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MICROSOFT AZURE
FINAL PROJECT

WHAT IS MICROSOFT AZURE?

Microsoft Azure is a cloud computing platform provided by Microsoft. It offers a wide range of services, such as computing power, storage, networking, and databases, that users can access over the internet. With Azure, businesses can build, manage, and deploy applications using various tools and technologies. It supports multiple programming languages and operating systems, making it flexible for different needs. Azure also includes features like virtual machines, AI, and IoT, allowing organizations to scale their operations, innovate, and maintain security.

PROJECT BY:

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BRANCH: ECE **YEAR:** 2nd

SIC: 22BECF50

UNIVERSITY: SILICON UNIVERSITY, BBSR

GROUP: 2-AZURE MASTERS-2024

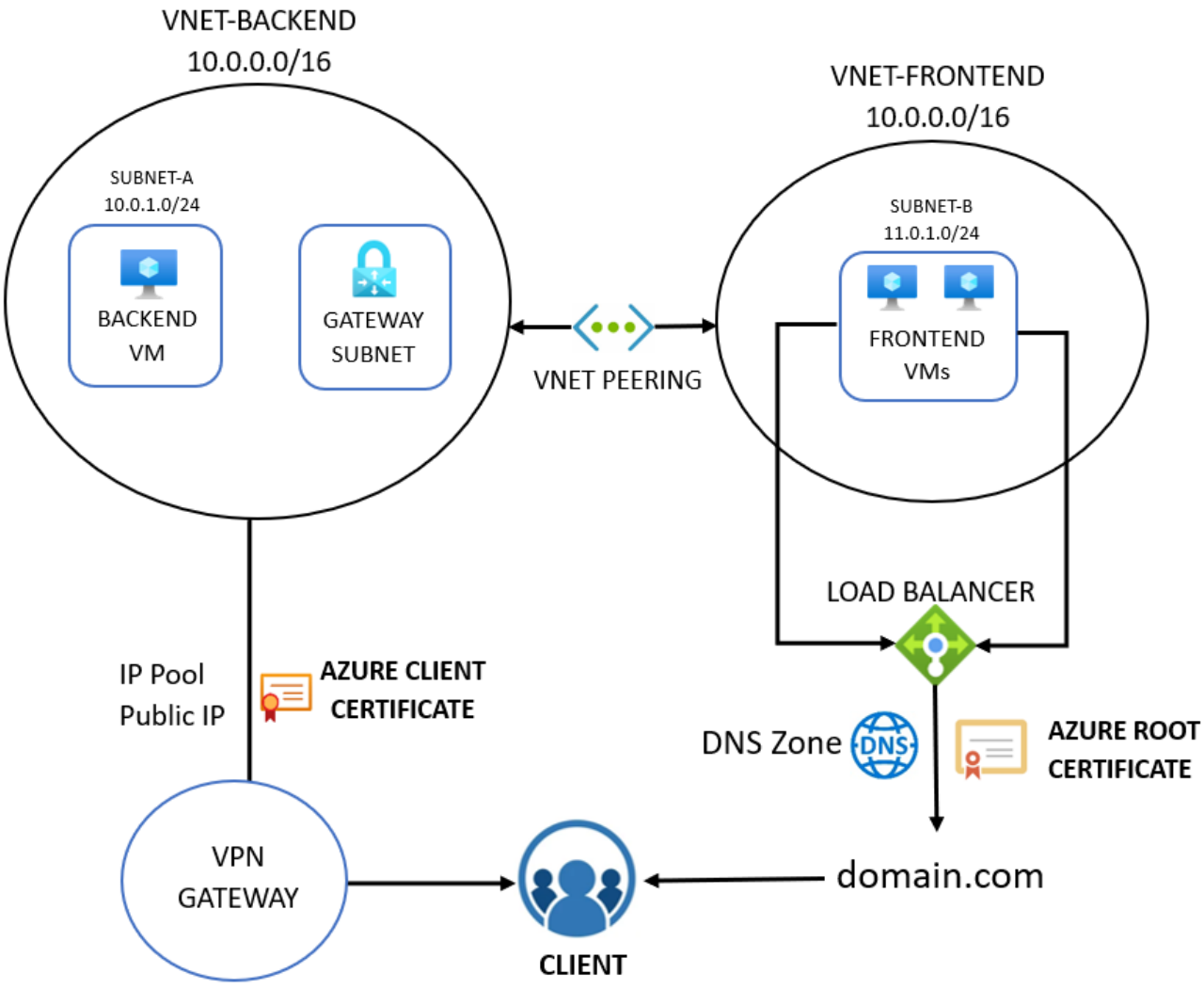
COURSE: AZURE MASTERS AND INTRODUCTION TO GENERATIVE AI

INSTRUCTOR: SUMIT SIR

ARCHITECTURE OF THE PROJECT:

Subscription: Azure For Students

Resource Group: RG-1



EXPLANATION OF THE ARCHITECTURE:

The architecture designed for this project incorporates several Azure services to ensure a scalable, secure, and efficient deployment. The infrastructure is divided into two primary virtual networks (VNets): the frontend and the backend. The frontend VNet contains a subnet hosting multiple instances of frontend virtual machines (VMs), which are managed by an Azure Load Balancer. This Load Balancer distributes incoming traffic evenly across the frontend VMs, ensuring high availability and reliability.

To handle varying levels of traffic, autoscaling is enabled for the frontend VMs, automatically adjusting the number of instances based on CPU usage and other metrics. This ensures that the application can efficiently manage increased load without manual intervention.

The backend VNet hosts the backend VM in a dedicated subnet, isolated from the frontend VNet to enhance security. Data communication between the frontend and backend is secured and controlled, ensuring that only necessary traffic flows between these networks.

A jump server is placed in a management subnet, providing a secure access point for administrators to manage both frontend and backend VMs. Access to the jump server is controlled through a VPN Gateway, which establishes a secure connection for administrative tasks.

Azure DNS is used to map the public IP of the Load Balancer to a user-friendly domain name, making it easier for end-users to access the application. Additionally, an SSL certificate is configured to encrypt data transmitted between the user's browser and the Load Balancer, ensuring that sensitive information is protected during transit.

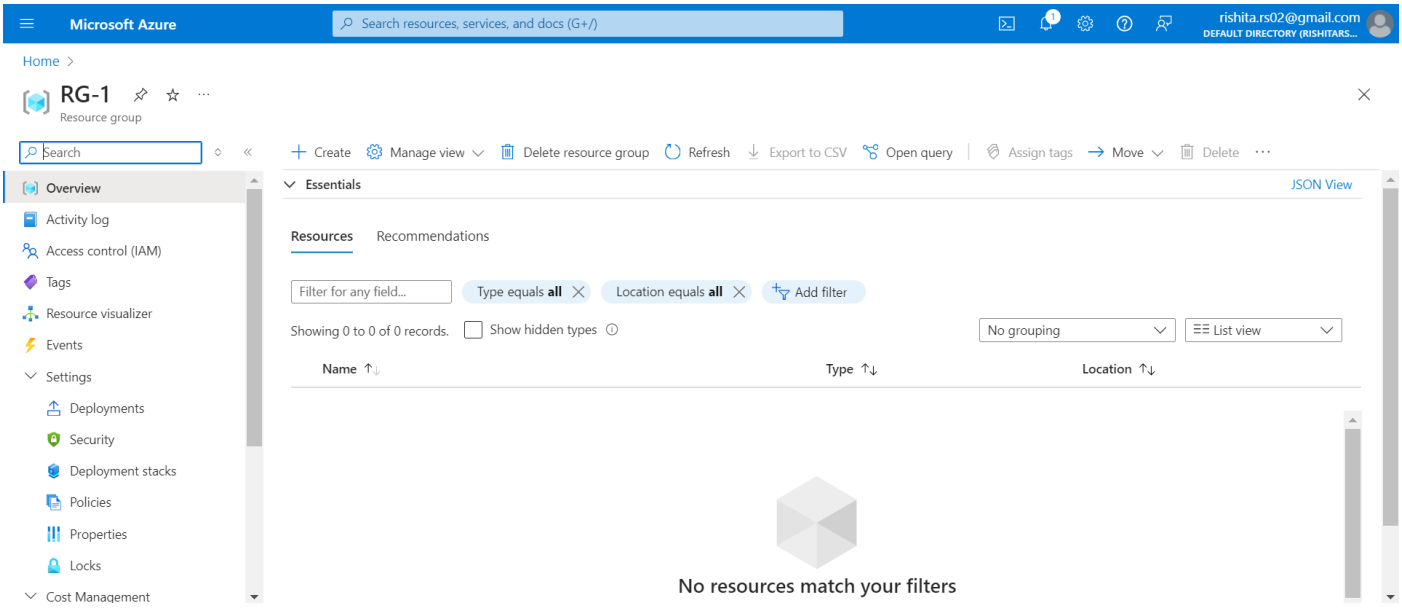
This architecture follows industry best practices by segmenting the network, using a jump server for secure access, enabling autoscaling for resource efficiency, and applying SSL for data security. The use of Azure services such as VNets, Load Balancer, VM Scale Sets, VPN Gateway, Azure DNS, and Key Vault ensures a robust, scalable, and secure infrastructure for the application.

SOME IMPORTANT SERVICES PROVIDED ON AZURE CLOUD:

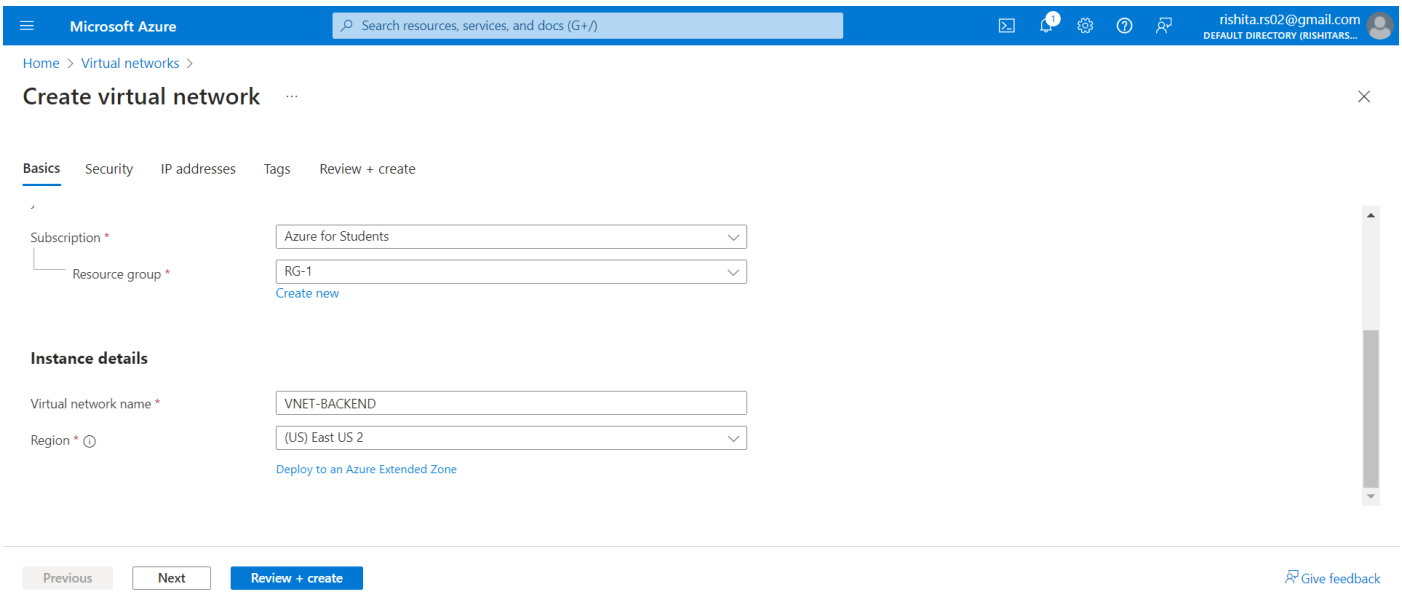
- **Create Virtual Networks:**
  - A Virtual Network (VNet) is a representation of your network in the cloud. It is a logical isolation of the Azure cloud dedicated to your subscription.
- **Deploy Virtual Machines:**
  - An Azure Virtual Machine (VM) is one of several types of on-demand, scalable computing resources that Azure offers. Typically, you choose a VM when you need more control over the computing environment.
- **Apply Load Balancer:**
  - An Azure Load Balancer is a Layer-4 (TCP, UDP) load balancer that distributes incoming network traffic across multiple backend resources or services.
- **Private Path Setup through Jump Servers:**
  - A VPN Gateway is a specific type of virtual network gateway that sends encrypted traffic between an Azure virtual network and an on-premises location over the public Internet. A Jump Server (or Bastion Host) is a special-purpose server on a network used to manage devices in a separate security zone.
- **Deploy with Azure Hosting Service:**
  - Azure DNS is a hosting service for DNS domains, providing name resolution using Microsoft Azure infrastructure.
- **Apply SSL Certificate:**
  - Azure Key Vault helps safeguard cryptographic keys and secrets used by cloud applications and services. An SSL certificate secures the data transferred between a user's browser and the website by encrypting it.

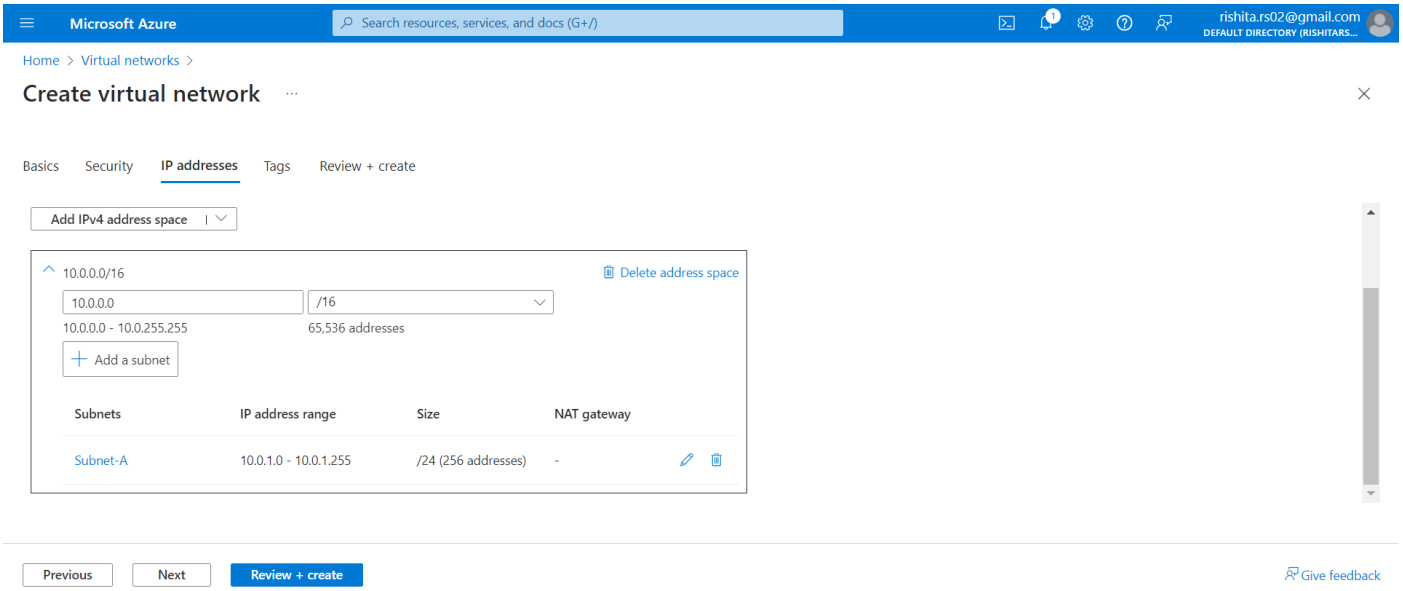
DETAILED PROCEDURE WITH SCREENSHOTS:

I. First a resource group was created namely 'RG-1'



II. Then two Virtual Networks (VNets) were created. The VNET-BACKEND contained Subnet-A and the VNET-FRONTEND contained Subnet-B.




Microsoft Azure
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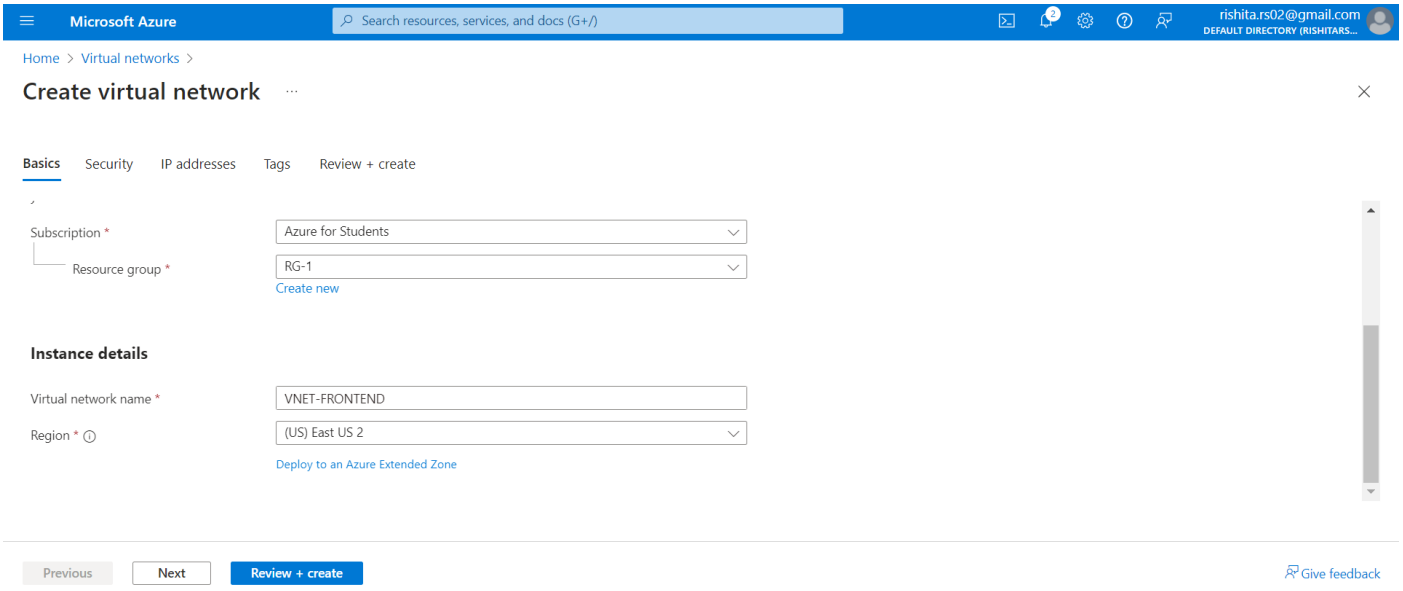
rishita.rs02@gmail.com
DEFAULT DIRECTORY (RISHITARS...
Home > Virtual networks >
Create virtual network
Basics Security IP addresses Tags Review + create
Add IPv4 address space
10.0.0.0/16
Delete address space
10.0.0.0
/16
10.0.0.0 - 10.0.255.255
65,536 addresses
Add a subnet
Subnets IP address range Size NAT gateway
Subnet-A 10.0.1.0 - 10.0.1.255 /24 (256 addresses) -
Previous Next Review + create
Give feedback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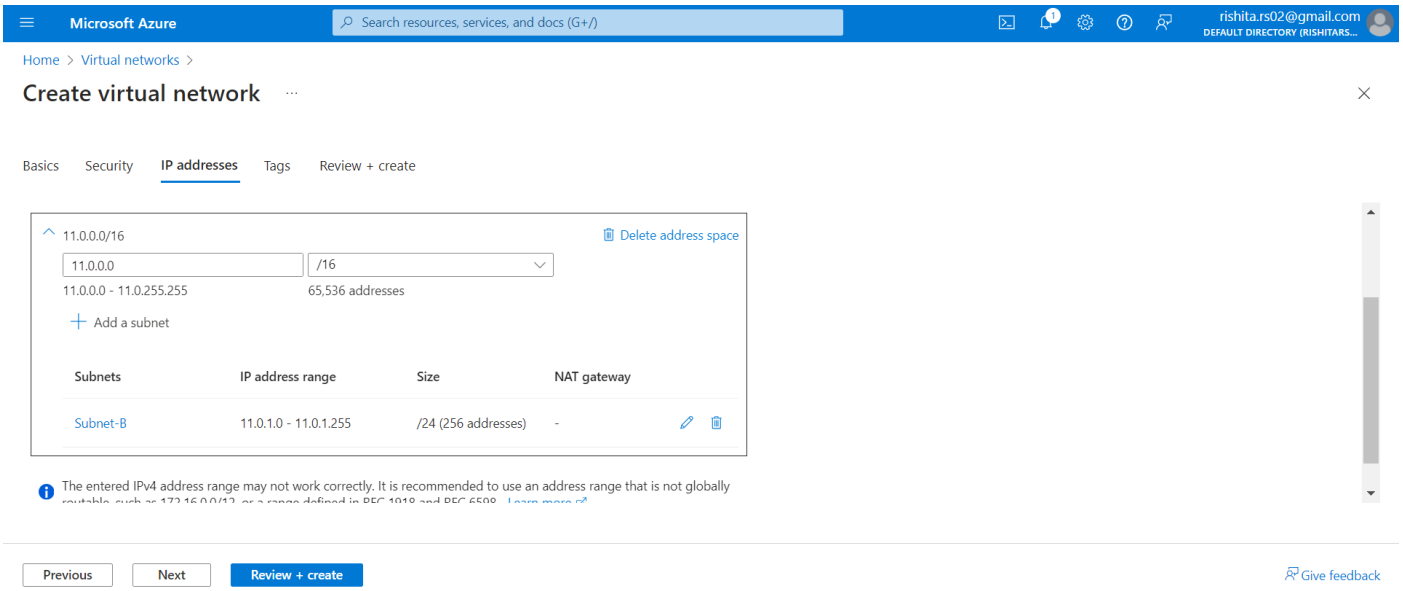
DEFAULT DIRECTORY (RISHITARS...
Home > Virtual networks >
Create virtual network
Basics Security IP addresses Tags Review + create
Subscription * Azure for Students
Resource group * RG-1
Create new
Instance details
Virtual network name * VNET-FRONTEND
Region * (US) East US 2
Deploy to an Azure Extended Zone
Previous Next Review + create
Give feedback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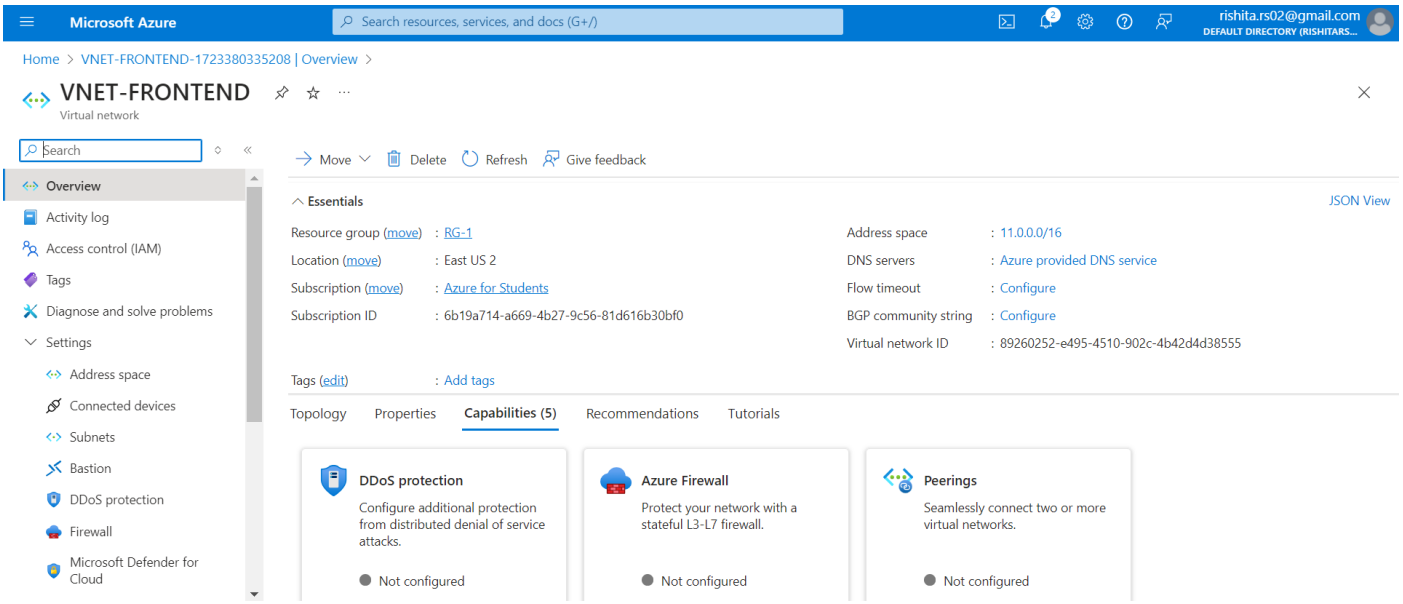
DEFAULT DIRECTORY (RISHITARS...
Home > Virtual networks >
Create virtual network
Basics Security IP addresses Tags Review + create
11.0.0.0/16
Delete address space
11.0.0.0
/16
11.0.0.0 - 11.0.255.255
65,536 addresses
Add a subnet
Subnets IP address range Size NAT gateway
Subnet-B 11.0.1.0 - 11.0.1.255 /24 (256 addresses) -
The entered IPv4 address range may not work correctly. It is recommended to use an address range that is not globally
Previous Next Review + create
Give feedback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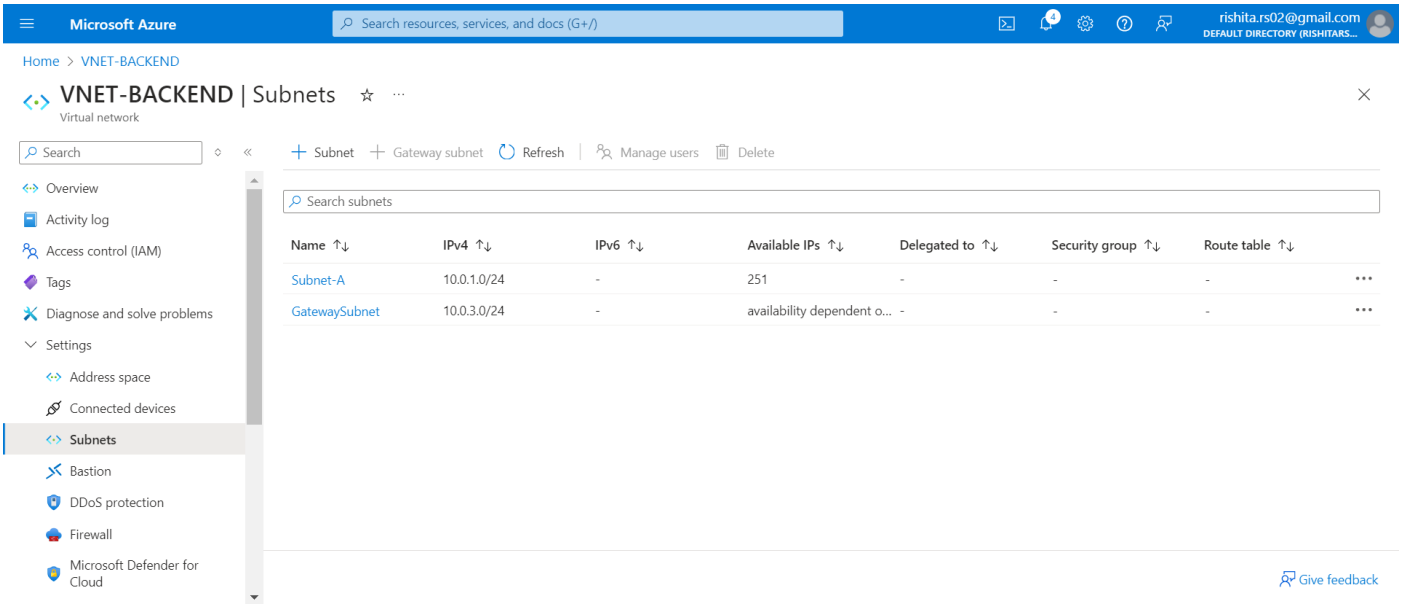
DEFAULT DIRECTORY (RISHITARS...
Home > VNET-FRONTEND-1723380335208 | Overview >
VNET-FRONTEND
Virtual network
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Settings
Address space
Connected devices
Subnets
Bastion
DDoS protection
Firewall
Microsoft Defender for Cloud
Move
Delete
Refresh
Give feedback
Essentials
JSON View
Resource group (move) : RG-1
Location (move) : East US 2
Subscription (move) : Azure for Students
Subscription ID : 6b19a714-a669-4b27-9c56-81d616b30bf0
Address space : 11.0.0.0/16
DNS servers : Azure provided DNS service
Flow timeout : Configure
BGP community string : Configure
Virtual network ID : 89260252-e495-4510-902c-4b42d4d38555
Tags (edit) : Add tags
Topology
Properties
Capabilities (5)
Recommendations
Tutorials
DDoS protection
Configure additional protection from distributed denial of service attacks.
Not configured
Azure Firewall
Protect your network with a stateful L3-L7 firewall.
Not configured
Peerings
Seamlessly connect two or more virtual networks.
Not configured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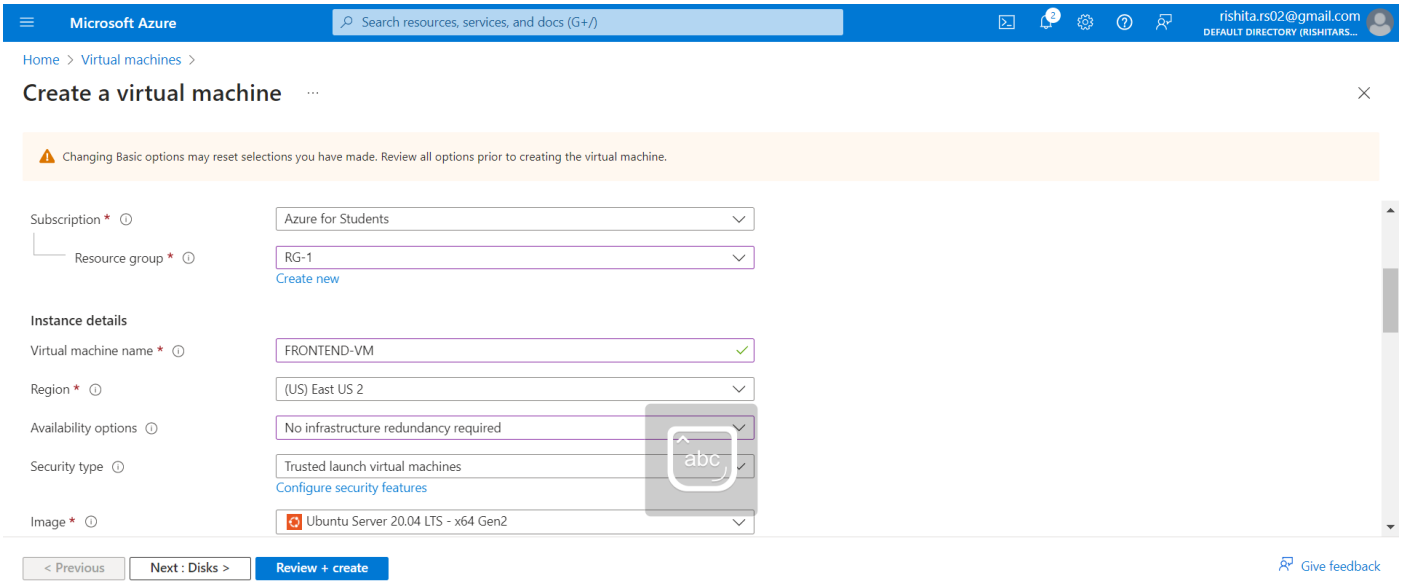
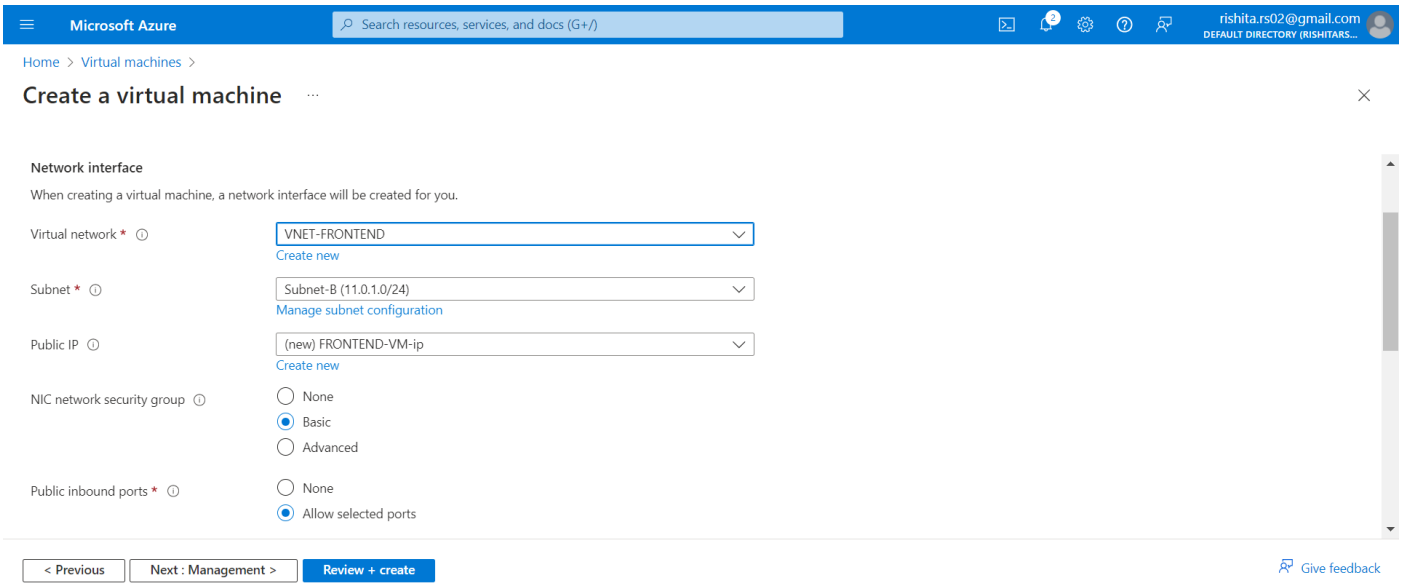
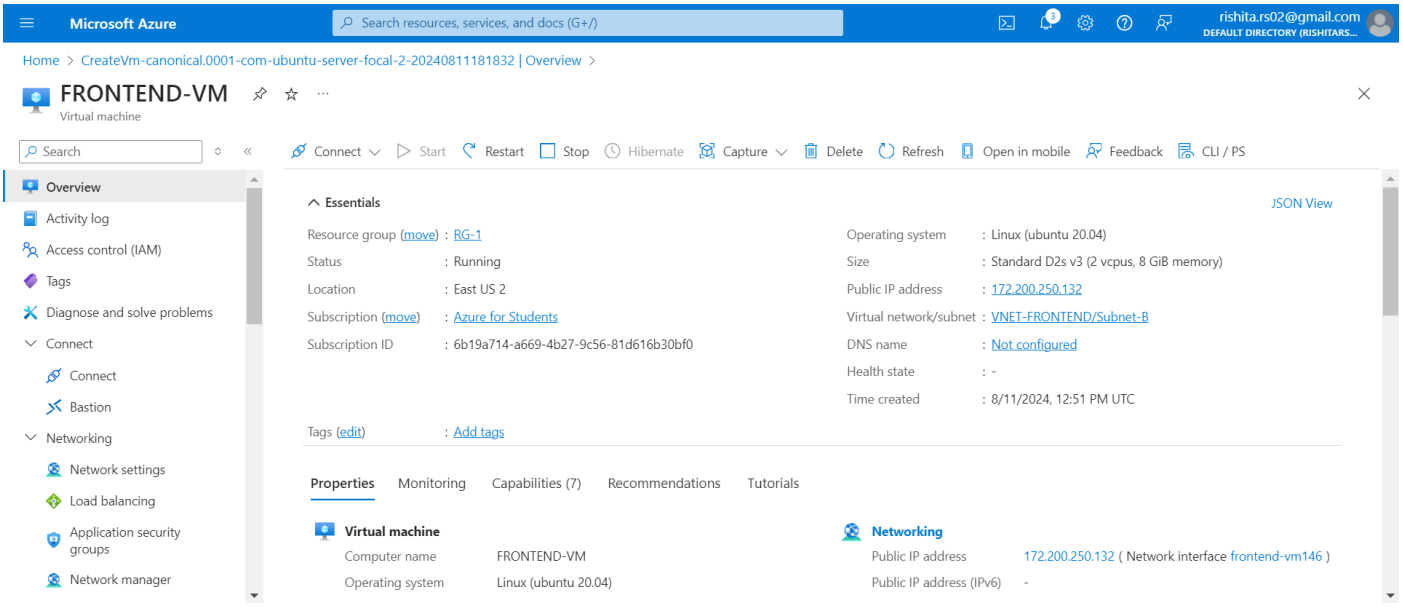
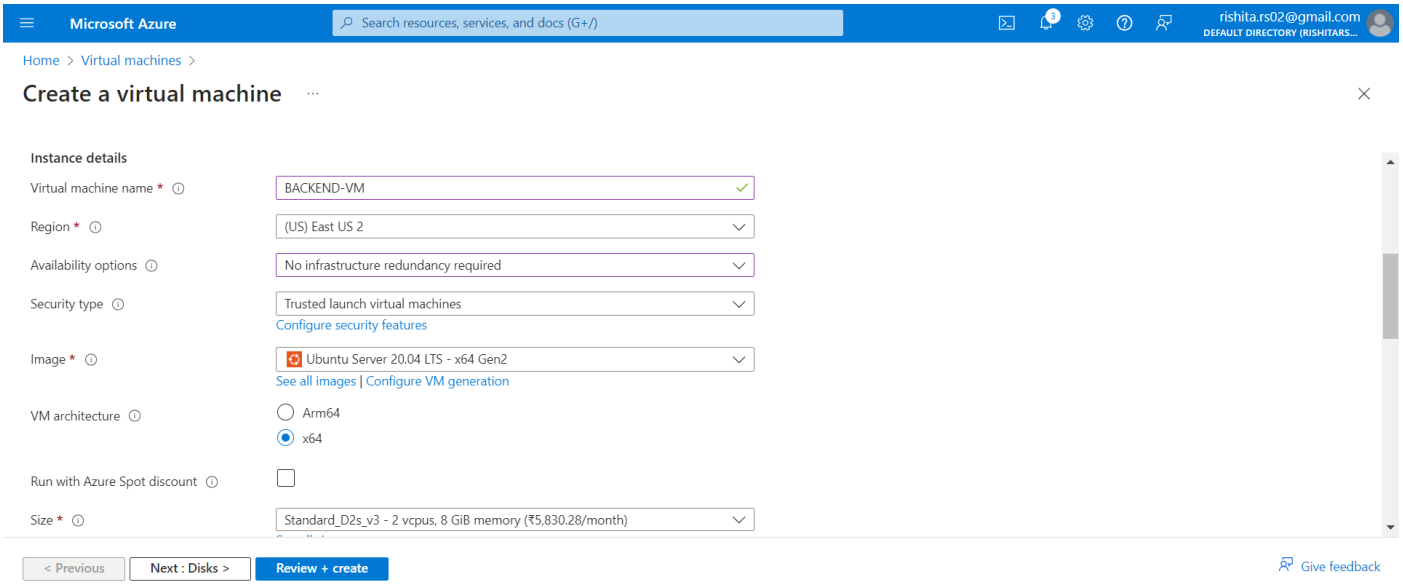
DEFAULT DIRECTORY (RISHITARS...
Home > VNET-BACKEND
VNET-BACKEND | Subnets
Virtual network
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Settings
Address space
Connected devices
Subnets
Bastion
DDoS protection
Firewall
Microsoft Defender for Cloud
Subnet
Gateway subnet
Refresh
Manage users
Delete
Search subnets
Name
IPv4
IPv6
Available IPs
Delegated to
Security group
Route table
Subnet-A 10.0.1.0/24 - 251 - - -
GatewaySubnet 10.0.3.0/24 - availability dependent o... - - -
Give feedback

III. Two Virtual Machines(VMs) were created. The FRONTEND-VM has a Public IP address and the BACKEND-VM has a Private IP address.








Microsoft Azure
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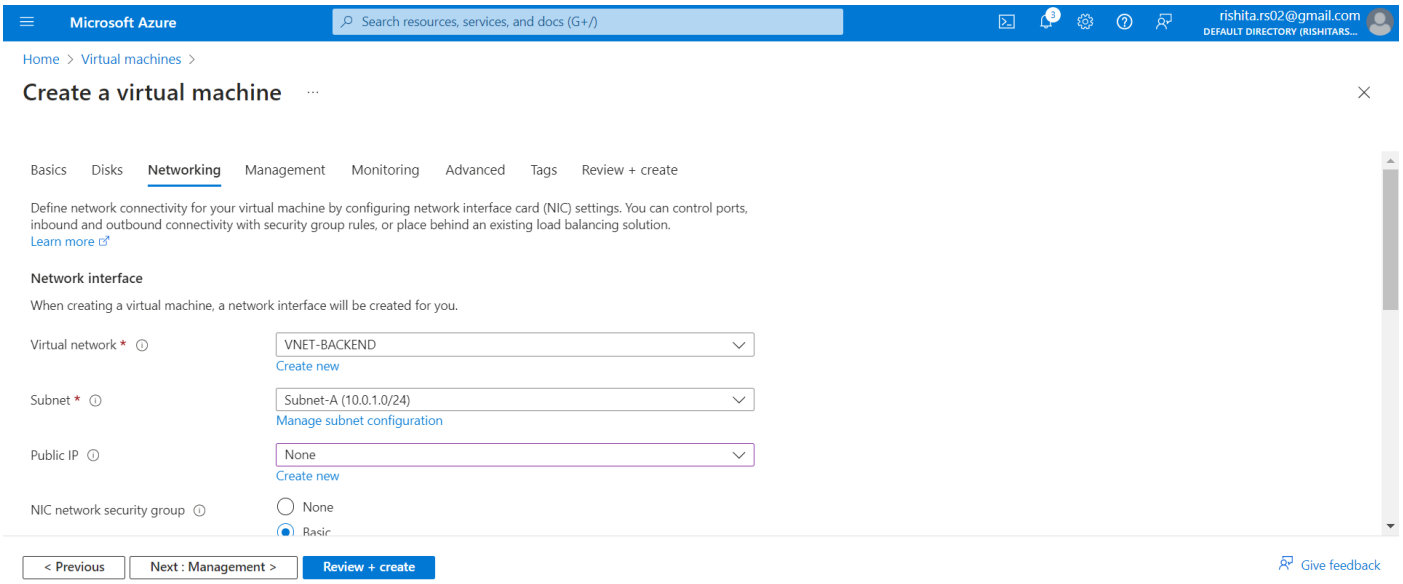
DEFAULT DIRECTORY (RISHITARS...
Home > Virtual machines >
Create a virtual machine
Instance details
Virtual machine name * BACKEND-VM
Region * (US) East US 2
Availability options No infrastructure redundancy required
Security type Trusted launch virtual machines
Configure security features
Image * Ubuntu Server 20.04 LTS - x64 Gen2
See all images | Configure VM generation
VM architecture Arm64
x64
Run with Azure Spot discount
Size * Standard_D2s_v3 - 2 vcpus, 8 GiB memory (₹5,830.28/month)
< Previous
Next : Disks >
Review + create
Give feedback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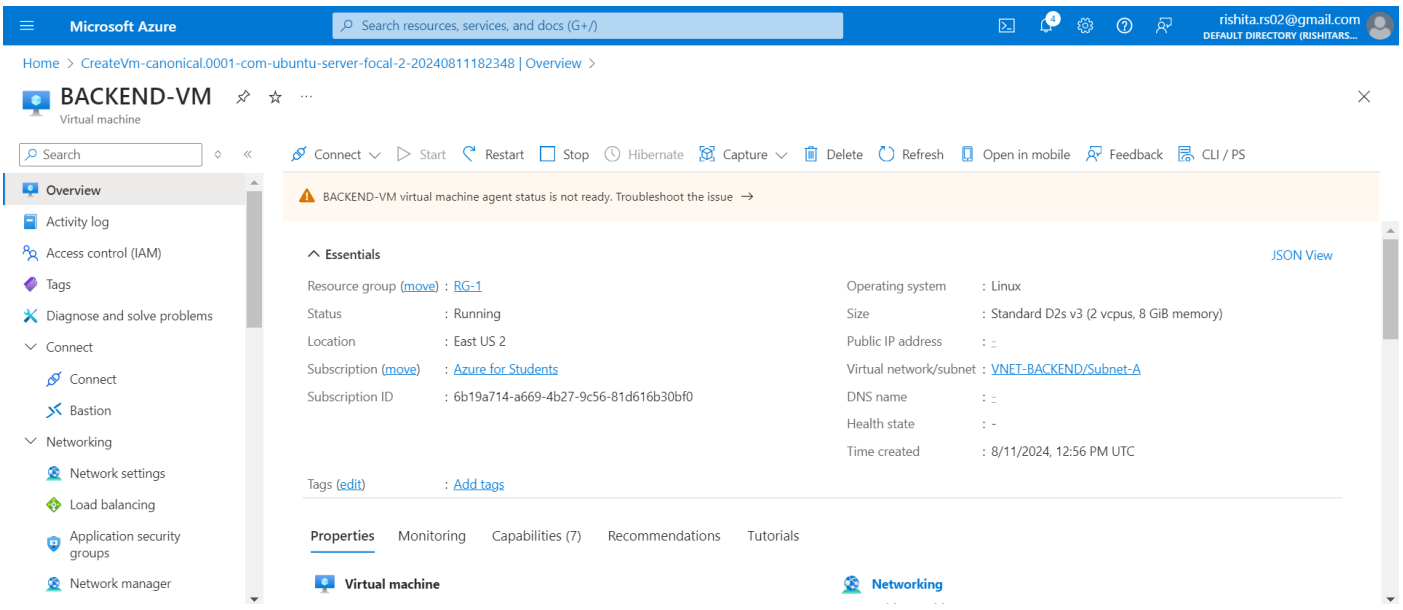
DEFAULT DIRECTORY (RISHITARS...
Home > Virtual machines >
Create a virtual machine
Basics Disks Networking Management Monitoring Advanced Tags Review + create
Define network connectivity for your virtual machine by configuring network interface card (NIC) settings. You can control ports, inbound and 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 * VNET-BACKEND
Create new
Subnet * Subnet-A (10.0.1.0/24)
Manage subnet configuration
Public IP None
Create new
NIC network security group None
Basic
< Previous
Next : Management >
Review + create
Give feedback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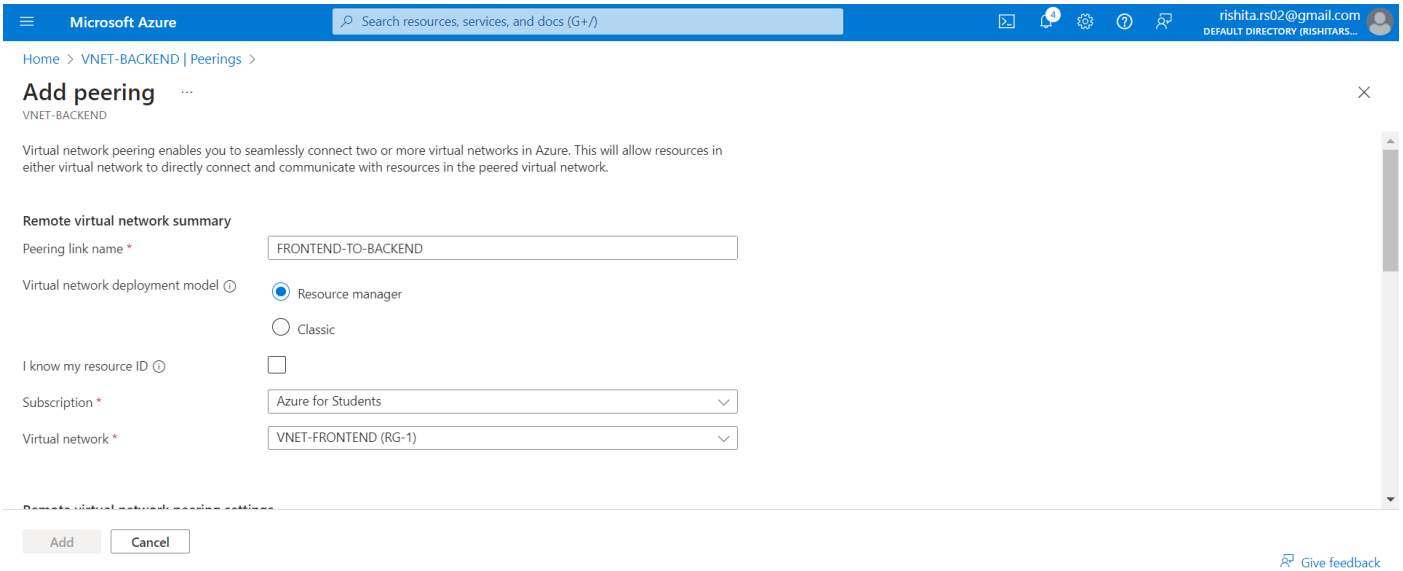
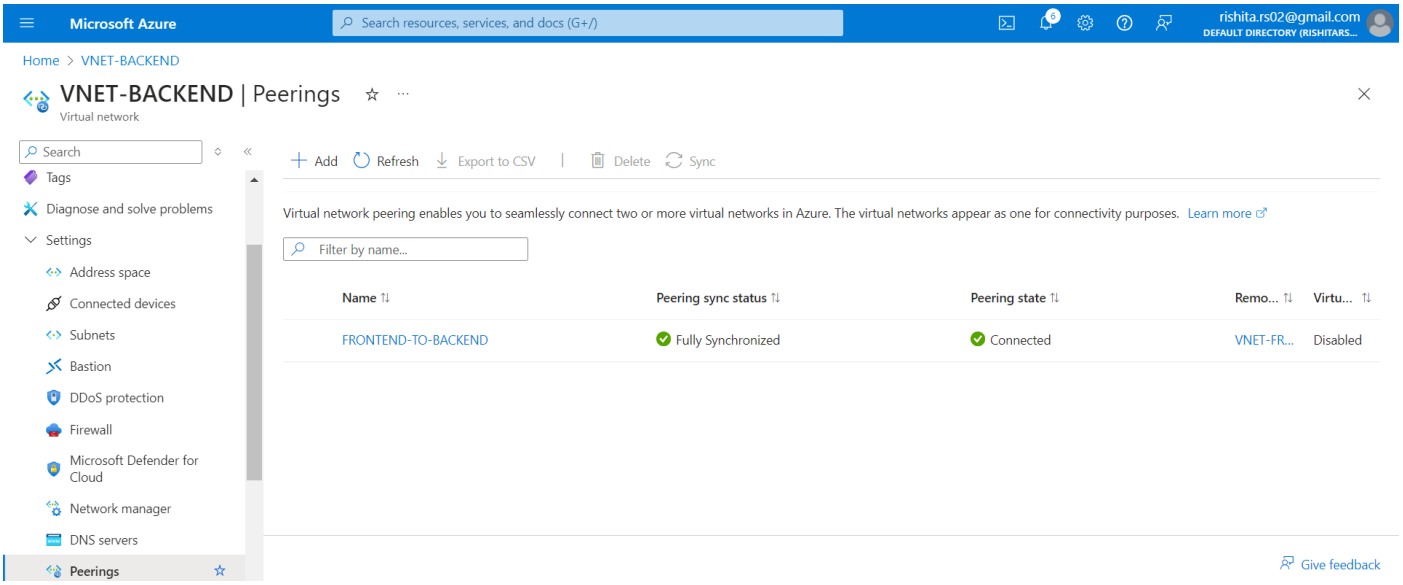
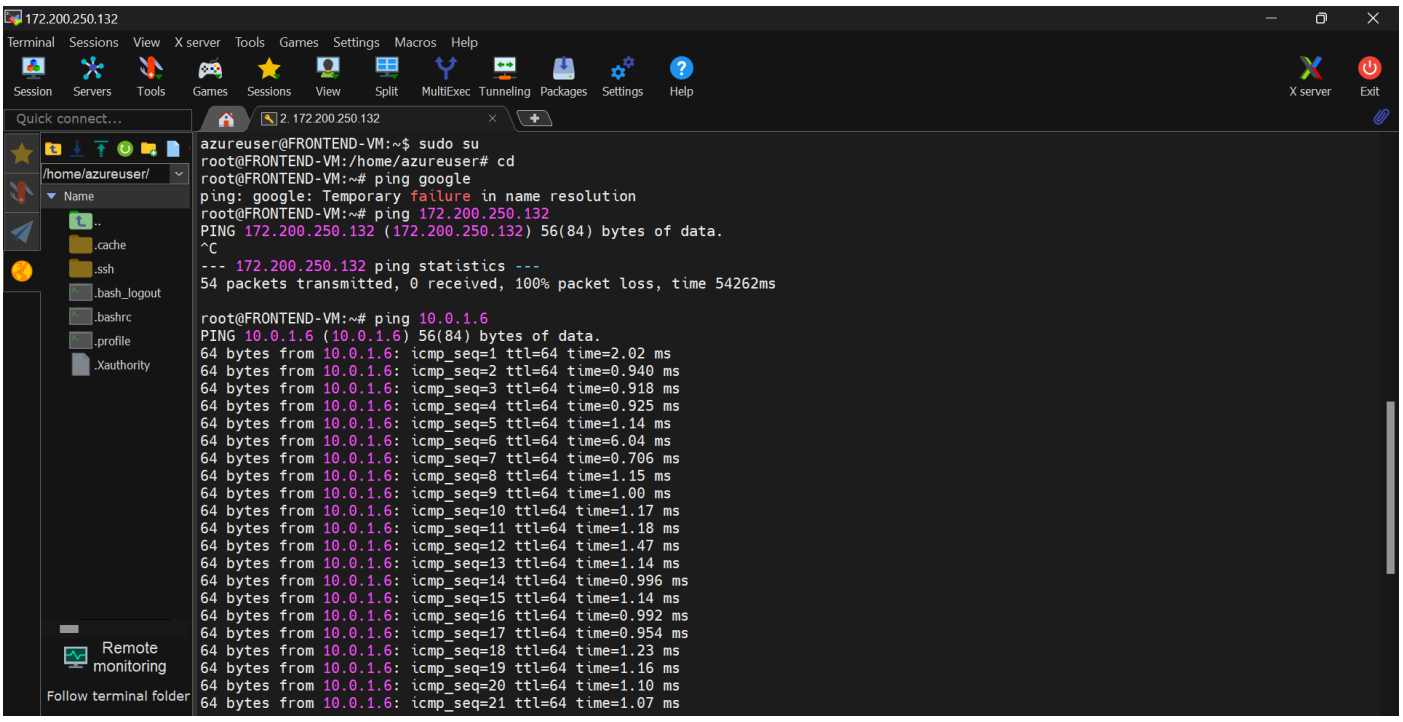
DEFAULT DIRECTORY (RISHITARS...
Home > CreateVm-canonical.0001-com-ubuntu-server-focal-2-20240811182348 | Overview >
BACKEND-VM
Virtual machine
Search
Connect Start Restart Stop Hibernate Capture Delete Refresh Open in mobile Feedback CLI / PS
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Connect
Connect
Bastion
Networking
Network settings
Load balancing
Application security groups
Network manager
BACKEND-VM virtual machine agent status is not ready. Troubleshoot the issue
Essentials
JSON View
Resource group (move) : RG-1
Status : Running
Location : East US 2
Subscription (move) : Azure for Students
Subscription ID : 6b19a714-a669-4b27-9c56-81d616b30bf0
Operating system : Linux
Size : Standard D2s v3 (2 vcpus, 8 GiB memory)
Public IP address : -
Virtual network/subnet : VNET-BACKEND/Subnet-A
DNS name : -
Health state : -
Time created : 8/11/2024, 12:56 PM UTC
Tags (edit) : Add tags
Properties Monitoring Capabilities (7) Recommendations Tutorials
Virtual machine
Networking

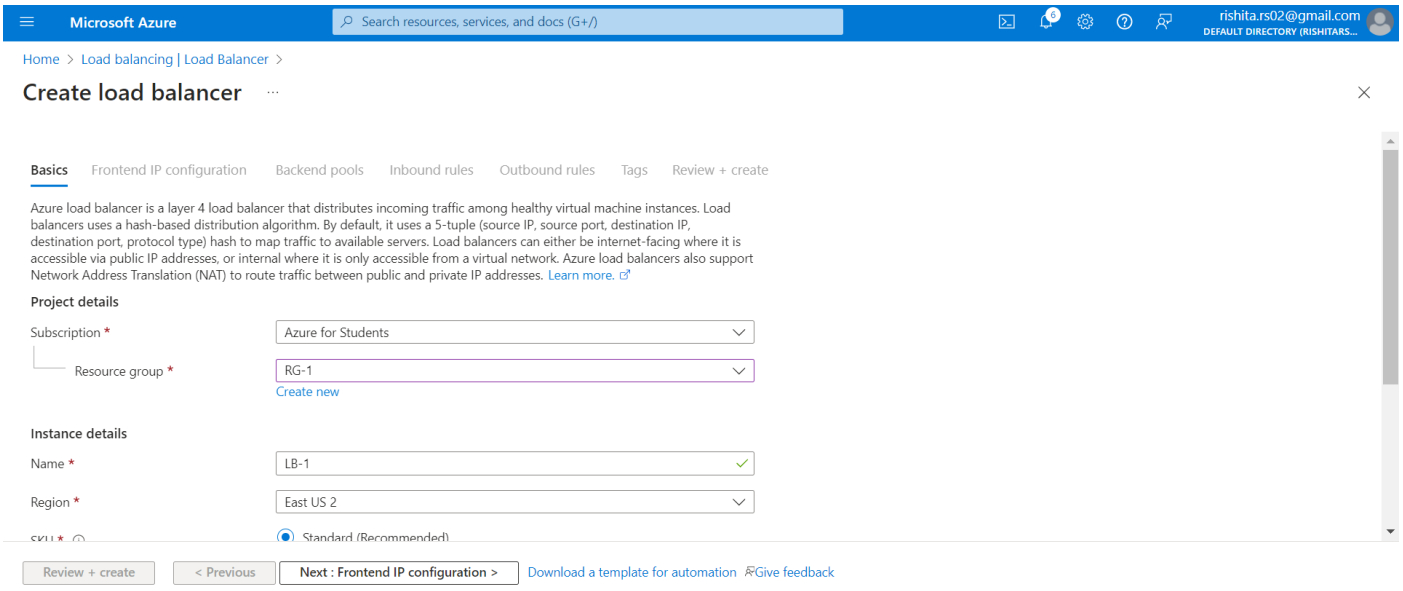
IV. Added peering to the VNets:

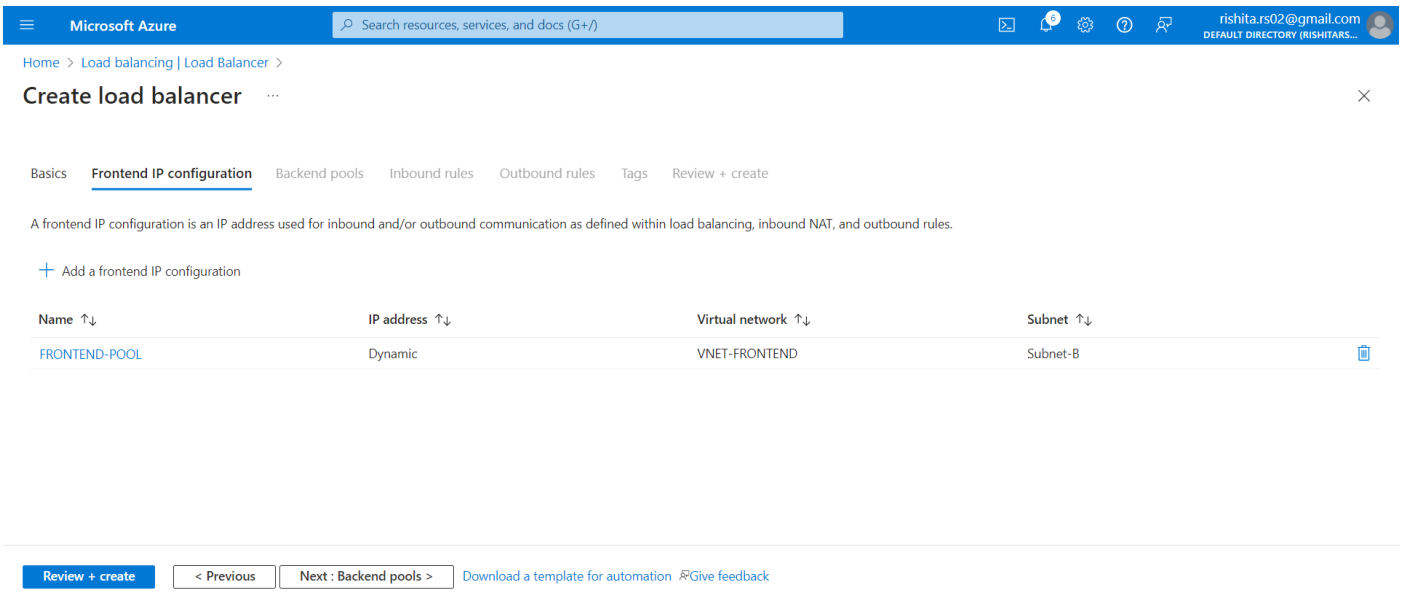


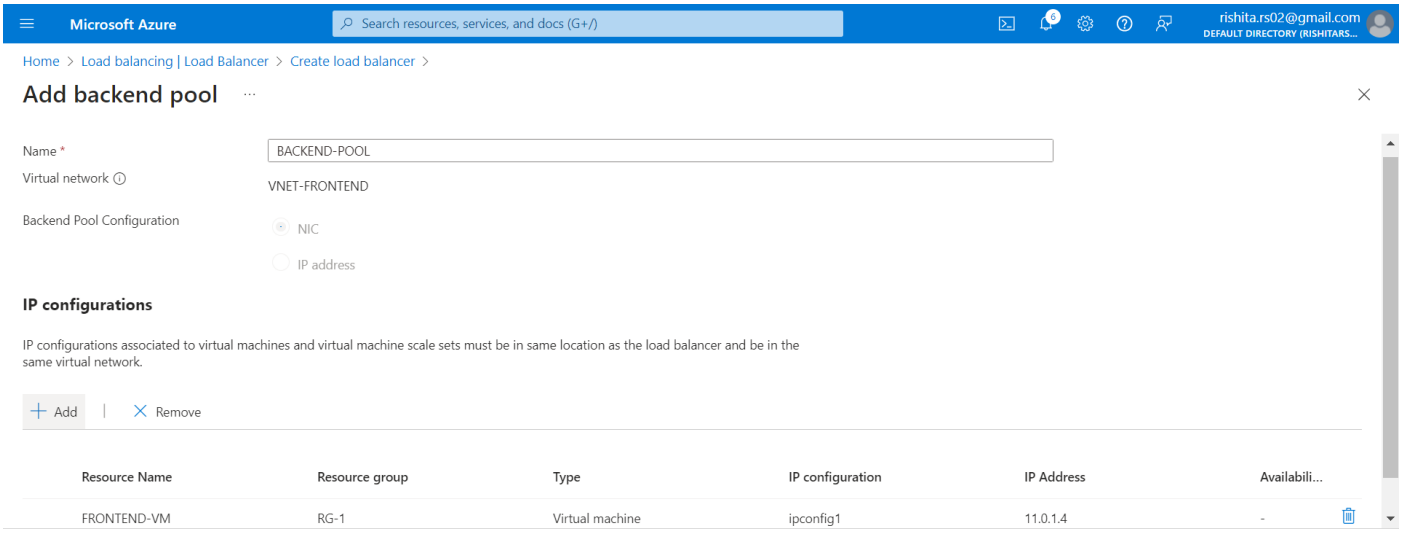


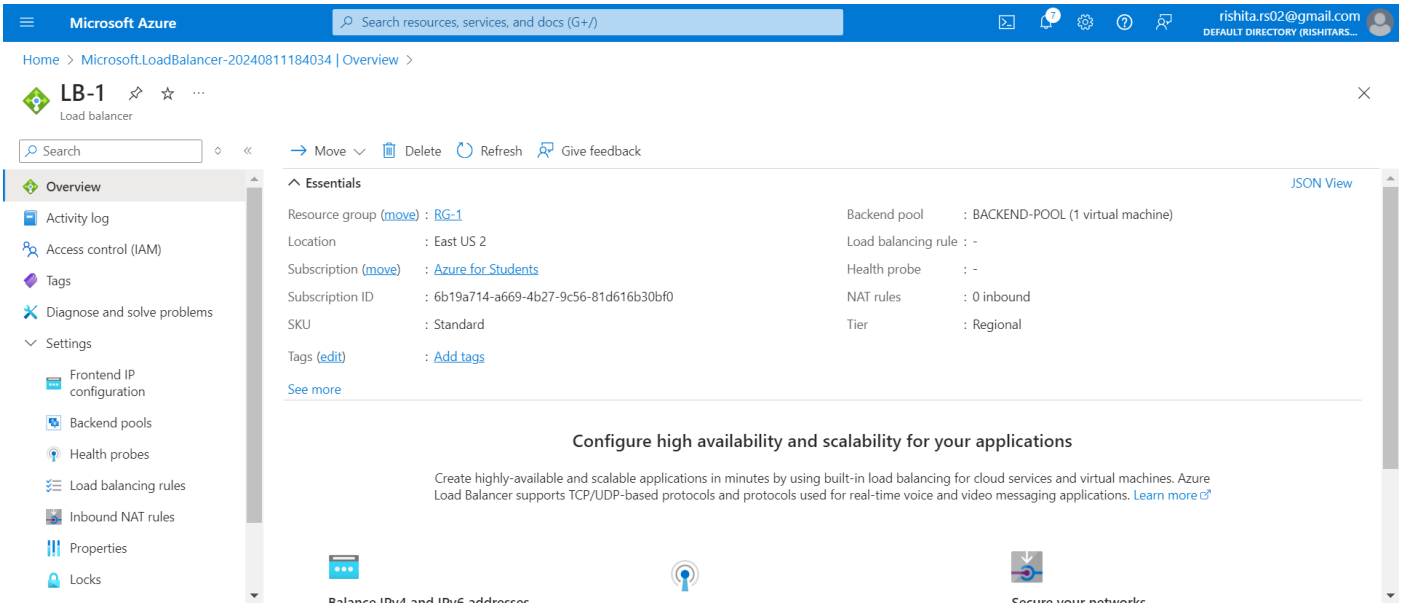


V. A Load Balancer was applied to FRONTEND servers and a public IP was added to it.

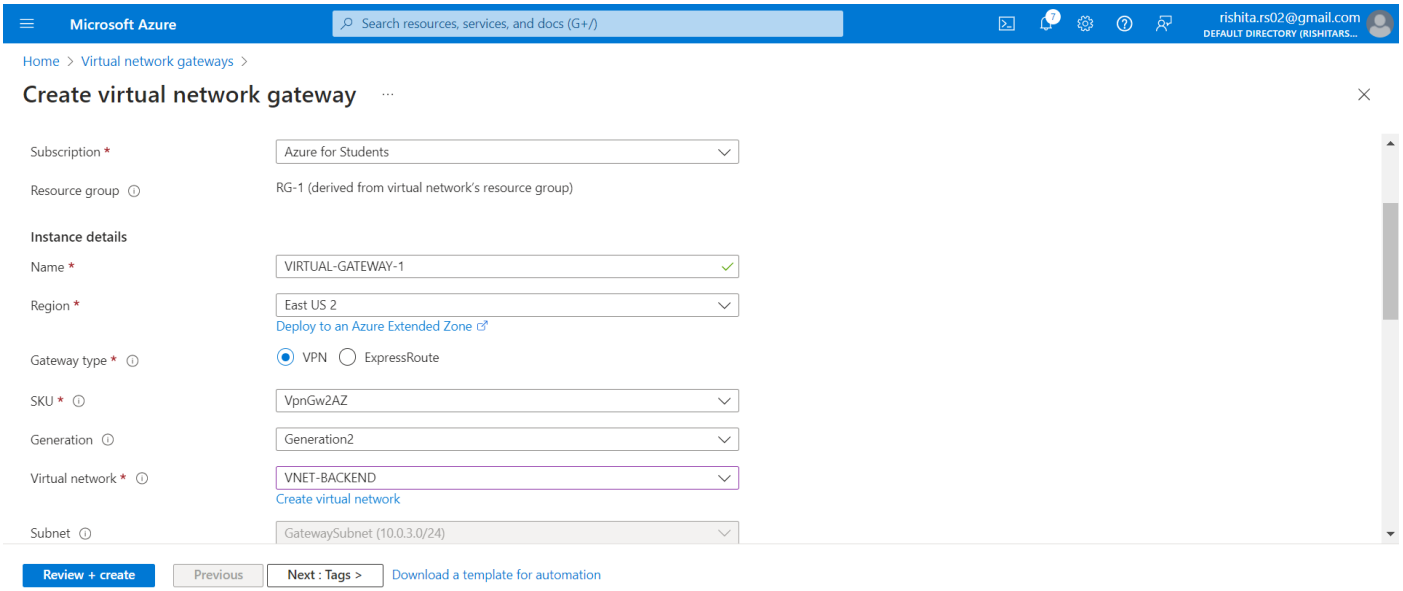


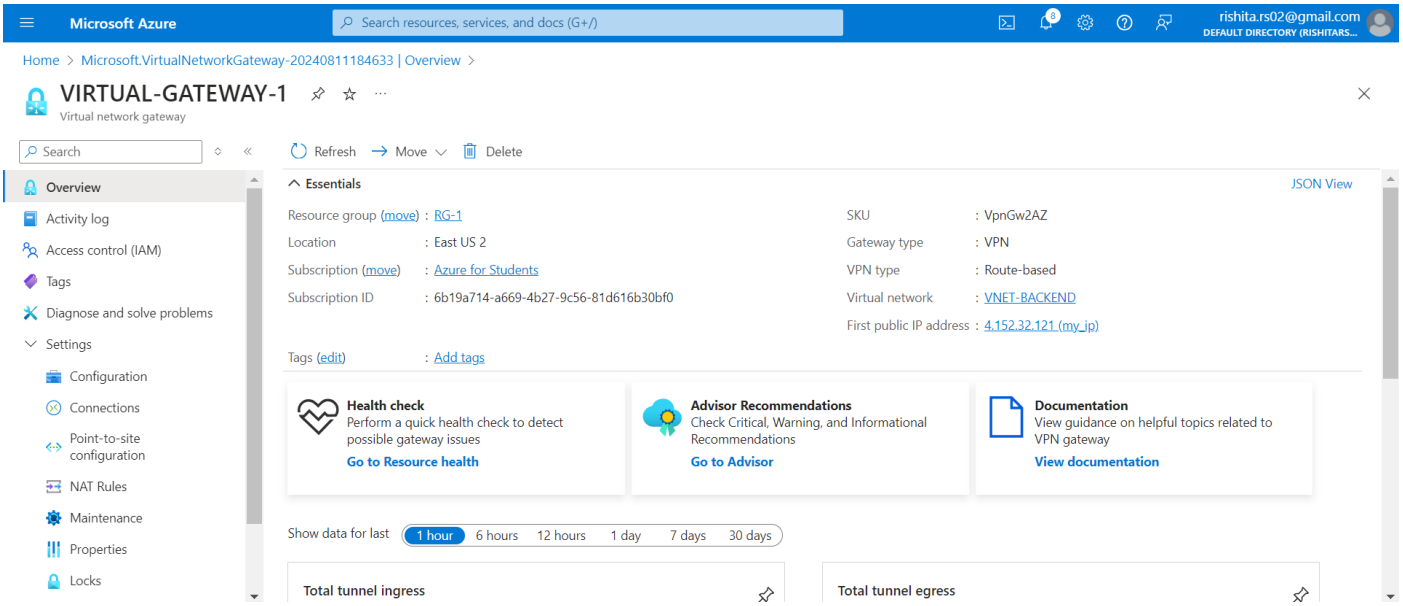




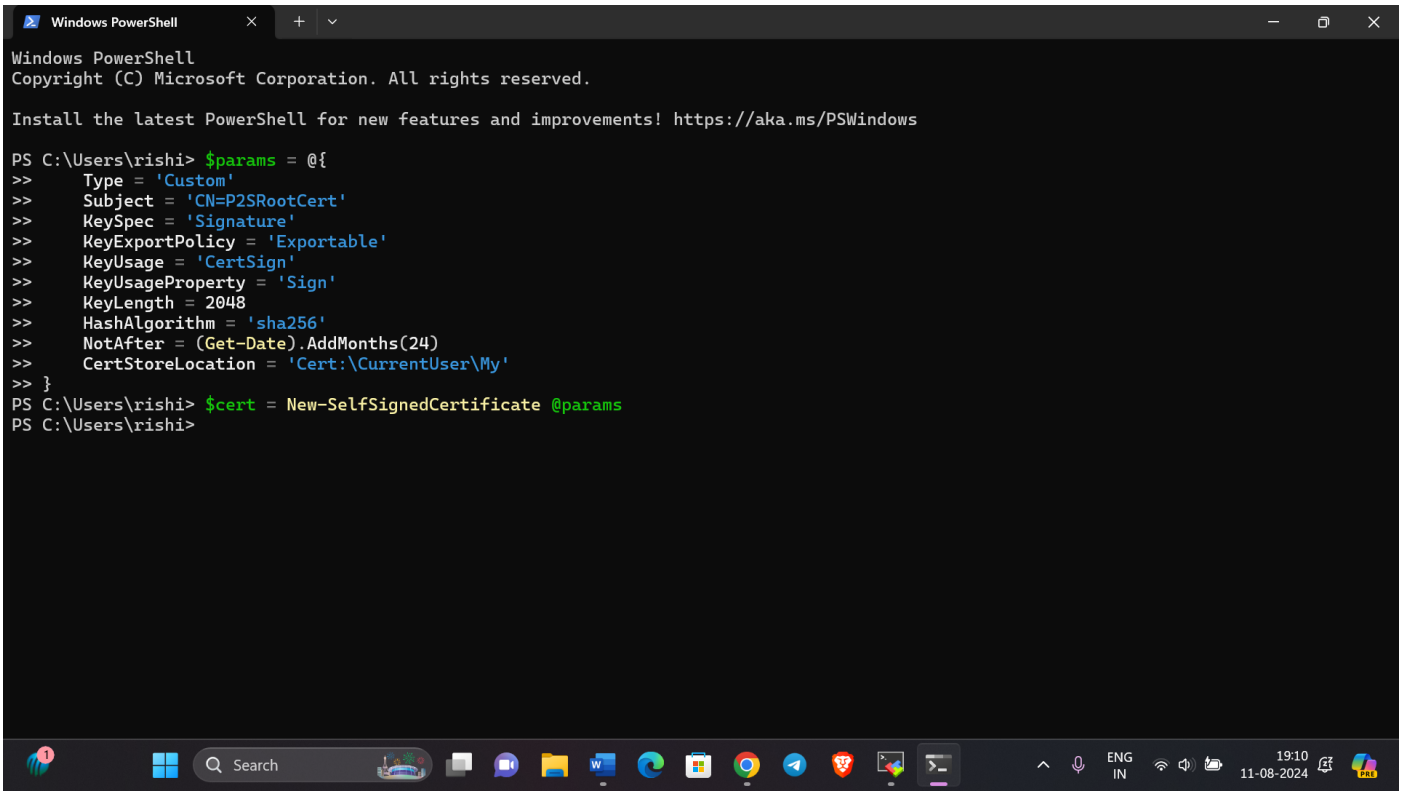


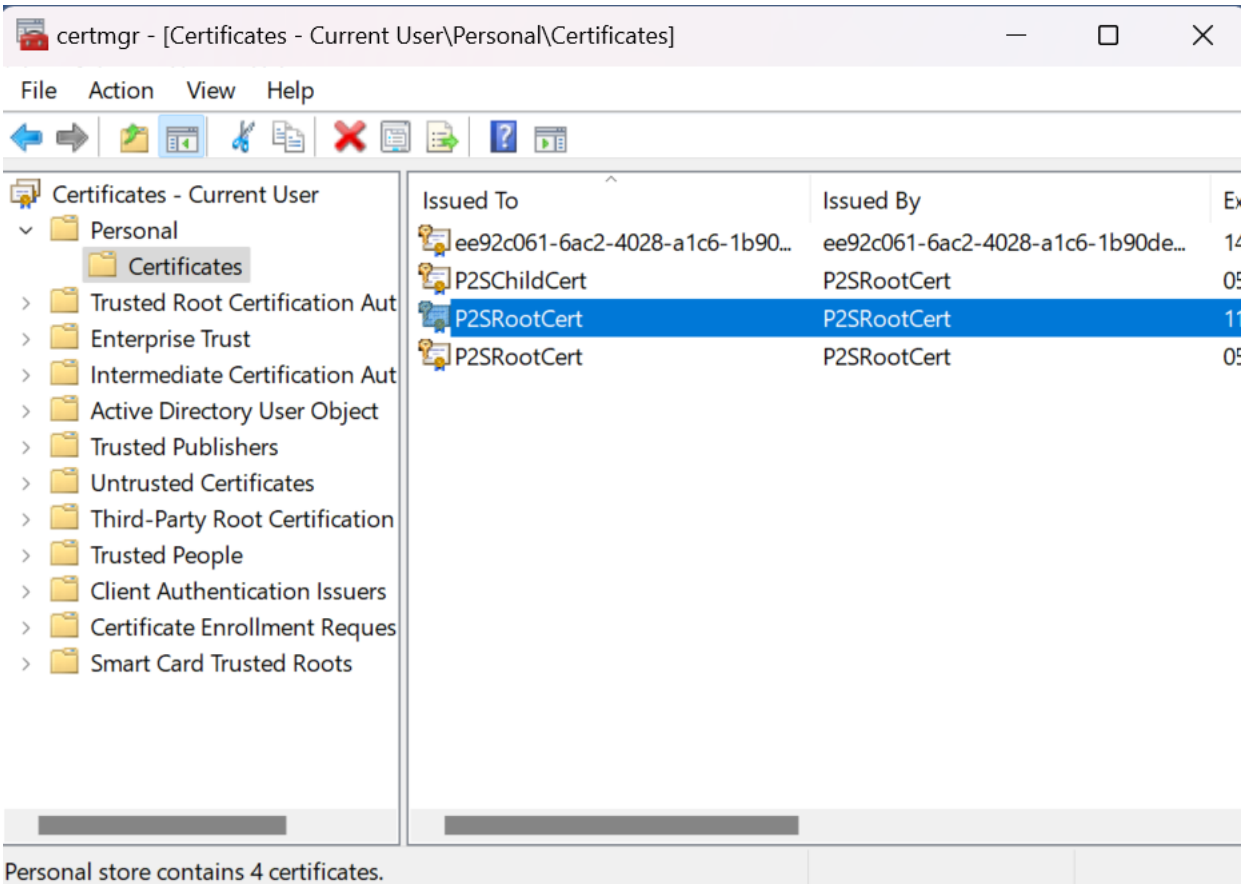
VI. A Virtual Network Gateway was used to connect the VMs through a private path setup using Jump servers (Using VPN)

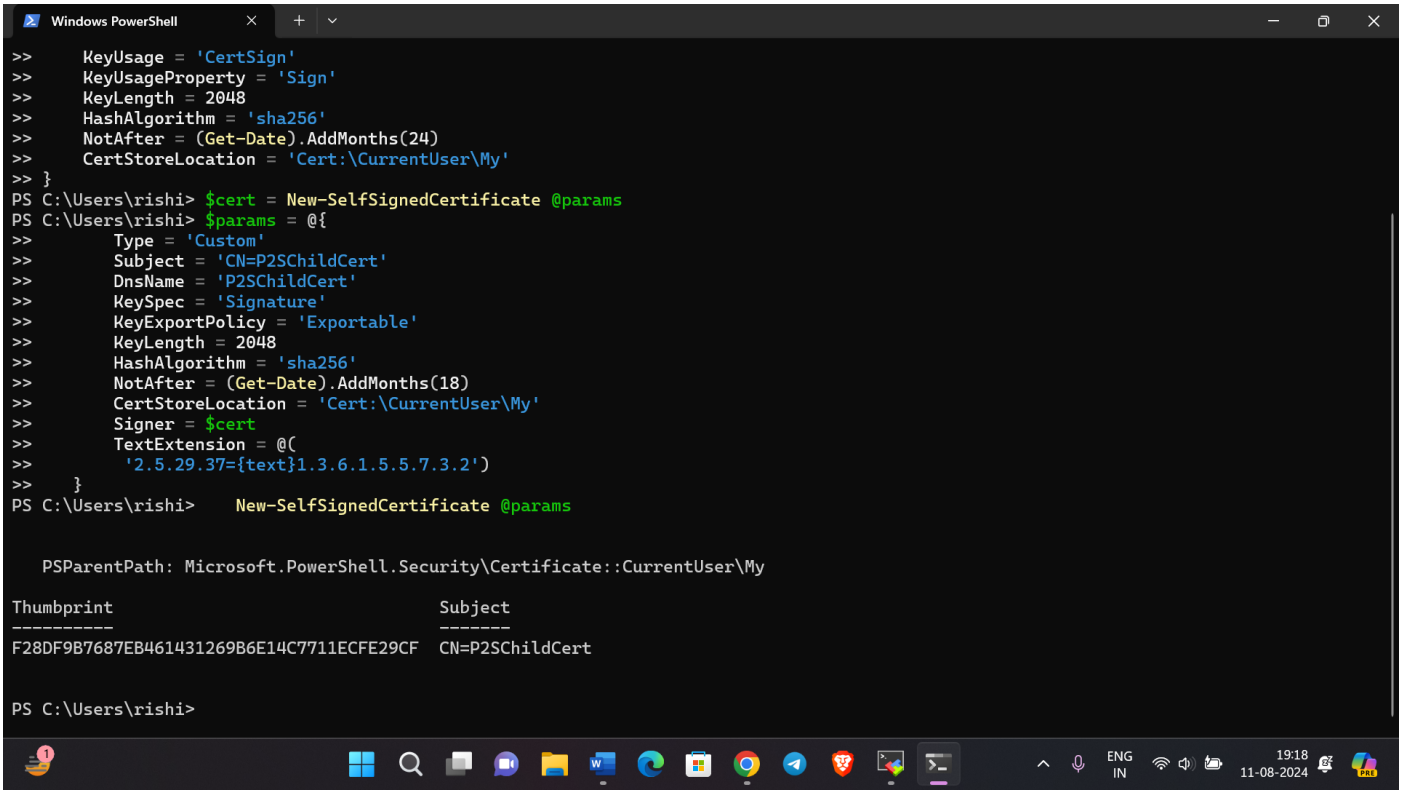




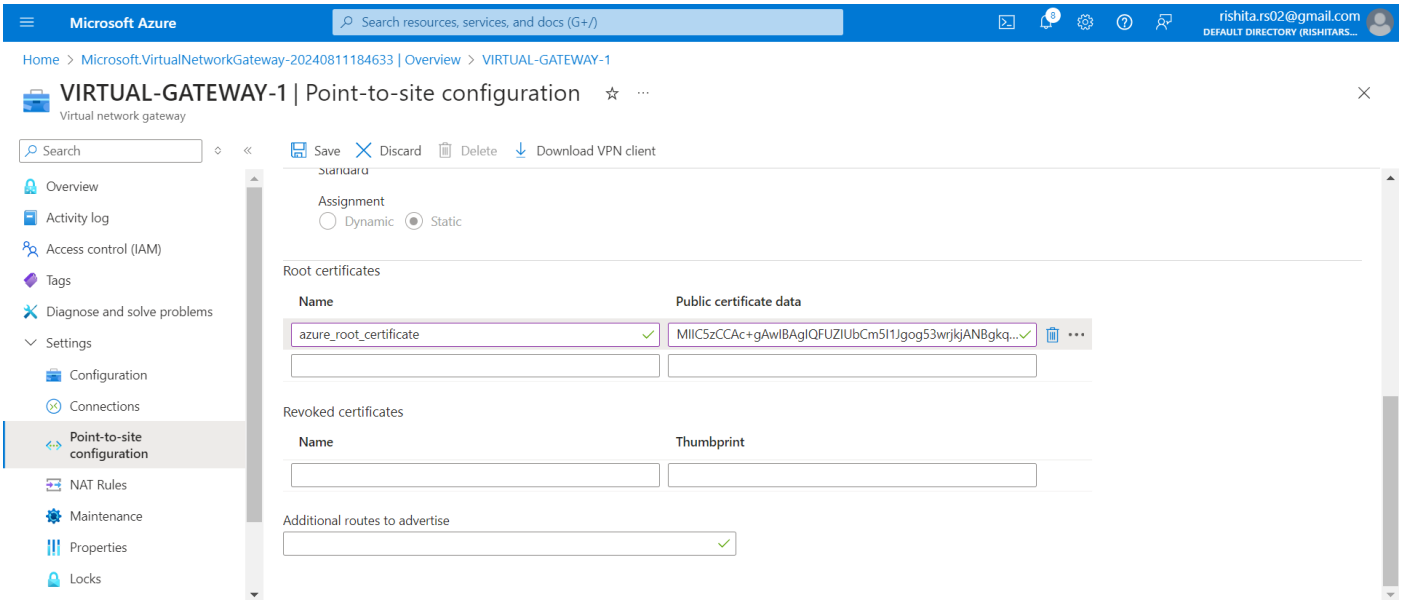
VII. Created the AZURE CLIENT CERTIFICATE and the AZURE ROOT CERTIFICATE.

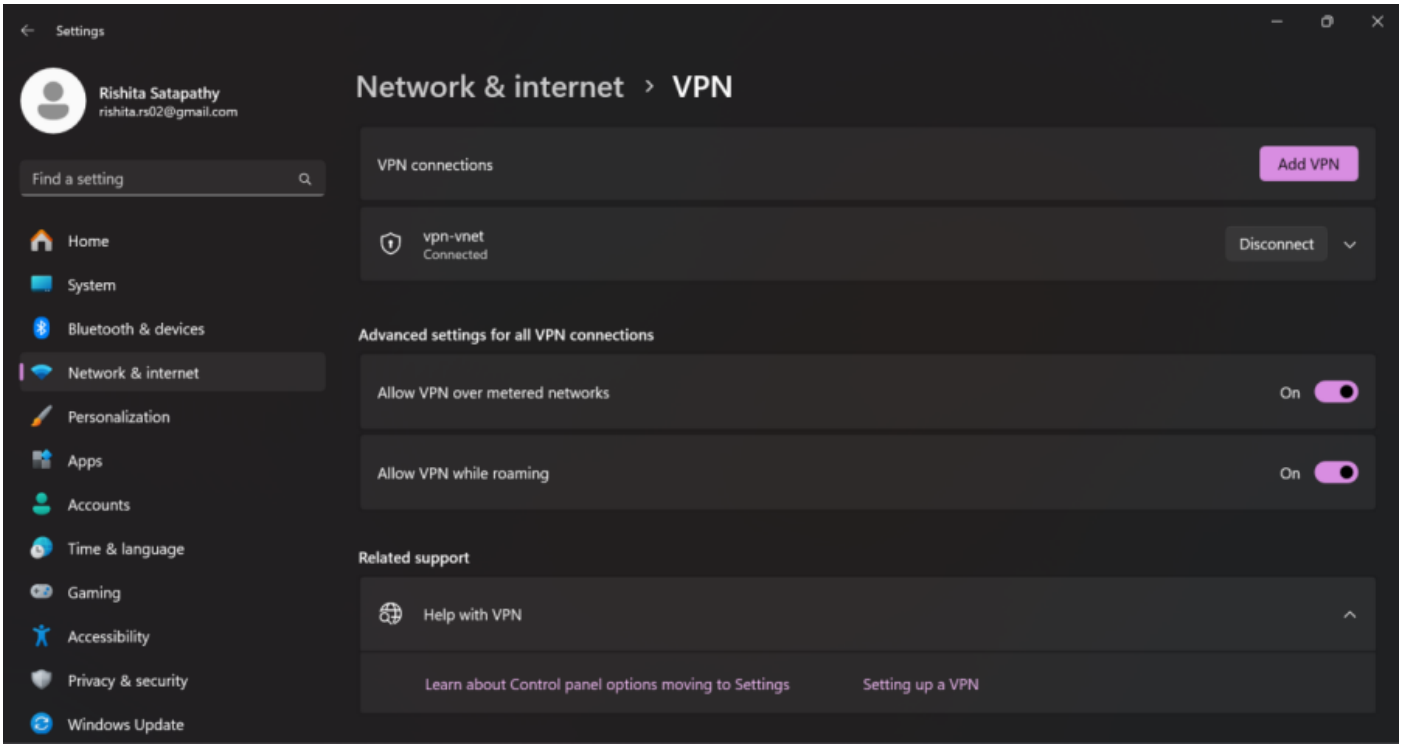




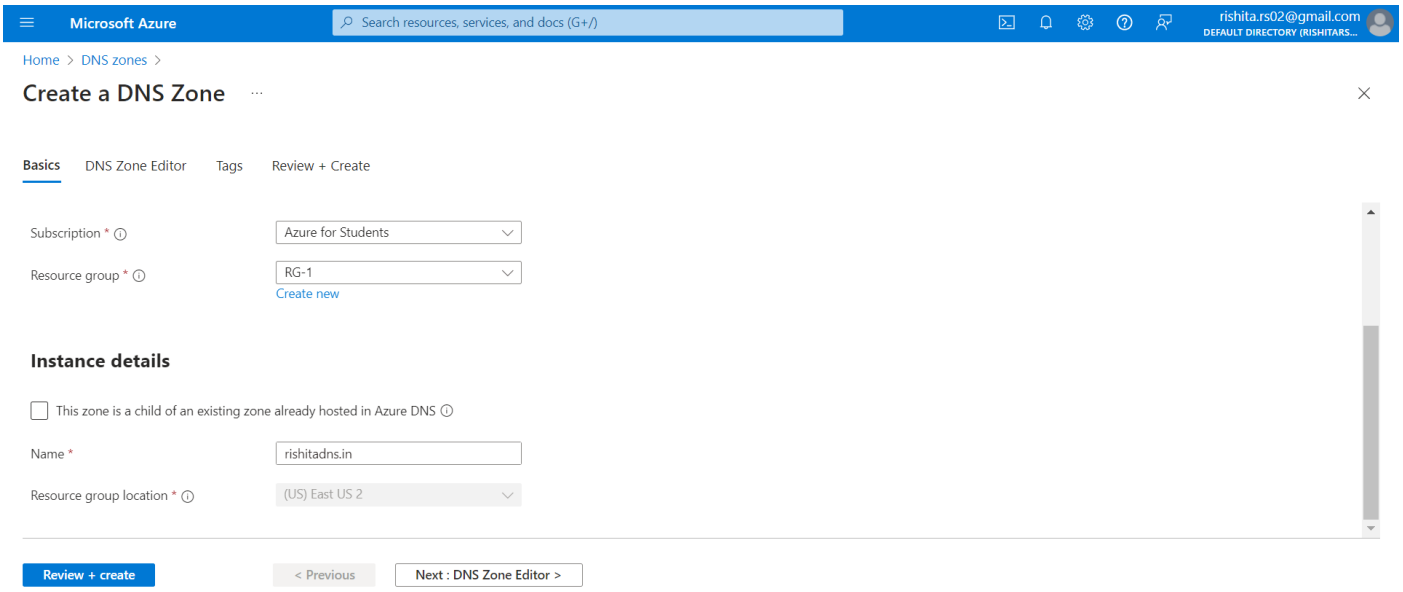


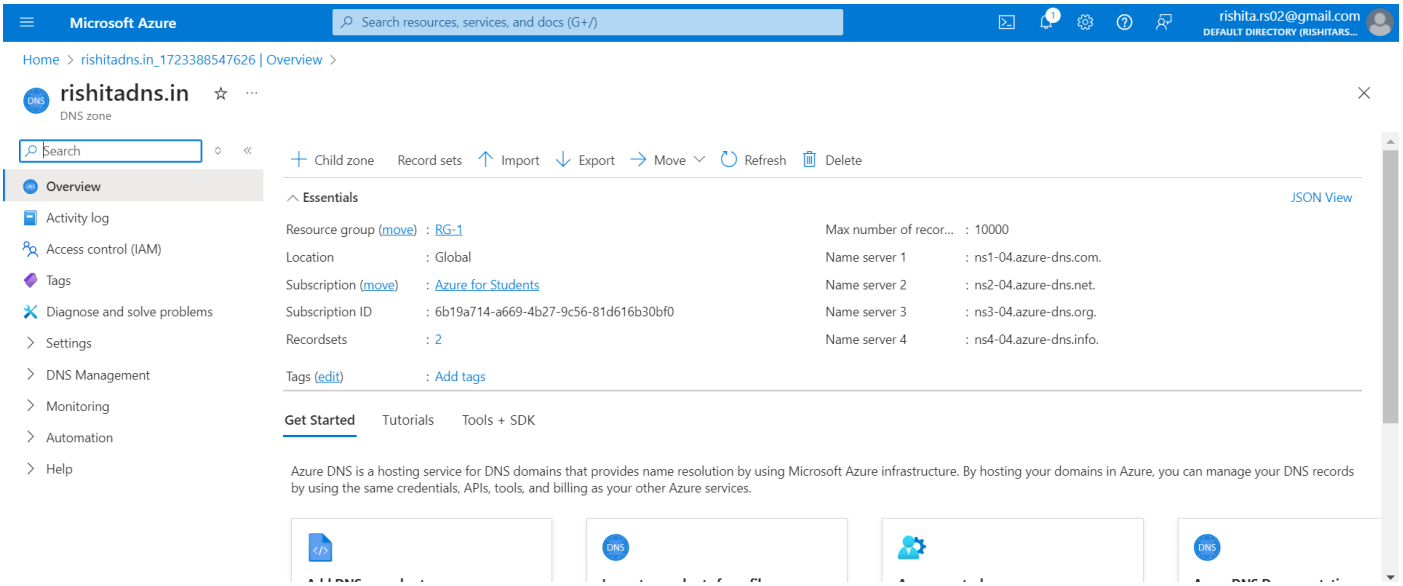
VIII. Added the Root Certificate to the Virtual Network Gateway using Point-to-site configuration.





IX. Deployed it using DNS zones and mapped the Public IP of the Load Balancer to the domain name.

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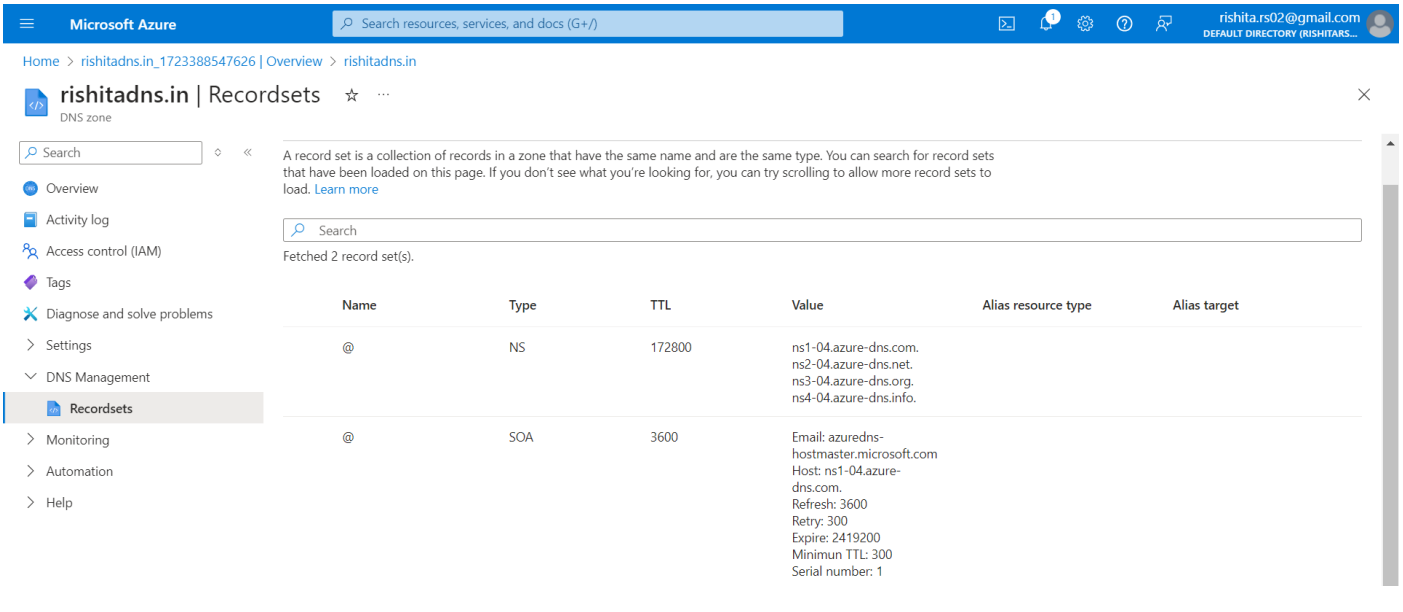
DEFAULT DIRECTORY (RISHITARS...
Home > rishitadns.in_1723388547626 | Overview >
rishitadns.in
DNS zone
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Settings
DNS Management
Monitoring
Automation
Help
Child zone
Record sets
Import
Export
Move
Refresh
Delete
Essentials
JSON View
Resource group (move) : RG-1
Location : Global
Subscription (move) : Azure for Students
Subscription ID : 6b19a714-a669-4b27-9c56-81d616b30bf0
Recordsets : 2
Max number of recor... : 10000
Name server 1 : ns1-04.azure-dns.com.
Name server 2 : ns2-04.azure-dns.net.
Name server 3 : ns3-04.azure-dns.org.
Name server 4 : ns4-04.azure-dns.info.
Tags (edit) : Add tags
Get Started
Tutorials
Tools + SDK
Azure DNS is a hosting service for DNS domains that provides name resolution by using Microsoft Azure infrastructure. By hosting your domains in Azure, you can manage your DNS records by using the same credentials, APIs, tools, and billing as your other Azure services.


Microsoft Azure
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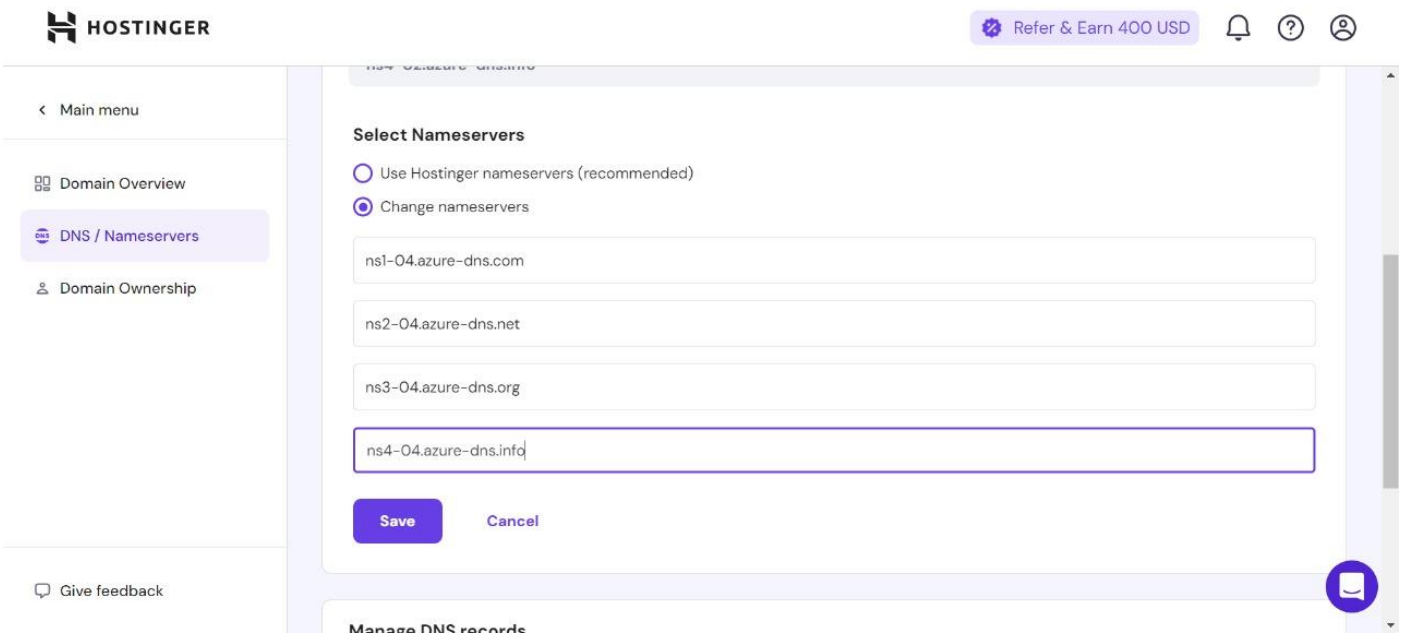
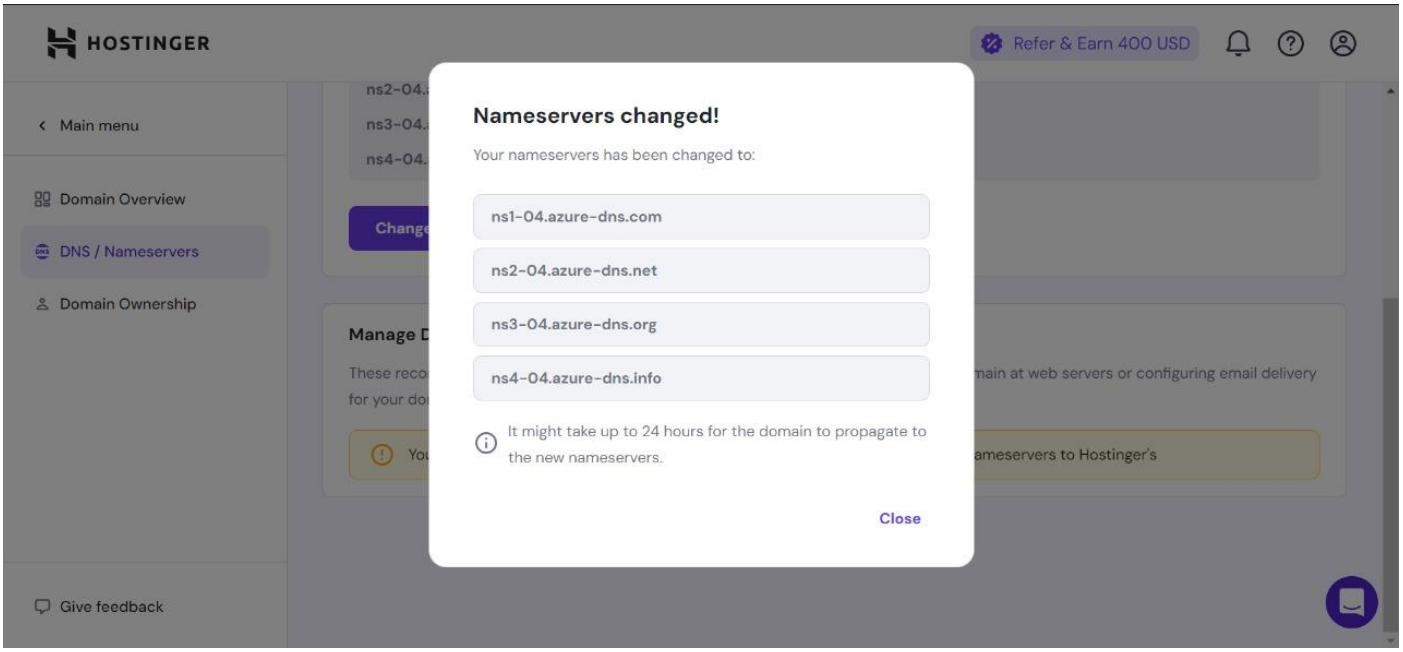
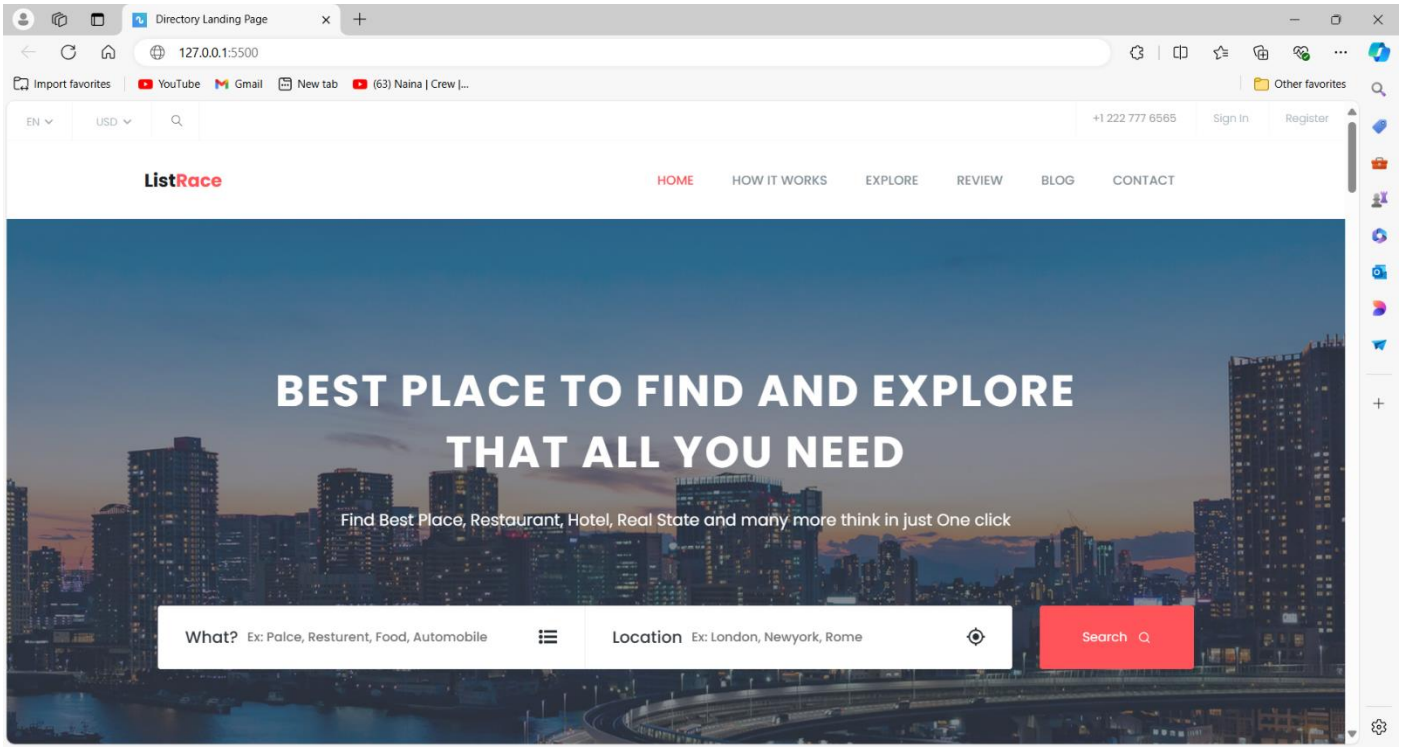
DEFAULT DIRECTORY (RISHITARS...
Home > rishitadns.in_1723388547626 | Overview > rishitadns.in
rishitadns.in | Recordsets
DNS zone
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Settings
DNS Management
Recordsets
Monitoring
Automation
Help
A record set is a collection of records in a zone that have the same name and are the same type. You can search for record sets that have been loaded on this page. If you don't see what you're looking for, you can try scrolling to allow more record sets to load. Learn more
Search
Fetched 2 record set(s).
Name
Type
TTL
Value
Alias resource type
Alias target
@
NS
172800
ns1-04.azure-dns.com.
ns2-04.azure-dns.net.
ns3-04.azure-dns.org.
ns4-04.azure-dns.info.
@
SOA
3600
Email: azuredns-hostmaster.microsoft.com
Host: ns1-04.azure-dns.com.
Refresh: 3600
Retry: 300
Expire: 2419200
Minimun TTL: 300
Serial number: 1


HOSTINGER
Refer & Earn 400 USD
Main menu
Domain Overview
DNS / Nameservers
Domain Ownership
Give feedback
Select Nameservers
Use Hostinger nameservers (recommended)
Change nameservers
ns1-04.azure-dns.com
ns2-04.azure-dns.net
ns3-04.azure-dns.org
ns4-04.azure-dns.info
Save
Cancel
Manage DNS records



X. Applied SSL to the domain while it was hosted.



INDUSTRY PRACTICES:

- Security: Implement the least privilege principle, use a jump server to secure VM access, and encrypt data both in transit (using SSL) and at rest.

- Scalability: Use autoscaling to adjust VM instances based on demand, ensuring the application can handle varying traffic loads efficiently.

- High Availability: Deploy load balancers across multiple availability zones, ensuring continuous service even if one zone fails.

- Cost Management: Optimize resource allocation through autoscaling and monitor usage to avoid over-provisioning, reducing unnecessary costs.


THANK YOU!