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An Integrated Approach to Secure Web Application Deployment on Azure Using Bastion Access, Virtual Network Firewalls, and NGINX Reverse Proxy on Virtual Machines

Project Overview->

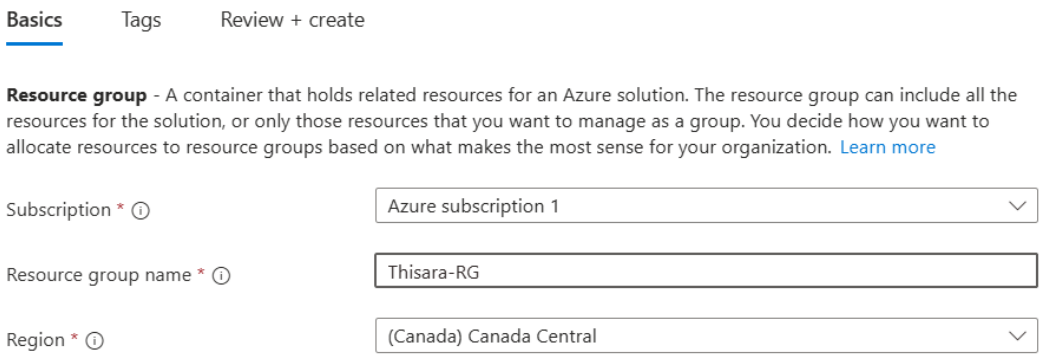
In this project, we will create a **Virtual Network (VNet)** in Azure and deploy an **Azure Firewall** to control and secure inbound and outbound traffic.

Behind the firewall, we will configure a **subnet** called **Web Application Subnet**, in which we will deploy a **Virtual Machine (VM)**. On this VM, we will install **Nginx** and host a simple HTML web page.

Since the VM will have only a **private IP address**, it will not be directly accessible from the internet. To securely connect to the VM, we will use **Azure Bastion**. This service allows secure RDP/SSH connections to the VM through the Azure Portal without exposing the VM to the public internet.

We will also configure **firewall rules** so that **authenticated users** can bypass the firewall and access the Nginx application hosted on the VM.

1. Starting with creating a resource group



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2. Create Virtual Network (VNet)

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 * Thisara-RG

Create new

Instance details

Virtual network name * Thisara-VNet

Region * (Canada) Canada Central

Deploy to an Azure Extended Zone

- **Create azure Bastian service**

Azure Bastion

Azure Bastion is a paid service that provides secure RDP/SSH connectivity to your virtual machines over TLS. When you connect via Azure Bastion, your virtual machines do not need a public IP address. Learn more.

Learn more.

Enable Azure Bastion

Azure Bastion host name Thisara-VNet-Bastion

Azure Bastion public IP address * (New) thisara-vnet-bastion

Create a public IP address

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- **Create firewall policies**

Azure Firewall name	Thisara-VNet-Firewall
Subnet name *	AzureFirewallSubnet
Tier *	Basic
Policy *	(New) Thisara-VNet-firewall-policy Create new
Azure Firewall public IP address *	(New) thisara-vnet-firewall Create a public IP address
Management traffic public IP address *	(New) thisara-vnet-traffic-management Create a public IP address

- Subnets

Subnets	IP address range	Size	NAT gateway
WebApp	10.0.0.0 - 10.0.0.255	/24 (256 addresses)	-
AzureBastionSubnet	10.0.1.0 - 10.0.1.63	/26 (64 addresses)	-
AzureFirewallSubnet	10.0.1.64 - 10.0.1.127	/26 (64 addresses)	-
AzureFirewallManagementS	10.0.1.128 - 10.0.1.191	/26 (64 addresses)	-

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3. Azure Virtual Machine creation Steps

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 * ⓘ — Thisara-RG

Create new

Instance details

Virtual machine name * ⓘ — nginx-web

Region * ⓘ — (Canada) Canada Central

Deploy to an Azure Extended Zone

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

Administrator account

Authentication type ⓘ

- (●) SSH public key
- ( ) Password

ⓘ Azure now automatically generates an SSH key pair for you and allows you to store it for future use. It is a fast, simple, and secure way to connect to your virtual machine.

Username * ⓘ — azureuser

SSH public key source — Generate new key pair

SSH Key Type

- (●) RSA SSH Format
- ( ) Ed25519 SSH Format

ⓘ Ed25519 provides a fixed security level of no more than 128 bits for 256-bit key, while RSA could offer better security with keys longer than 3072 bits.

Key pair name * — nginx-web1_key

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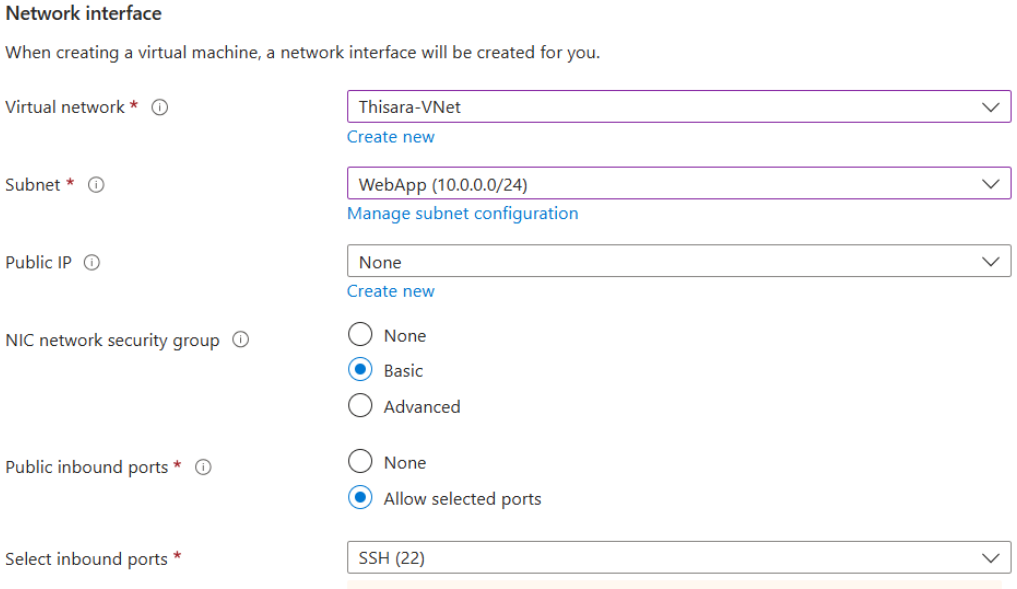
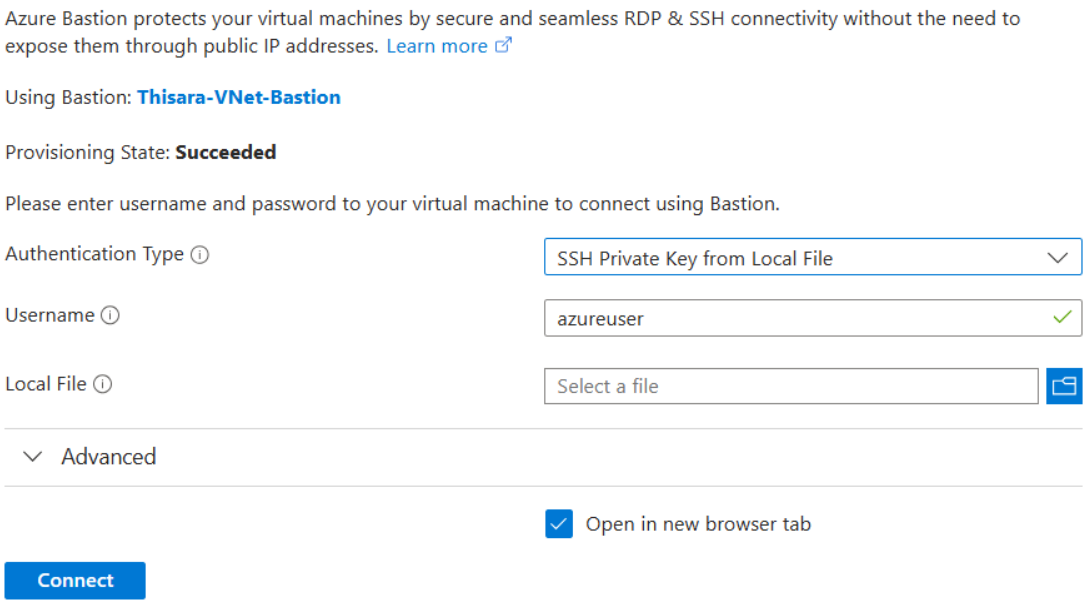
- **Network configurations**



Without a public IP we can't SSH to the VM. so, we need to set up Bastian service

4. Connect VM via Bastian



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```
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

azureuser@nginx-web1:~$
azureuser@nginx-web1:~$
azureuser@nginx-web1:~$
azureuser@nginx-web1:~$ ll
total 28
drwxr-x--- 4 azureuser azureuser 4096 Aug  8 15:30 ./
drwxr-xr-x 3 root      root      4096 Aug  8 14:58 ../
-rw-r--r-- 1 azureuser azureuser  220 Mar 31  2024 .bash_logout
-rw-r--r-- 1 azureuser azureuser 3771 Mar 31  2024 .bashrc
drwx------ 2 azureuser azureuser 4096 Aug  8 15:30 .cache/
-rw-r--r-- 1 azureuser azureuser  807 Mar 31  2024 .profile
drwx------ 2 azureuser azureuser 4096 Aug  8 14:58 .ssh/
azureuser@nginx-web1:~$
```

In here I use Bastian as a proxy

5. Connect to root

```
azureuser@nginx-web1:~$ sudo su -
root@nginx-web1:~#
root@nginx-web1:~#
root@nginx-web1:~#
root@nginx-web1:~#
```

6. Nginx installation

```
root@nginx-web1:~# apt-get install nginx -y
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  nginx-common
Suggested packages:
  fcgiwrap nginx-doc ssl-cert
The following NEW packages will be installed:
```

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7. Create HTML file in correct path

```
root@nginx-web1:~# cd /var/www/html
root@nginx-web1:/var/www/html#
root@nginx-web1:/var/www/html#
root@nginx-web1:/var/www/html# vim index.html
```

```
~
<!DOCTYPE html>
<html lang="en">
        <head>
                <meta charset="UTF-8">
                    <meta name="viewport" content="width=device-width, initial-scale=1.0">
                        <title>Demo Page</title>
        </head>
        <body>
                <h1> I Learnt how networking works in Azure today</h1>
        </body>
</html>
~
~
```

8. Restart Nginx

```
root@nginx-web1:/var/www/html# systemctl restart nginx
root@nginx-web1:/var/www/html#
root@nginx-web1:/var/www/html#
```

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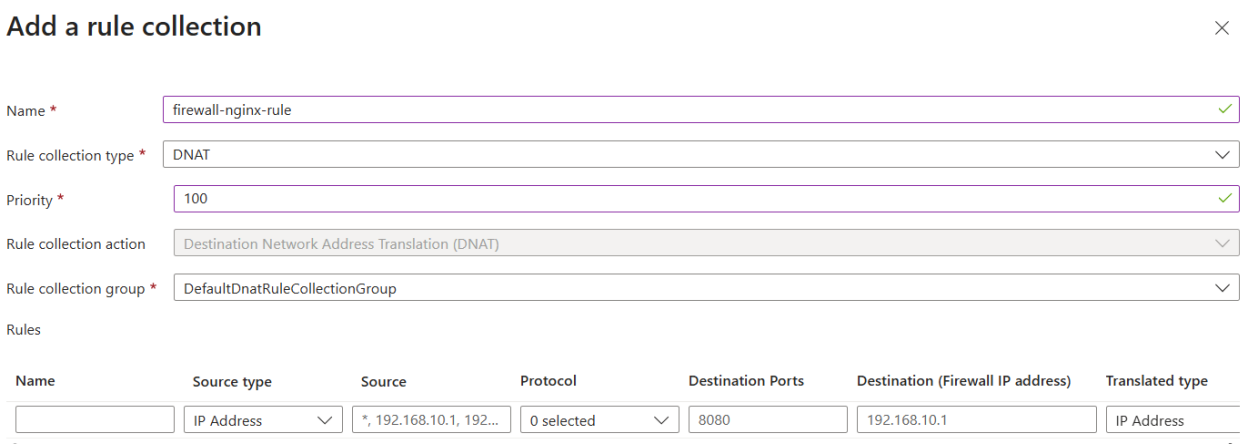
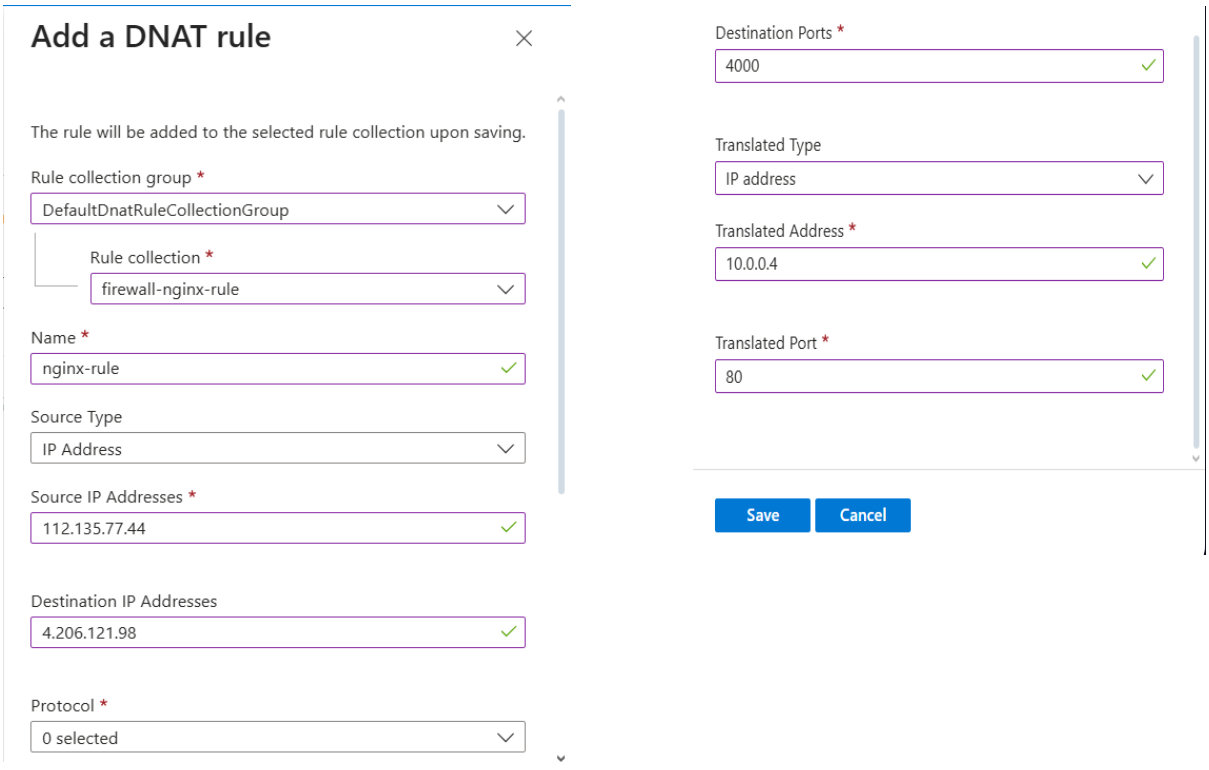
9. Setup Firewall DNAT rules





What I have done here is: if the IP address **112.135.77.44** sends a request to the firewall (**4.206.121.98**) on port **4000**, it will be translated to the IP address **10.0.0.4** (the IP of the Nginx VM) on port **80**.

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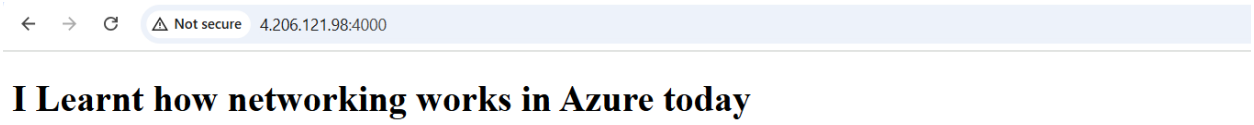
10. Access the webapp trough the browser



Summary:

I successfully set up a secure cloud infrastructure on Azure by creating and configuring:

- **Virtual Network (VNet)** for network segmentation and security.
- **Azure Bastion** to enable secure, browser-based RDP/SSH access to the VM without exposing public Ips.
- **Network Security Groups (NSGs)** and **VNet Firewall rules** to control inbound and outbound traffic.
- **Linux Virtual Machine** hosted inside the VNet.
- **NGINX** installed and configured on the VM for web server hosting.

This setup follows best practices for secure remote management and restricted network access, ensuring both **security** and **functionality** in a cloud environment.