

# **FINAL CSI ASSIGNMENT**

**Name – Debducta Basu (CT\_CSI\_DV\_4383)**

## **PROJECT OVERVIEW**

**Objective:** To create a robust infrastructure using the Azure portal to handle increased traffic for a growing e-commerce platform. This includes setting up a public Azure Load Balancer, configuring a backend pool with two virtual machines, and setting up Azure Bastion, a NAT Gateway, a virtual network, and necessary subnets.

### **Step 1: Prerequisites (These are required to be performed before advancing with the project)**

1. **Azure Account:** One need to ensure you have an active Azure subscription. I have got the Azure Subscription for Students Starter Group for which I am not getting all the benefits that I must be getting.
2. **Resource Group:** Create a resource group if you don't already have one.

**If you don't have a resource group then you can create it using the following steps in Azure Studio -**

#### **Navigate to Resource Groups:**

- In the Azure portal, click on the menu icon (three horizontal lines) in the upper-left corner to open the Azure services menu.
- Select "Resource groups" from the list.

#### **Create Resource Group:**

- In the "Resource groups" page, click on the "+ Create" button at the top of the page.

#### **Configure Resource Group:**

- Subscription: Ensure the correct subscription is selected.
- Resource Group: Enter a unique name for the resource group (e.g., "MyNewResourceGroup").
- Region: Choose the region where you want the resource group to be located. It's generally best to choose the region closest to where your resources will be used to minimize latency (e.g., Central US).

### **Step 2: Set Up Virtual Network (This step describes the 2<sup>nd</sup> step to advance in the project by setting up virtual network)**

1. **Create Virtual Network:**
  - At first, go to the Azure portal.

- Search for "Virtual Networks" and click on "Create."
- Choose your subscription and resource group. (Here I have chosen my “**Azure for Students Starter**” subscription and my created resource network “**MyNewResourceGroup**”).
- Enter a name for the virtual network. (Here I have inserted the name “**SampleProjectVirtualNetwork**”)
- Define the address space (I have used **10.0.0.0/16**).
- Click "Next" to go to the Subnets tab.

The screenshot shows the 'Create virtual network' page in the Microsoft Azure portal. The 'Basics' tab is selected. Under 'Project details', the 'Subscription' is 'Azure for Students Starter' and the 'Resource group' is '(New) MyNewResourceGroup'. Under 'Instance details', the 'Virtual network name' is 'SampleProjectVirtualNetwork' and the 'Region' is '(US) Central US'. At the bottom, there are 'Previous', 'Next', and 'Review + create' buttons.

## 2. Create Subnets:

- **Resource Subnet:**
  - Name: “**ResourceSubnet**”
  - Address range: **10.0.1.0/24**

The screenshot shows the 'Create virtual network' page with the 'IP addresses' tab selected. A table lists the address spaces: 10.0.0.0/16 (65,536 addresses) and 10.0.0.0 - 10.0.255.255 (256 addresses). The 'Subnets' table shows a 'default' subnet with IP range 10.0.0.0 - 10.0.255.255 and size /24. The 'Edit subnet' dialog is open for 'ResourceSubnet', showing it is an IPv4 subnet with address range 10.0.0.0/16, starting address 10.0.1.0, and size /24 (256 addresses). The 'Private subnet' checkbox is unchecked.

- **Bastion Subnet:**
  - Name: “**AzureBastionSubnet**”
  - Address range: **10.0.2.0/24**

Microsoft Azure

Search resources, services, and docs (G+)

Copilot

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UNIVERSITY OF ENGINEERING & ...

Home > Virtual networks >

Create virtual network

Basics Security IP addresses Tags Review + create

Configure your virtual network address space with the IPv4 and IPv6 addresses and subnets you need. [Learn more](#)

Define the address space of your virtual network with one or more IPv4 or IPv6 address ranges. Create subnets to segment the virtual network address space into smaller ranges for use by your applications. When you deploy resources into a subnet, Azure assigns the resource an IP address from the subnet. [Learn more](#)

Add IPv4 address space

10.0.0.0/16

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
ResourceSubnet	10.0.1.0 - 10.0.1.255	/24 (256 addresses)	-

Previous

Next

Review + create

Add a subnet

Select an address space and configure your subnet. You can customize a default subnet or select from subnet templates if you plan to add select services later. [Learn more](#)

Subnet purpose

Azure Bastion

Name

AzureBastionSubnet

IPv4

Include an IPv4 address space

☒

IPv4 address range

10.0.0.0/16

10.0.0.0 - 10.0.255.255

Starting address

10.0.2.0

Size

/26 (64 addresses)

Subnet address range

10.0.2.0 - 10.0.2.63

IPv6

Include an IPv6 address space

☐

This virtual network has no IPv6 address ranges.

Private subnet

PREVIEW

Private subnets enhance security by not providing default outbound access. To enable outbound connectivity for virtual machines to access the internet, it is necessary to explicitly grant outbound access. A NAT gateway is the recommended way to provide outbound connectivity for virtual machines in the subnet. [Learn more](#)

Add

Cancel

Give feedback

Home > Virtual networks >

Create virtual network

Basics Security IP addresses Tags Review + create

Define the address space of your virtual network with one or more IPv4 or IPv6 address ranges. Create subnets to segment the virtual network address space into smaller ranges for use by your applications. When you deploy resources into a subnet, Azure assigns the resource an IP address from the subnet. [Learn more](#)

Add IPv4 address space

10.0.0.0/16

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
ResourceSubnet	10.0.1.0 - 10.0.1.255	/24 (256 addresses)	-
AzureBastionSubnet	10.0.2.0 - 10.0.2.63	/26 (64 addresses)	-

Previous

Next

Review + create

## Step 3: Create Virtual Machines

### 1. Create VM 1 ("lb-vm1"):

- Go to the Azure portal and search for "Virtual Machines."
- Click "Add" to create a new VM.
- Choose your subscription and resource group.
- Enter the name lb-vm1 in the space Virtual Machine Name.
- Select your region and availability zone (Here "Zone 1").

Home > Create a resource > Marketplace >

## Create a virtual machine

Try out the Microsoft Copilot for Azure for additional recommendations when creating a virtual machine.

Help me create a low cost VM | Help me create a VM optimized for high availability | Help me choose the right VM size for my workload

Resource group \* (New) lb-vm1\_group [Create new](#)

**Instance details**

Virtual machine name \* lb-vm1 ✓

Region \* (US) West US 3 ✓

Availability options Availability zone ✓

Zone options ☒ Self-selected zone  
Choose up to 3 availability zones, one VM per zone  
☐ Azure-selected zone (Preview)  
Let Azure assign the best zone for your needs

Availability zone \* Zone 1 ✓  
You can now select multiple zones. Selecting multiple zones will create one VM per zone. 1 zone selected. 2 zones max. (2)

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[Give feedback](#)

- Choose an image (Here I have chosen **“Windows Server 2019”**).
- Choose a VM size (Here I have chosen **“Standard D2s”** but you can also go for Standard B2s).
- Set up username and password. (I have included my username as **“Contributor”** and a 12 character password. You can give the data as you like.)
- Place it in the **“ResourceSubnet”**.
- Enable the public IP and set it to none.

Home > Create a resource > Marketplace >

## Create a virtual machine

Try out the Microsoft Copilot for Azure for additional recommendations when creating a virtual machine.

Help me create a low cost VM | Help me create a VM optimized for high availability | Help me choose the right VM size for my workload

**Administrator account**

Username \* Contributor ✓

Password \* ..... ✓

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 Select one or more ports ✓

All traffic from the internet will be blocked by default. You will be able to change inbound port rules in the VM > Networking page.

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### Now create another VM 2 (“lb-vm1”):

- Go to the Azure portal and search for **"Virtual Machines."**
- Click **"Add"** to create a new VM.
- Choose your subscription and resource group.
- Enter the name **“lb-vm2”**.
- Select your region and availability zone (In this case **“Zone 2”**).

## Create a virtual machine ...

Try out the Microsoft Copilot for Azure for additional recommendations when creating a virtual machine.

[Help me create a low cost VM](#)

[Help me create a VM optimized for high availability](#)

[Help me choose the right VM size for my workload](#)

Resource group \* ⓘ (New) lb-vm2\_group  
[Create new](#)

**Instance details**

Virtual machine name \* ⓘ lb-vm2 ✓

Region \* ⓘ (Asia Pacific) Australia East

Availability options ⓘ Availability zone

Zone options ⓘ

☒ Self-selected zone  
Choose up to 3 availability zones, one VM per zone

☐ Azure-selected zone (Preview)  
Let Azure assign the best zone for your needs

Availability zone \* ⓘ Zone 2

✓ You can now select multiple zones. Selecting multiple zones will create one VM per zone. Learn more.

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Next : Disks >

Review + create

- Choose an image (“**Windows Server 2019**”).
- Choose a VM size (“**Chose Standard D2s**”).

## Create a virtual machine ...

Try out the Microsoft Copilot for Azure for additional recommendations when creating a virtual machine.

[Help me create a low cost VM](#)

[Help me create a VM optimized for high availability](#)

[Help me choose the right VM size for my workload](#)

Security type ⓘ Trusted launch virtual machines  
[Configure security features](#)

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.

Run with Azure Spot discount ⓘ ☐

Size \* ⓘ Standard\_D2s\_v3 - 2 vcpus, 8 GiB memory (₹13,178.87/month)  
[See all sizes](#)

Enable Hibernation ⓘ ☐

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Review + create

- Set up username and password.(Input same from the above creation)
- Place it in the “**ResourceSubnet**”.
- Enable public IP and set it to none.

## Create a virtual machine ...

Try out the Microsoft Copilot for Azure for additional recommendations when creating a virtual machine.

Help me create a low cost VM Help me create a VM optimized for high availability Help me choose the right VM size for my workload

---

**Administrator account**

Username \* ⓘ  ✓

Password \*  ✓

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  ▾

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### Step 4: Install IIS on Both VMs

1. Access VM via RDP: (The first step is for “lb-vm1”)
  - Go to the VM's overview page. Go to “lb-vm2”.
  - Click "**Connect**" to download the RDP file.
  - Use the RDP file to log into the VM.
2. Install IIS:
  - Open PowerShell on the VM.
  - Run the following command to install IIS:

#### CODE-

**“Install-WindowsFeature -name Web-Server -IncludeManagementTools”**

3. Access VM via RDP: (The 2<sup>nd</sup> step is for “lb-vm2”)
  - Go to the VM's overview page. Go to the “lb-vm2”.
  - Click "**Connect**" to download the RDP file.
  - Use the RDP file to log into the VM.
4. Install IIS:
  - Open PowerShell on the VM.
  - Run the following command to install IIS:

#### CODE-

**Install-WindowsFeature -name Web-Server -IncludeManagementTools**

### Step 5: Now create Public IP Addresses

1. Create Public IP for Load Balancer:
  - Go to "Public IP addresses" in the Azure portal.
  - Click "Add" to create a new public IP.

- Choose your subscription, resource group, and enter a name. (Here I have entered my public IP name as “**MyPersonalPublicIP**”)
- Set SKU to "Standard" and leave the rest as default.

Basics ● DDoS Protection Tags Review + create

**Configuration details**

Name \*

IP Version \* ⓘ ☒ IPv4 ☐ IPv6

SKU \* ⓘ ☒ Standard ☐ Basic

Tier \* ⓘ ☒ Regional ☐ Global

IP address assignment

Static IPs are assigned at the time the resource is created and released when the resource is deleted. Dynamic IPs are assigned when associating the IP to a resource and is released when you stop, restart, or delete a resource. Dynamic is only available for

- Click "Review + create."
- 2. Create Public IP for NAT Gateway:**
- Go to "Public IP addresses" in the Azure portal.
  - Click "Add" to create a new public IP.
  - Choose your subscription, resource group, and enter a name. (Here I have entered my public IP name as “**IPNATGateway**”)
  - Set SKU to "Standard" and leave the rest as default.
  - Click "Review + create."

## Create public IP address ...

**Basics** ● DDoS Protection Tags Review + create

Region \* (Asia Pacific) South India ▼  
[Deploy to an Azure Extended Zone](#)

### Configuration details

Name \* IPNATGateway

IP Version \* ⓘ ☒ IPv4  
☐ IPv6

SKU \* ⓘ ☒ Standard  
☐ Basic

Tier \* ⓘ ☒ Regional

[Previous](#)

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[Review + create](#)


## Step 6: Create NAT Gateway

### 1. Create NAT Gateway:

- Search for "NAT Gateway" in the Azure portal.
- Click "Create."
- Choose your subscription, resource group, and enter a name. (Here I have entered the name as “**MyNATGateway**” and the resource group is selected as “**MyResourceGroup**”).
- Select the public IP address created for the NAT Gateway.
- Associate it with the ResourceSubnet.



## Create network address translation (NAT) gateway ...

 Changing Basic options may reset selections you have made. Review all options prior to creating the resource.

[Basics](#)   [Outbound IP](#)   [Subnet](#)   [Tags](#)   [Review + create](#)

Azure NAT gateway can be used to translate outbound flows from a virtual network to the public internet.

[Learn more about NAT gateways.](#) 

### Project details

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

Subscription \*

Resource group \*  [Create new](#)

### Instance details

NAT gateway name \*  

Region \*

Availability zone

[Review + create](#)

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[Next : Outbound IP >](#)

[Download a template for automation](#)


## Step 7: Create Load Balancer

### 1. Create Load Balancer:

- Search for "Load Balancers" in the Azure portal.
- Click "Add" to create a new load balancer.
- Choose your subscription and resource group. (Here I chose the resource group previously created “**MyResourceGroup**”)
- Enter a name for the load balancer. (The load balancer name that I gave “**MyFirstLoadBalancer**”)
- Select "Public" and choose the public IP created for the load balancer.
- Set SKU to "Standard" and leave the rest as default.

## Create load balancer ...

[Basics](#)   [Frontend IP configuration](#)   [Backend pools](#)   [Inbound rules](#)   [Outbound rules](#)   [Tags](#)   [Review + create](#)


Azure load balancer is a layer 4 load balancer that distributes incoming traffic among healthy virtual machine instances. Load balancers uses a hash-based distribution algorithm. By default, it uses a 5-tuple (source IP, source port, destination IP, destination port, protocol type) hash to map traffic to available servers. Load balancers can either be internet-facing where it is accessible via public IP addresses, or internal where it is only accessible from a virtual network. Azure load balancers also support Network Address Translation (NAT) to route traffic between public and private IP addresses. [Learn more.](#) 

### Project details

Subscription \*

Resource group \*  [Create new](#)

### Instance details

Name \*  

Region \*

SKU \* ⓘ ☒ Standard (Recommended)  
☐ Gateway  
☐ Basic (Retiring soon)

Type \* ⓘ ☒ Public  
☐ Internal

2. **Configure Backend Pool:**

- In the load balancer settings, go to "Backend pools."
- Click "Add" to create a new backend pool.
- Enter a name. (Let's enter a name like "**MyBackendPool**")
- Choose "Virtual network."
- Add the two VMs (lb-vm1 and lb-vm2 these are the previously created VM's).

3. **Create Health Probe:**

- Go to "Health probes" in the load balancer settings.
- Click "Add" to create a new health probe.
- Enter a name. (Enter the name as "**NewHealthProbe**")
- Protocol: TCP
- Port: 80
- Interval: 5 seconds
- Unhealthy threshold: 2

4. **Create Load Balancer Rule:**

- Go to "Load balancing rules" in the load balancer settings.
  - Click "Add" to create a new rule.
  - Enter a name. (Enter the name as "**BalancingRuleOne**")
  - IP Version: IPv4
  - Frontend IP address: Select the public IP of the load balancer.
  - Protocol: TCP
  - Port: 80
  - Backend port: 80
  - Backend pool: Select the backend pool created. (i.e with the name "**MyBackendPool**")
  - Health probe: Select the health probe created. (i.e with the name "**NewHealthProbe**")
  - Session persistence: None
  - Idle timeout (minutes): 4
- 

**Step 8: Set Up Azure Bastion**

1. **Create Bastion:**

- Search for "Bastion" in the Azure portal.
  - Click "Add" to create a new bastion host.
  - Choose your subscription and resource group. (Here my resource group is "MyResourceGroup")
  - Enter a name. (Enter a suitable name like "**MyAzureBastion**")
  - Select the virtual network created. (The virtual network that was created at first with the name "**SampleProjectVirtualNetwork**")
  - Subnet: Choose AzureBastionSubnet.
  - Public IP address: Create a new public IP for Bastion.
- 

**Step 9: Testing the Setup**

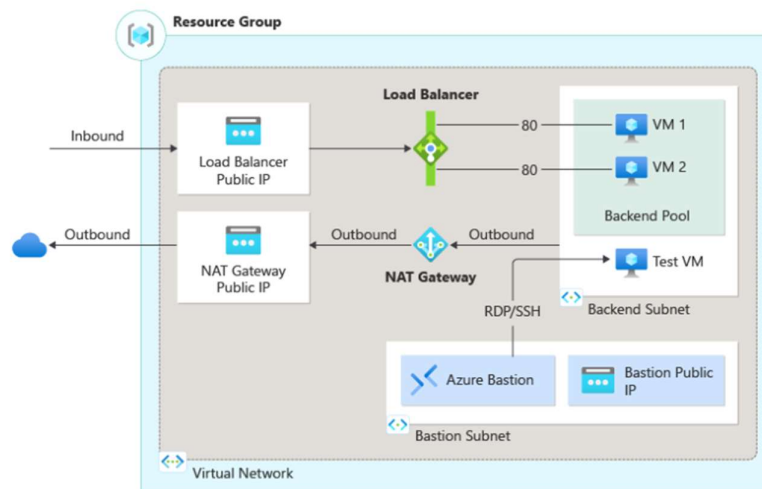
1. **Test Load Balancer:**

- Access the public IP of the load balancer in a web browser.
- You should see the default IIS page.
- To verify load balancing, stop one VM and check if the page still loads from the other VM.

2. **Test NAT Gateway:**
  - Access the internet from the VMs to ensure outbound traffic is routed through the NAT Gateway.
3. **Test Azure Bastion:**
  - Go to the Azure Bastion page.
  - Click "Connect" to any VM in the virtual network using Bastion.

- ### 3. Test Azure Bastion:

- This architecture was conserved throughout the project-**



By following these steps, I successfully created a scalable and highly available infrastructure on Azure, capable of handling increased traffic and ensuring a robust user experience for the growing e-commerce platform. The setup included key components like a public Azure Load Balancer, a NAT Gateway, Azure Bastion, a virtual network, and necessary subnets, all configured to meet the project's objectives and business requirements. As I had limited Azure Students Starter Package facility so could not provide the visual representation of all the steps.

By following these steps, I successfully created a scalable and highly available infrastructure on Azure, capable of handling increased traffic and ensuring a robust user experience for the growing e-commerce platform. The setup included key components like a public Azure Load Balancer, a NAT Gateway, Azure Bastion, a virtual network, and necessary subnets, all configured to meet the project's objectives and business requirements. As I had limited Azure Students Starter Package facility so could not provide the visual representation of all the steps.