bytes=32 time=2ms 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 = 2ms, Maximum = 5ms, Average = 2ms
C:\Users\OnPrem-VM>

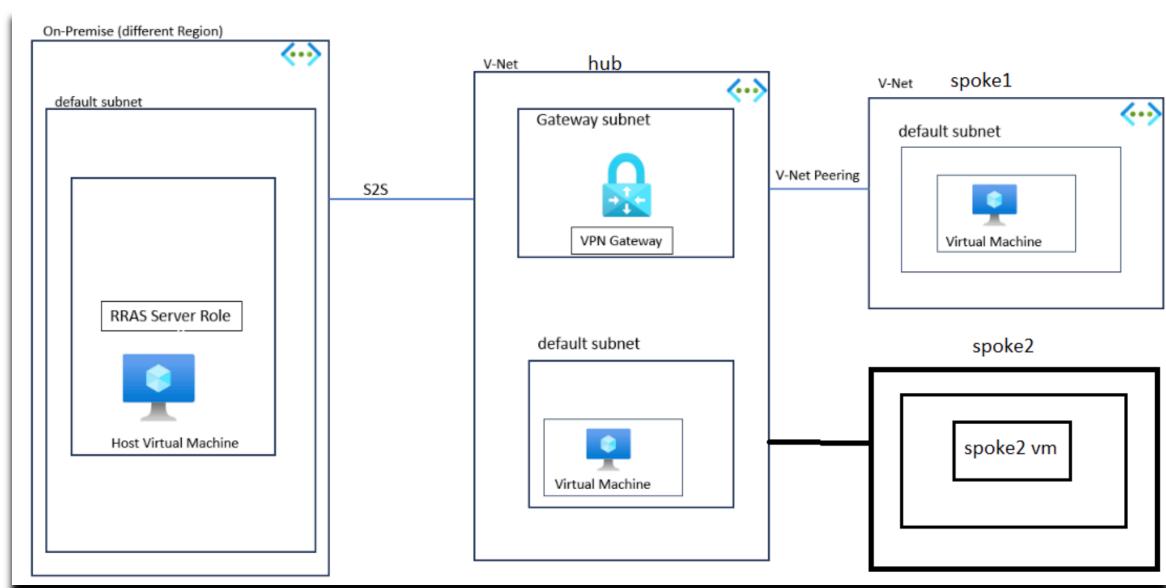
```

Pinging OnPrem-VM to Azure-Vm and Azure-Vm to OnPrem-VM.

Chapter – 6 : Project Definition

6.1 Project Definition

- Project Description Configuration of On-premises to Hub and Spoke connectivity using S2S tunneling from On-premises and hub and Transit Vnet peering from hub to spoke. Configure RRAS on on-premises VM and establish S2S connectivity to the Hub. The On-premises VM should be able to ping both Hub VM and Spoke VM successfully. The connectivity should be bi-directional. There is no direct connectivity established between spoke and On-premises Vnet.



6.2 Screenshot

Resource groups

Showing 1 to 5 of 5 records.

Name	Subscription
NetworkWatcherRG	Azure for Students
safik_HUB_RG	Azure for Students
safik_OnPrem_RG	Azure for Students
safik_Spoke1_RG	Azure for Students
safik_Spoke2_RG	Azure for Students

1. Create resource Group for HUB , OnPrem, Spoke1 , Spoke2.

Virtual networks

Showing 1 to 4 of 4 records.

Name	Resource group	Location
safik_Hub_Vnet	safik_HUB_RG	Central India
safik_Onprem_vnet	safik_OnPrem_RG	East US
safik_Spoke1_Vnet	safik_Spoke1_RG	Central India
safik_Spoke2_RG	safik_Spoke2_RG	Central India

2. Create Virtual Network for HUB , OnPrem , Spoke1 , Spoke2.

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources. [Learn more](#)

Subscription *	Azure for Students
Resource group ⓘ	safik_HUB_RG (derived from virtual network's resource group)
Instance details	
Name *	safik_VNG
Region *	Central India
Gateway type * ⓘ	<input checked="" type="radio"/> VPN <input type="radio"/> ExpressRoute
VPN type * ⓘ	<input checked="" type="radio"/> Route-based <input type="radio"/> Policy-based
SKU * ⓘ	VpnGw3AZ
Generation ⓘ	Generation2
Virtual network * ⓘ	safik_Hub_Vnet
Create virtual network	

3. Create Virtual Network Gateway.

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Define network connectivity for your virtual machine by configuring network interface card (NIC) settings. You can control ports, inbound and outbound connectivity with security group rules, or place behind an existing load balancing solution. [Learn more](#)

Network interface

When creating a virtual machine, a network interface will be created for you.

Virtual network * ⓘ	safik_Onprem_vnet
Create new	
Subnet * ⓘ	default (10.3.0.0/24)
Manage subnet configuration	
Public IP ⓘ	(new) safik-Onprem-VM-ip
Create new	
NIC network security group ⓘ	<input type="radio"/> None <input checked="" type="radio"/> Basic <input type="radio"/> Advanced

4. Networking Details of VNG.

safik_VNG ⌘ ⚡ ⚙ ...

Virtual network gateway

Search Refresh → Move ↺ Delete

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Essentials

Resource group (move)	safik_HUB_RG	SKU	VpnGw3AZ
Location	Central India	Gateway type	VPN
Subscription (move)	Azure for Students	VPN type	Route-based
Subscription ID	7312f3ff-29b1-4465-8885-aa72f34bdc7f	Virtual network	safik_Hub_Vnet/GatewaySubnet

5. Overview of VNG.

Basics	Advanced	Review + create
Summary		
Name		
Name	safik_LNG	
Subscription	Azure for Students	
Resource group	safik_HUB_RG	
Region	Central India	
Endpoint	IP address	
IP address	40.76.120.72	
Address Space(s)	10.3.0.0/16	

6. Create LNG in Hub-RG.

The screenshot shows the 'safik_LNG' Local network gateway in the Azure portal. The 'Overview' tab is selected. Key details shown include:

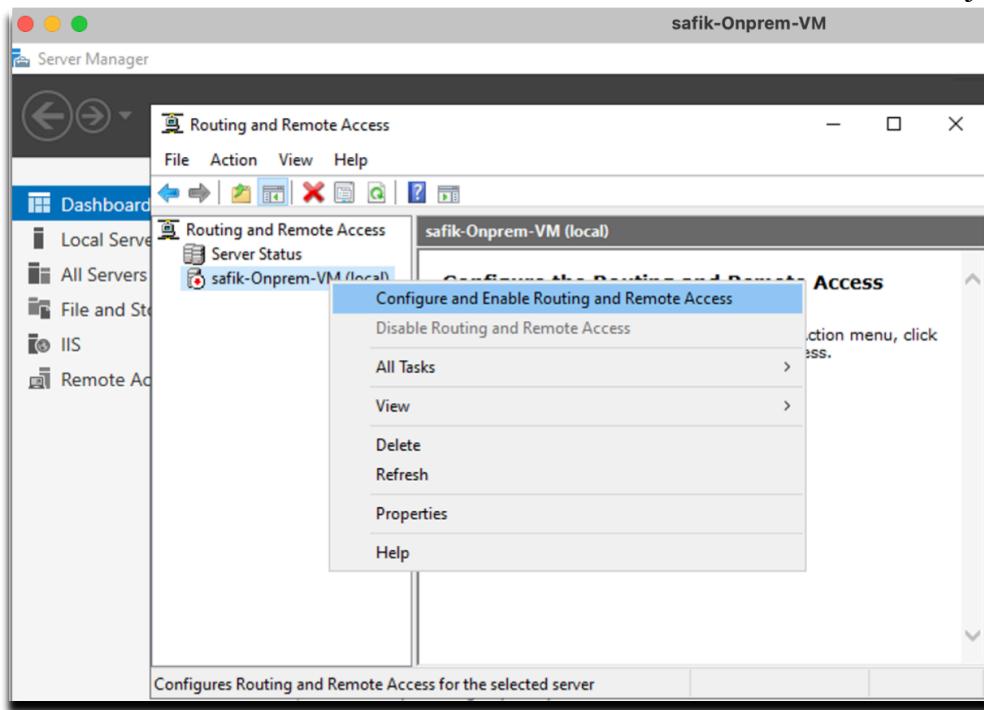
- Resource group: safik_HUB_RG
- Location: Central India
- Subscription: Azure for Students
- Subscription ID: 7312f3ff-29b1-4465-8885-aa72f34bdc7f
- IP address: 40.76.120.72
- Address Space(s): 10.3.0.0/16
- Tags: Click here to add tags

7. Overview of LNG.

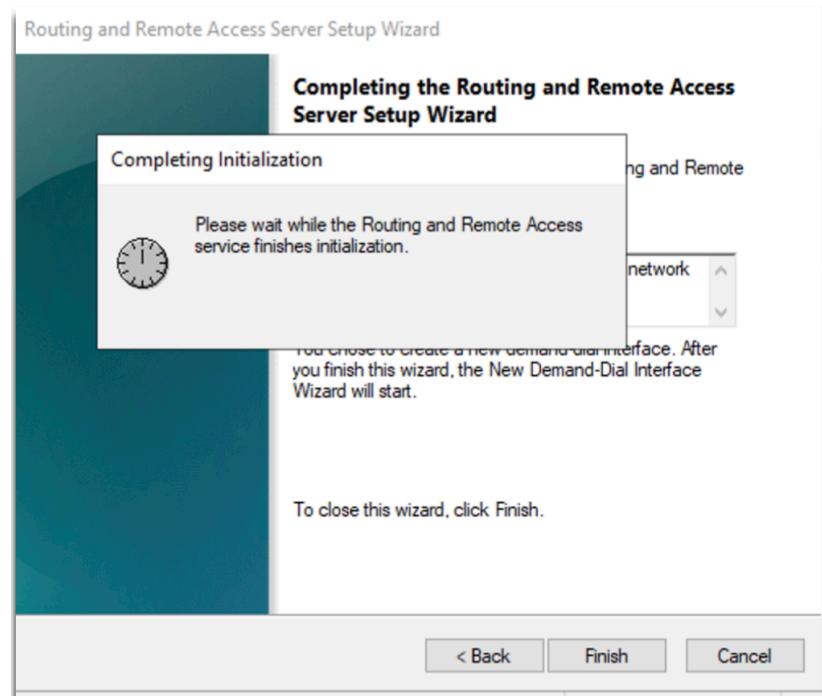
The screenshot shows the 'S2S' Site-to-site connection in the Azure portal. The 'Overview' tab is selected. Key details shown include:

- Resource group: safik_HUB_RG
- Status: Not connected
- Location: Central India
- Subscription: Azure for Students
- Subscription ID: 7312f3ff-29b1-4465-8885-aa72f34bdc7f
- Data in: 0 B
- Data out: 0 B
- Virtual network: safik_Hub_Vnet
- Virtual network gateway: safik_VNG
- Local network gateway: safik_LNG (40.76.120.72)
- Tags: Click here to add tags

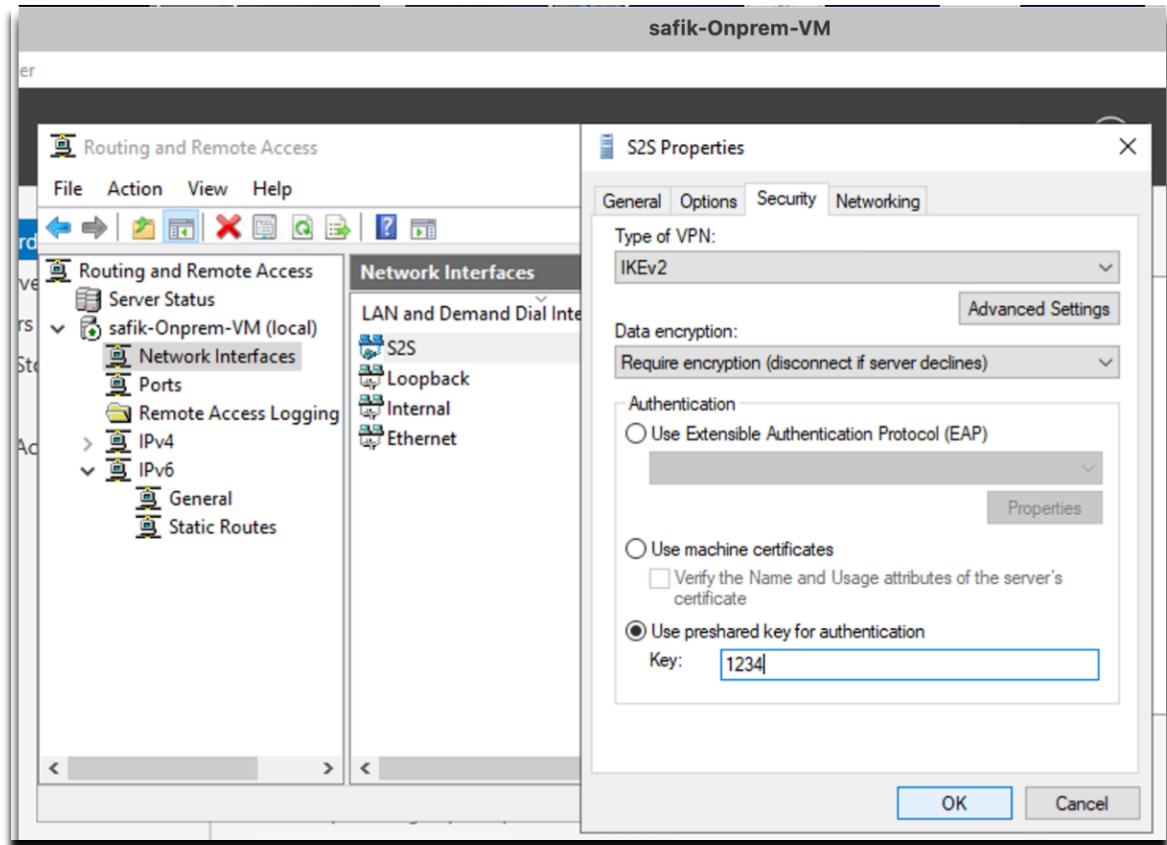
8. Create Site-to-site connection.



9. Configure RRAS in Onprem-VM.



10. Succesfully Configure RRAS on Onprem-VM.



11. Configure S2S properties.

```

safik-Onprem-VM:
PS C:\Users\safikonpremvm> ipconfig
Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : hwpqio3kjduppvconlxxc4tpb.bx.internal
  Link-local IPv6 Address . . . . . : fe80::23f8:54c8:7a17:4510%5
  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\safikonpremvm> ping 10.0.0.4

Pinging 10.0.0.4 with 32 bytes of data:
Reply from 10.0.0.4: bytes=32 time=22ms 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 = 22ms, Maximum = 22ms, Average = 22ms
PS C:\Users\safikonpremvm>

safik-Hub-vm:
PS C:\Users\safikhubvm> hostname
safik-Hub-vm
PS C:\Users\safikhubvm> ipconfig
Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : f215u4oix1duppi3wmpawgnkb.rx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::67ee:bb6e:9824%6
  IPv4 Address . . . . . : 10.0.0.4
  Subnet Mask . . . . . : 255.255.255.0
  Default Gateway . . . . . : 10.0.0.1

PS C:\Users\safikhubvm> ping 10.3.0.4

Pinging 10.3.0.4 with 32 bytes of data:
Reply from 10.3.0.4: bytes=32 time=223ms TTL=127
Reply from 10.3.0.4: bytes=32 time=222ms TTL=127
Reply from 10.3.0.4: bytes=32 time=222ms TTL=127
Reply from 10.3.0.4: bytes=32 time=222ms 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 = 222ms, Maximum = 223ms, Average = 222ms
PS C:\Users\safikhubvm>

```

12. Pinging HUB – OnPrem VM , OnPrem – HUB VM.

The screenshot shows the Azure portal interface. On the left, under 'Virtual networks', there are four entries: 'safik_Hub_Vnet' (selected), 'safik_Onprem_vnet', 'safik_Spoke1_Vnet', and 'safik_Spoke2_RG'. On the right, under 'safik_Hub_Vnet | Peerings', it shows two peering connections: 'safik-HUB-Spoke1' (Connected) and 'safik-HUB-Spoke2' (Connected). Both are listed under the 'Peering status' column.

13. Configure VNet-Peering Between HUB and Spoke1 and Spoke2.

This screenshot shows two separate Windows Server Manager sessions. The left window is titled 'safik-Spoke1-vm' and the right is 'safik-Hub-vm'. Both are running PowerShell. In the left window, the user runs 'ping 10.0.0.4' from 'Administrator: Windows PowerShell'. In the right window, the user runs 'ping 10.1.0.4' from 'Administrator: Windows PowerShell'. Both pings are successful with low latency.

14. Pinging Spoke1 – HUB , HUB -Spoke1 VM.

This screenshot shows two separate Windows Server Manager sessions. The left window is titled 'safik-spoke2-vm' and the right is 'safik-Hub-vm'. Both are running PowerShell. In the left window, the user runs 'ping 10.0.0.4' from 'Administrator: Windows PowerShell'. In the right window, the user runs 'ping 10.2.0.4' from 'Administrator: Windows PowerShell'. Both pings are successful with low latency.

15. Pinging Spoke2 – HUB , HUB – Spoke2 VM.

Route tables ⚡ ...

Default Directory (shaikhshafik987@gmail.onmicrosoft.com)

+ Create Manage view Refresh Export to CSV Open query Assign tags

Filter for any field... Subscription equals all Resource group equals all Location equals all

Showing 1 to 2 of 2 records.

Name	Resource group
spoke1-RouteTable	safik_Spoke1_RG
spoke2-RouteTable	safik_Spoke2_RG

16. Create Route Table For Spoke1 and Spoke2.

Home > Virtual networks > safik_Spoke1_Vnet

Virtual networks

+ Create Manage view ...

Filter for any field...

Name
safik_Hub_Vnet
safik_Onprem_vnet
safik_Spoke1_Vnet
safik_Spoke2_RG

safik_Spoke1_Vnet | Subnets

Virtual network

+ Subnet + G...

Search

Overview Activity log Tags Diagnose and solve problems

Name: default

Subnet address range * 10.1.0.0/24 10.1.0.0 - 10.1.0.255 (251 + 5 Azure reserved addresses)

Add IPv6 address space

NAT gateway: None

Network security group: None

Route table: spoke1-RouteTable

SERVICE ENDPOINTS

Create service endpoint policies to allow traffic to specific azure resources from your virtual network over service endpoints. [Learn more](#)

17. Now , We add Route Table in Vnet.

```

Administrator: Windows PowerShell
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows
PS C:\Users\safikspoke2vm> hostname
safik-spoke2-vm
PS C:\Users\safikspoke2vm> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : zd540c0jchwevalgx5y13eesrg.rx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::a87d:c50e:6153:e092%6
    IPv4 Address . . . . . : 10.2.0.4
      Subnet Mask . . . . . : 255.255.255.0
      Default Gateway . . . . . : 10.2.0.1
PS C:\Users\safikspoke2vm> ping 10.1.0.4

Pinging 10.1.0.4 with 32 bytes of data:
Reply from 10.1.0.4: bytes=32 time=2ms 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 = 1ms, Maximum = 2ms, Average = 1ms

Administrator: Windows PowerShell
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows
PS C:\Users\safikspoke1vm> hostname
safik-Spoke1-vm
PS C:\Users\safikspoke1vm> ipconfig

Windows IP Configuration

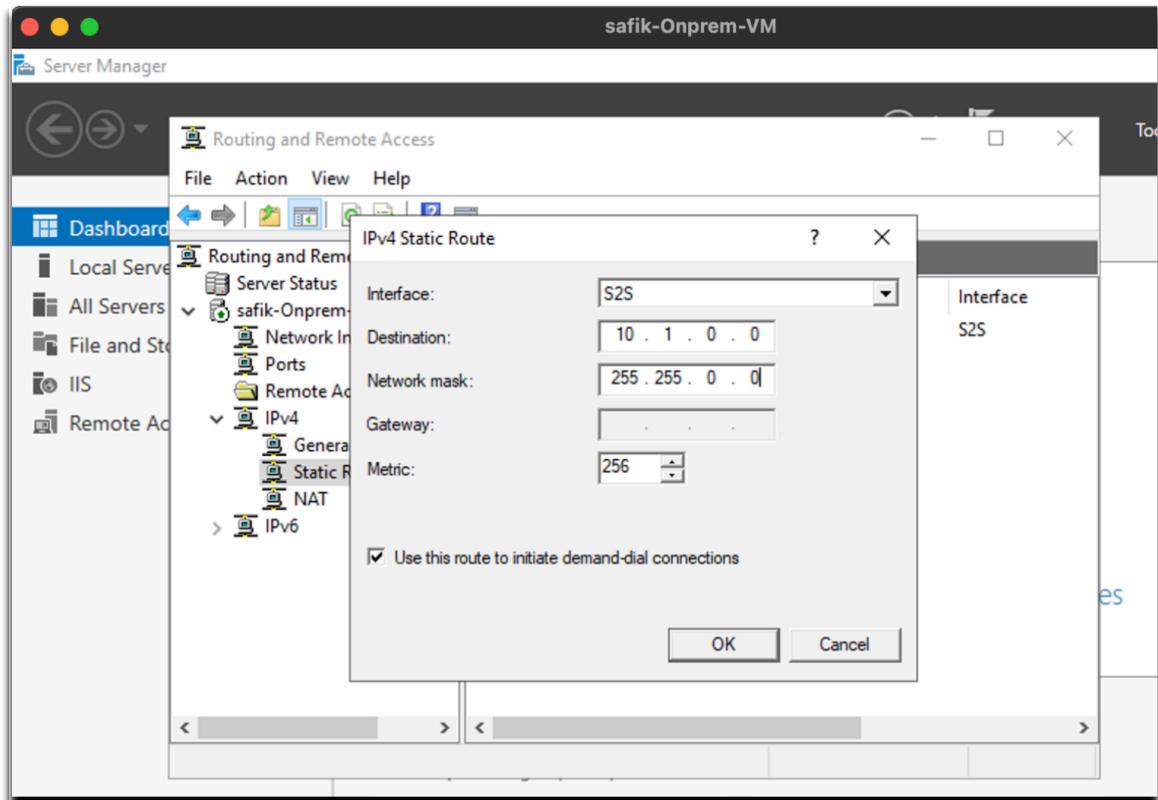
Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : 2wd4fsqqlpnu5g1xoqs0uk2izg.rx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::e572:6cd8:546c:c498%6
    IPv4 Address . . . . . : 10.1.0.4
      Subnet Mask . . . . . : 255.255.255.0
      Default Gateway . . . . . : 10.1.0.1
PS C:\Users\safikspoke1vm> ping 10.2.0.4

Pinging 10.2.0.4 with 32 bytes of data:
Reply from 10.2.0.4: bytes=32 time=3ms TTL=127
Reply from 10.2.0.4: bytes=32 time=2ms TTL=127
Reply from 10.2.0.4: bytes=32 time=2ms TTL=127
Reply from 10.2.0.4: bytes=32 time=2ms 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 = 2ms, Maximum = 3ms, Average = 2ms

```

18. Pinging Spoke1-Spoke2 VM and Spoke2- Spoke1 VM.



19. Now Add Static Route for customize data Flow.

```

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

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\safikspoke2vm> hostname
safik-spoke2-vm
PS C:\Users\safikspoke2vm> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : zd540c0jchwevalgx5y13eesrg.rxiinternal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::a87d:c50e:6153:e092%6
    IPv4 Address. . . . . : 10.3.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.2.0.1
PS C:\Users\safikspoke2vm> ping 10.3.0.4

Pinging 10.3.0.4 with 32 bytes of data:
Reply from 10.3.0.4: bytes=32 time=233ms 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 = 233ms, Maximum = 233ms, Average = 233ms
PS C:\Users\safikspoke2vm> tracert 10.3.0.4

Tracing route to 10.3.0.4 over a maximum of 30 hops
  1  226 ms   226 ms   226 ms  169.254.0.28
  2  227 ms   227 ms   226 ms  10.3.0.4

Trace complete.
PS C:\Users\safikspoke2vm>

Select Administrator: Windows PowerShell
PS C:\Users\safikonpremmv> hostname
safik-Onprem-VM
PS C:\Users\safikonpremmv> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : hwbpqio3kjduppvconlxxc4tpb.bx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::23f8:54c8:7a17:4510%8
    IPv4 Address. . . . . : 10.3.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.3.0.1
PS C:\Users\safikonpremmv> ping 10.2.0.4

Pinging 10.2.0.4 with 32 bytes of data:
Reply from 10.2.0.4: bytes=32 time=227ms TTL=127
Reply from 10.2.0.4: bytes=32 time=227ms TTL=127
Reply from 10.2.0.4: bytes=32 time=226ms TTL=127
Reply from 10.2.0.4: bytes=32 time=226ms 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 = 226ms, Maximum = 227ms, Average = 226ms
PS C:\Users\safikonpremmv> 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   safik-Onprem-VM.hwbpqio3kjduppvconlxxc4tpb.bx.internal.cloudapp.net [10.3.0.4]
  2  227 ms   226 ms   226 ms  10.2.0.4

Trace complete.
PS C:\Users\safikonpremmv>

```

20. Pinging From Spoke2 – OnPrem , Onprem-Spoke2 VM.

```

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

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\safikspoke1vm> hostname
safik-Spoke1-vm
PS C:\Users\safikspoke1vm> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : 2wd4fsrqlpnusg1x0qs0uk2izg.rxiinternal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::e572:6cd8:546c:c498%6
    IPv4 Address. . . . . : 10.1.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.1.0.1
PS C:\Users\safikspoke1vm> ping 10.3.0.4

Pinging 10.3.0.4 with 32 bytes of data:
Reply from 10.3.0.4: bytes=32 time=228ms TTL=127
Reply from 10.3.0.4: bytes=32 time=230ms TTL=127
Reply from 10.3.0.4: bytes=32 time=227ms TTL=127
Reply from 10.3.0.4: bytes=32 time=227ms 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 = 227ms, Maximum = 230ms, Average = 228ms
PS C:\Users\safikspoke1vm> tracert 10.3.0.4

Tracing route to 10.3.0.4 over a maximum of 30 hops
  1  226 ms   226 ms   226 ms  169.254.0.28
  2  227 ms   232 ms   227 ms  10.3.0.4

Trace complete.
PS C:\Users\safikspoke1vm>

Select Administrator: Windows PowerShell
PS C:\Users\safikonpremmv> hostname
safik-Onprem-VM
PS C:\Users\safikonpremmv> ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:
  Connection-specific DNS Suffix . : hwbpqio3kjduppvconlxxc4tpb.bx.internal.cloudapp.net
  Link-local IPv6 Address . . . . . : fe80::23f8:54c8:7a17:4510%8
    IPv4 Address. . . . . : 10.3.0.4
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.3.0.1
PS C:\Users\safikonpremmv> ping 10.1.0.4

Pinging 10.1.0.4 with 32 bytes of data:
Reply from 10.1.0.4: bytes=32 time=228ms TTL=127
Reply from 10.1.0.4: bytes=32 time=226ms TTL=127
Reply from 10.1.0.4: bytes=32 time=227ms TTL=127
Reply from 10.1.0.4: bytes=32 time=227ms 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 = 226ms, Maximum = 228ms, Average = 227ms
PS C:\Users\safikonpremmv> 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   safik-Onprem-VM.hwbpqio3kjduppvconlxxc4tpb.bx.internal.cloudapp.net [10.3.0.4]
  2  227 ms   226 ms   226 ms  10.1.0.4

Trace complete.
PS C:\Users\safikonpremmv>

```

21. Pinging Spoke1 – OnPrem VM and OnPrem – Spoke1 VM.

Chapter – 7 : Outcomes

7.1 Outcomes

During my internship at Celebal Technology, I had the privilege of working on cutting-edge technologies in Microsoft Azure's Cloud Infrastructure and Security domain. The immersive experience provided me with a comprehensive skill set and in-depth knowledge of various critical Azure services and concepts.

- **Virtual Network (VNet):** I gained a deep understanding of Azure Virtual Networks and their role as the building blocks of cloud-based infrastructures. I learned how to design and implement VNets, create subnets, and effectively manage IP address spaces to optimize resource utilization.
- **Virtual Network Peering:** I explored the importance of Virtual Network Peering in enabling seamless communication between Azure VNets. Understanding peering configurations allowed me to design interconnected and scalable cloud architectures.
- **Site-to-Site Connection:** My hands-on experience with Site-to-Site Connection in Azure was instrumental in establishing secure and encrypted connections between on-premises networks and Azure VNets. I learned to configure and manage VPN gateways to facilitate hybrid network architectures.
- **Virtual Network Gateway:** I honed my skills in configuring Virtual Network Gateways, enabling secure connectivity between Azure VNets and remote networks. This included implementing IPsec tunnels and ensuring smooth data transmission over the public internet.
- **Local Network Gateway:** I delved into Local Network Gateways, understanding their role in connecting on-premises networks to Azure VNets. This experience provided valuable insights into extending the corporate network into the cloud.
- **Routing and Remote Access Services (RRAS):** I acquired expertise in deploying RRAS in Azure to enable routing between VNets and on-premises networks. This knowledge enhanced the efficiency and resilience of the network infrastructure.

Chapter – 8 : Conclusion

8.1 Conclusion

My internship at Celebal Technology in the Microsoft Azure Cloud Infrastructure and Security domain was a transformative and enriching experience. I had the privilege of working with cutting-edge technologies and gaining practical expertise in various critical Azure services.

During the internship, I delved into the intricacies of Virtual Networks, Virtual Network Peering, Site-to-Site Connection, Virtual Network Gateway, Local Network Gateway, and Routing and Remote Access Services (RRAS). These hands-on experiences allowed me to design, deploy, and manage secure and scalable cloud infrastructures, enabling seamless communication between on-premises networks and Azure resources.

I also deepened my understanding of cloud security best practices, implementing identity and access management with Azure Active Directory, applying Network Security Groups for traffic control.

This internship not only equipped me with technical expertise but also instilled in me the importance of teamwork, continuous learning, and adaptability in the fast-paced world of cloud computing.

As I move forward, I am confident that the invaluable experiences and learning from this internship will serve as a driving force in shaping my professional growth and making a meaningful impact in the ever-evolving landscape of cloud technology.

Chapter – 9 : Reference

9.1 Reference

- <https://azure.microsoft.com/en-in>
- <https://azure.microsoft.com/en-in/free/students>
- <https://medium.com/chenjd-xyz/azure-fundamental-iaas-paas-saas-973e0c406de7>
- <https://k21academy.com/microsoft-azure/az-303/azure-vnet-peering/>
- <https://www.azurecitadel.com/network/concepts/peering/>
- <https://learn.microsoft.com/en-us/azure/vpn-gateway/vpn-gateway-howto-site-to-site-classic-portal>
- <https://www.ibm.com/docs/en/storagevirtualizecl/8.4.x?topic=configuration-configuring-site-site-vpn-microsoft-azure-installations>
- <https://directaccess.richardhicks.com/2019/09/09/always-on-vpn-and-rras-in-azure/#:~:text=RRAS%20can%20be%20configured%20on,one%20network%20interface%20or%20two.>
- <https://www.thealfaaz.com/how-to-create-and-configure-rras-vpn-server-on-azure-vm-01/>
- <https://serverfault.com/questions/1040795/rras-server-in-azure-internet-access>
- <https://learn.microsoft.com/en-us/azure/virtual-network/virtual-networks-udr-overview>
- <https://www.azurecitadel.com/network/concepts/routing/>