CSP 450 FINAL REPORT

By Kunjan Sharma

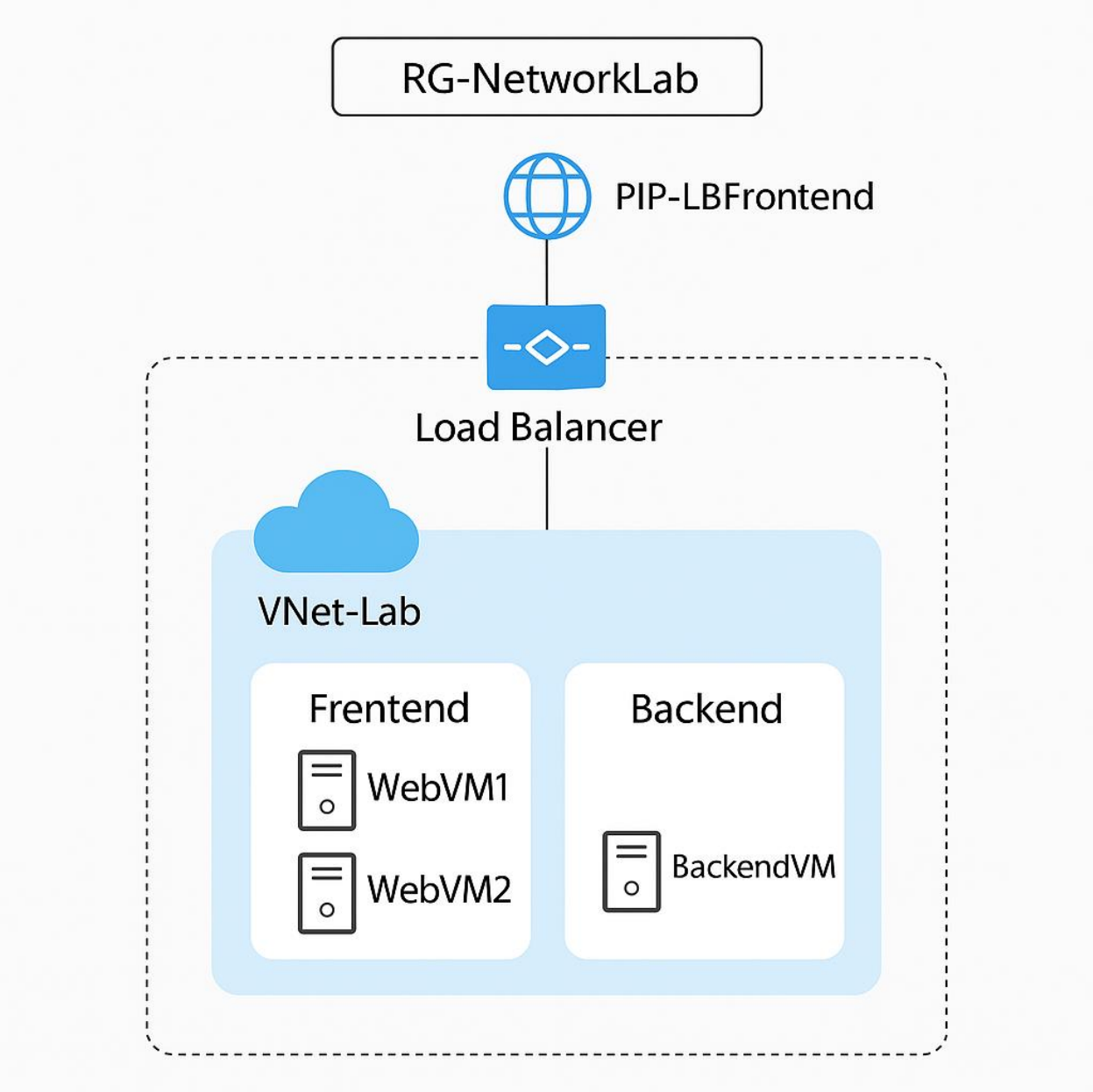
Project Overview: This final project involved designing and deploying a scalable and redundant network architecture on Microsoft Azure. The architecture includes a virtual network (VNet), subnets, two virtual machines (VMs), a standard Azure Load Balancer, and monitoring components.

Azure Resource Summary

- **Resource Group:** Student-RG-1569892
- **Virtual Network:** Student-1569892-vnet
- **Subnets:**
    - FrontendSubnet (for Load Balancer and web-facing VMs)
    - BackendSubnet (for future expansion)
- **Virtual Machines:**
    - WebVM1 (running IIS, deployed in FrontendSubnet)
    - WebVM2 (identical setup, part of the same availability set)
- **Availability Set:** AVSet-WebTier (ensures redundancy across fault and update domains)
- **Load Balancer:** LB-Frontend (standard SKU with public IP and health probes)
- **Monitoring Tools:** Azure Monitor

Design Overview

The network architecture designed in this lab demonstrates both **scalability** and **redundancy** using core Azure infrastructure components. The solution consists of a resource group (RG-NetworkLab), a virtual network (VNet-Lab) with two subnets (Frontend and Backend), and two virtual machines (WebVM1, WebVM2) placed within an **Availability Set** for high availability. These VMs are connected to a **Standard Load Balancer** with a public IP (PIP-LBFrontend), configured with health probes and load balancing rules on port 80.



Scalability

This design is scalable because:

- Additional VMs can be added to the **Availability Set** and automatically included in the Load Balancer's backend pool.
- Subnets are designed with sufficient IP ranges to support future growth.
- The architecture supports horizontal scaling by increasing the number of front-end servers.

Redundancy

Redundancy is achieved through:

- Use of an **Availability Set** with 2 fault domains and 5 update domains, protecting against hardware failures and maintenance outages.
- The **Azure Load Balancer** evenly distributes HTTP traffic across both VMs, ensuring continued service even if one VM fails.
- Optional use of **Availability Zones** (if implemented) would further enhance zone-level resiliency.

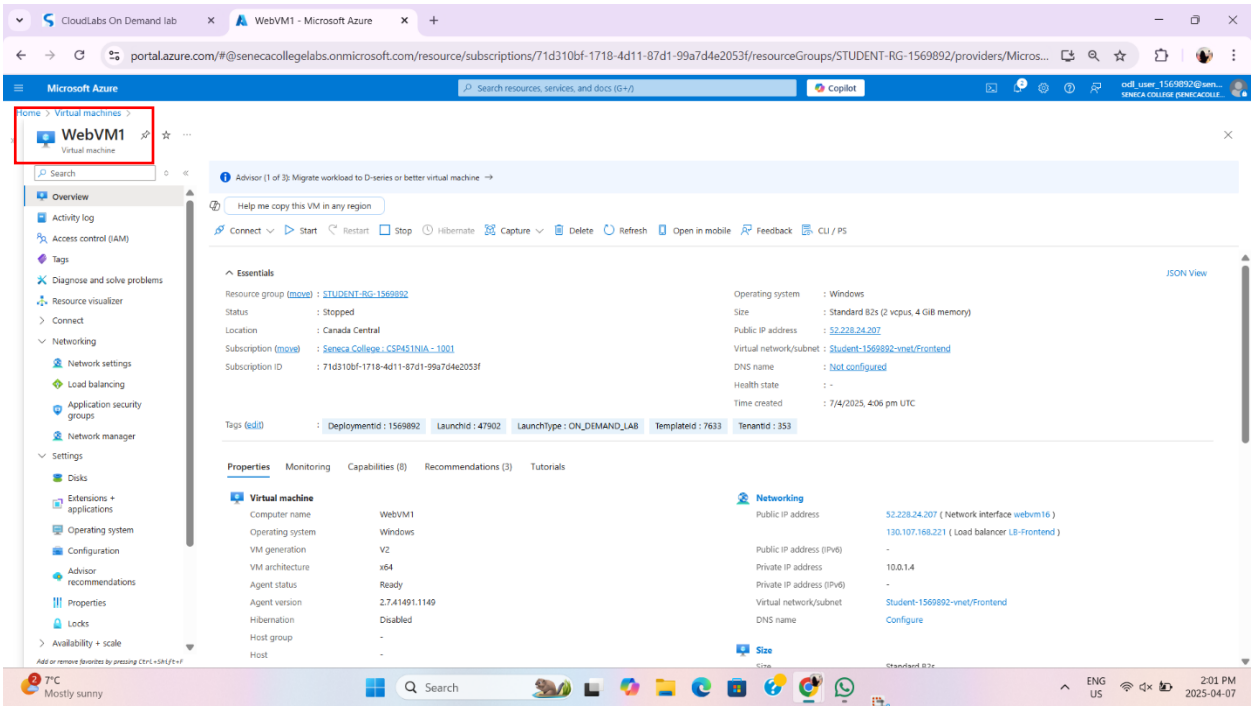
Monitoring

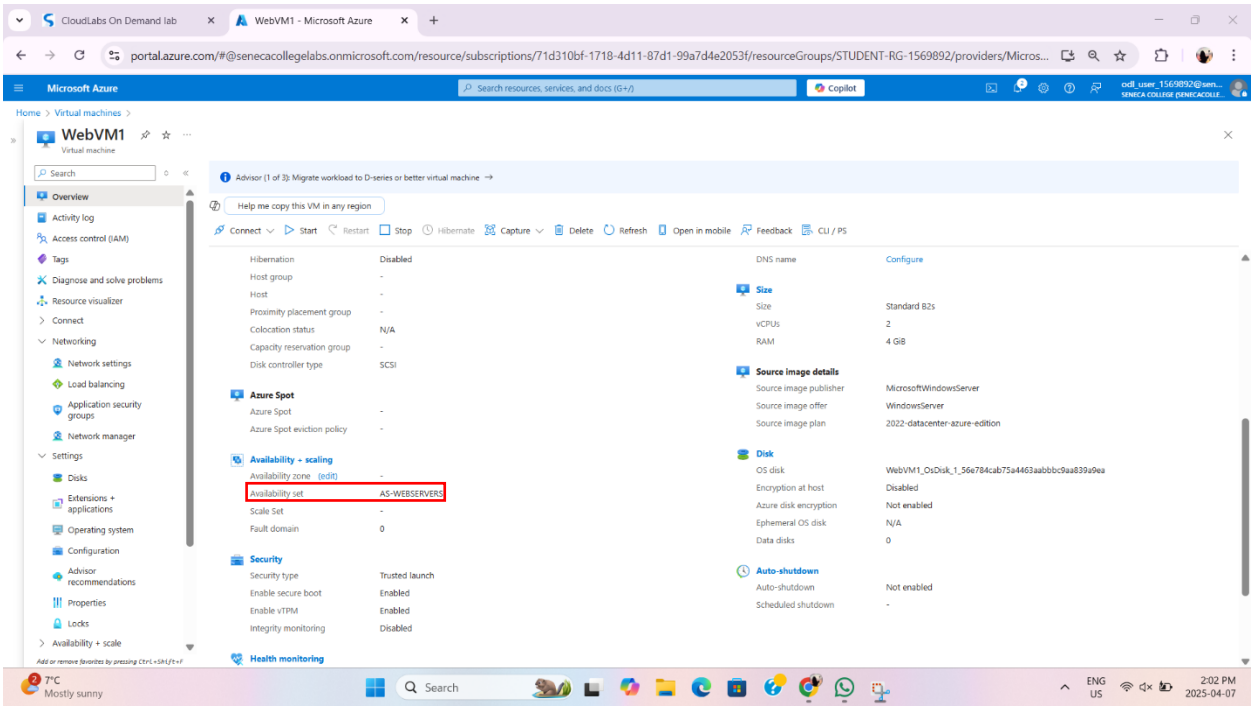
Azure Monitor and Network Watcher were used to track resource health:

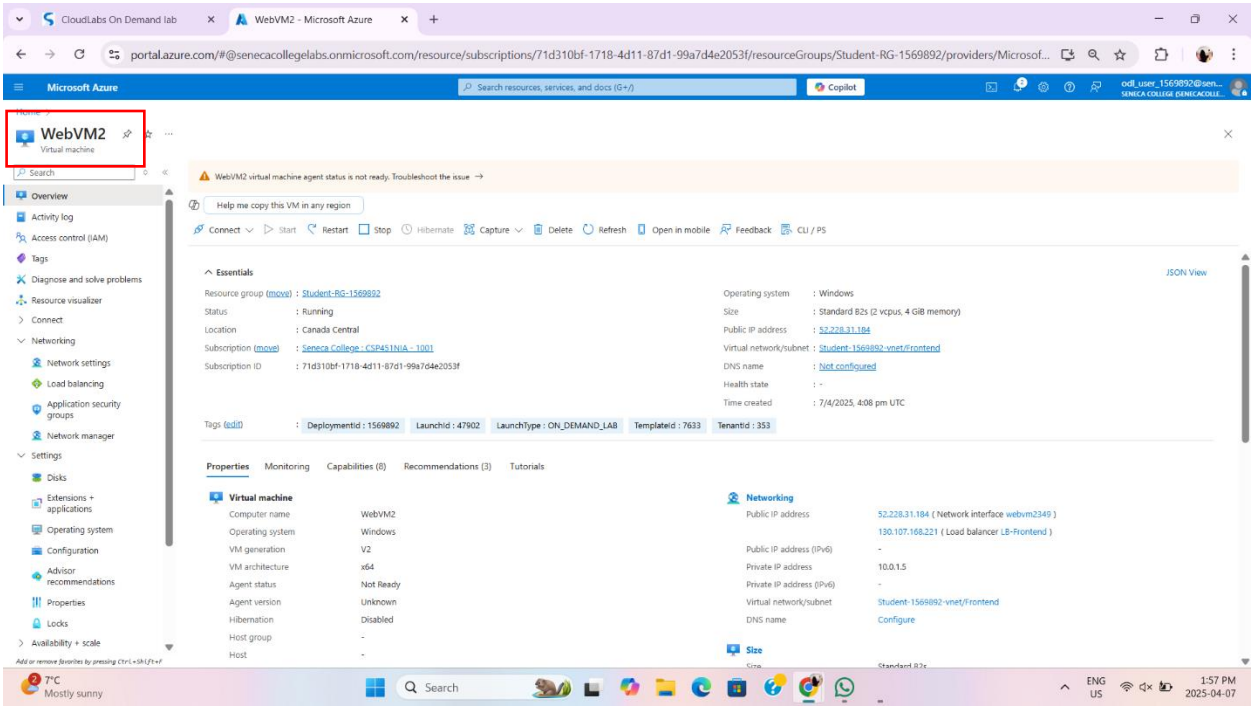
- NSG Flow Logs were enabled for the Frontend subnet to capture network traffic.
- An alert rule was created to monitor CPU usage on WebVM1, ensuring proactive response to performance issues.

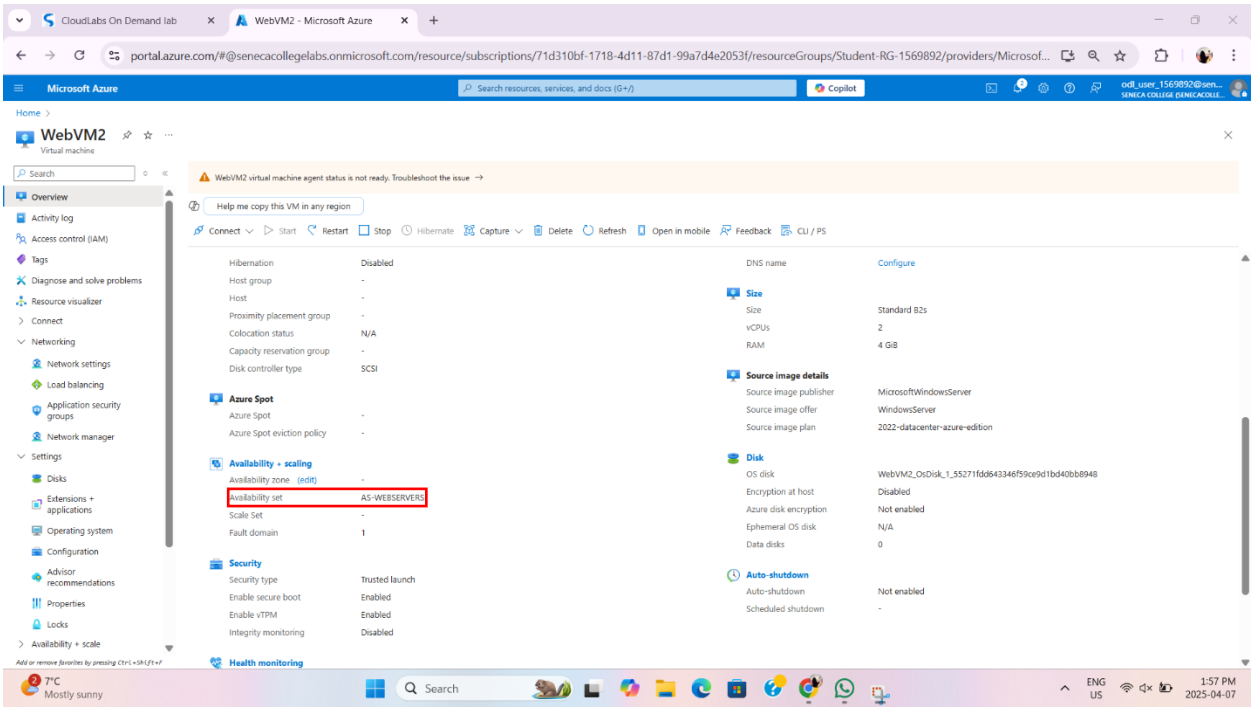
Screenshots Required:

VM settings:

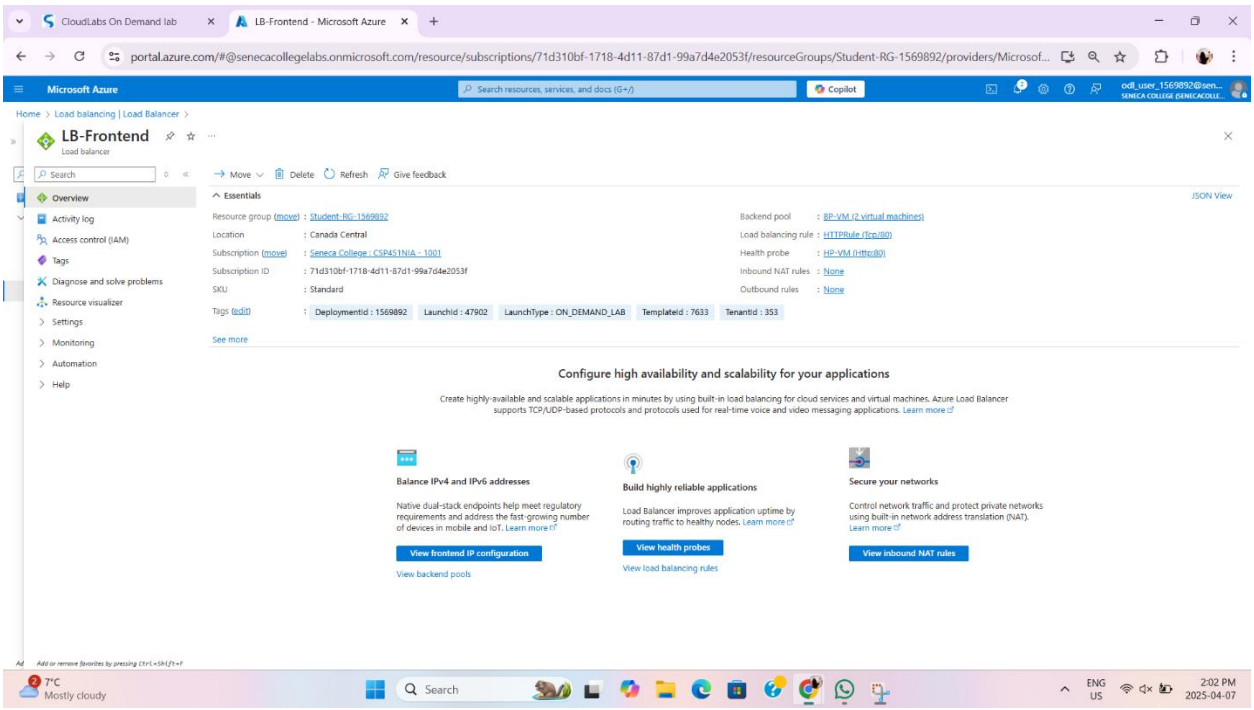


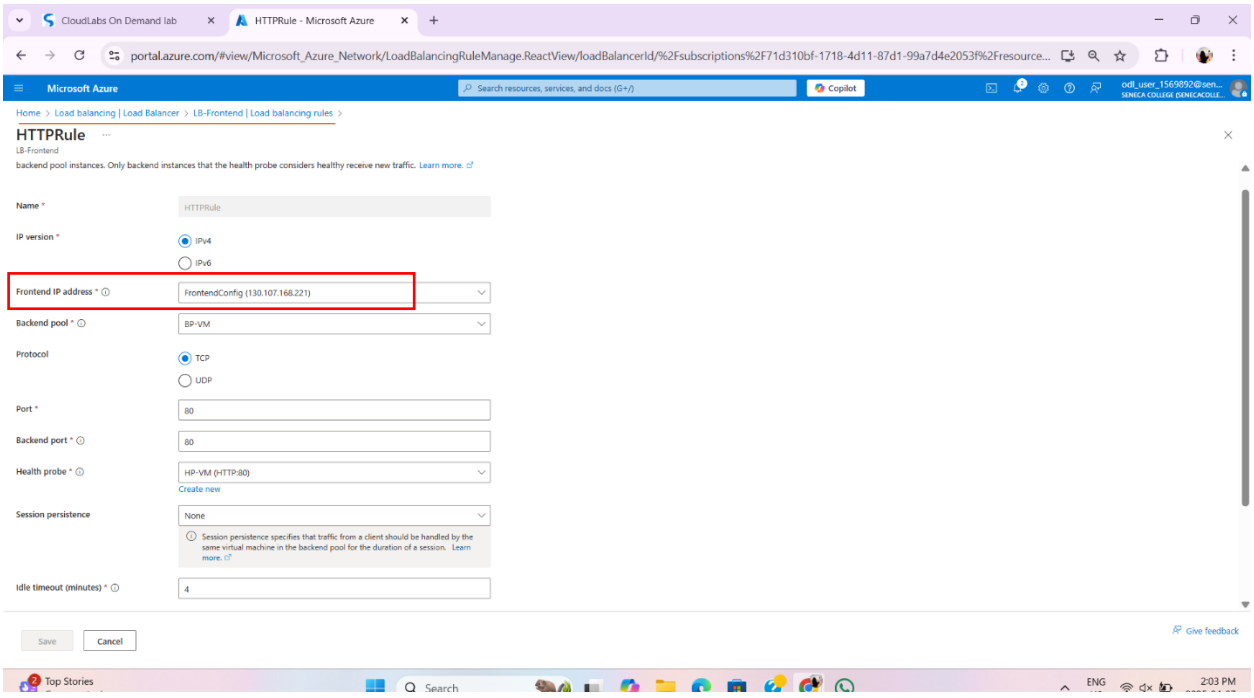

CloudLabs On Demand lab
WebVM1 - Microsoft Azure
portal.azure.com/#@senecacollegelabs.onmicrosoft.com/resource/subscriptions/71d310bf-1718-4d11-87d1-99a7d4e2053f/resourceGroups/STUDENT-RG-1569892/providers/Micros...
Microsoft Azure
Search resources, services, and docs (G+/)
Copilot
Home > Virtual machines >
WebVM1
Virtual machine
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Resource visualizer
Connect
Networking
Network settings
Load balancing
Application security groups
Network manager
Settings
Disks
Extensions + applications
Operating system
Configuration
Advisor recommendations
Properties
Locks
Availability + scale
Advisor (1 of 3): Migrate workload to D-series or better virtual machine
Help me copy this VM in any region
Connect
Start
Restart
Stop
Hibernate
Capture
Delete
Refresh
Open in mobile
Feedback
CLI / PS
Hibernation Disabled
Host group -
Host -
Proximity placement group -
Colocation status N/A
Capacity reservation group -
Disk controller type SCSI
Azure Spot
Azure Spot -
Azure Spot eviction policy -
Availability + scaling
Availability zone (edit) -
Availability set AS-WEBSERVERS
Scale Set -
Fault domain 0
Security
Security type Trusted launch
Enable secure boot Enabled
Enable vTPM Enabled
Integrity monitoring Disabled
Health monitoring
DNS name Configure
Size
Size Standard B2s
vCPUs 2
RAM 4 GiB
Source image details
Source image publisher MicrosoftWindowsServer
Source image offer WindowsServer
Source image plan 2022-datacenter-azure-edition
Disk
OS disk WebVM1_OsDisk_1_56e784cab75a4463aabbbc9aa839a9ea
Encryption at host Disabled
Azure disk encryption Not enabled
Ephemeral OS disk N/A
Data disks 0
Auto-shutdown
Auto-shutdown Not enabled
Scheduled shutdown -
7°C
Mostly sunny
Search
ENG
US
2:02 PM
2025-04-07


CloudLabs On Demand lab
WebVM2 - Microsoft Azure
portal.azure.com/#@senecacollegelabs.onmicrosoft.com/resource/subscriptions/71d310bf-1718-4d11-87d1-99a7d4e2053f/resourceGroups/Student-RG-1569892/providers/Microsof...
Microsoft Azure
Search resources, services, and docs (G+/)
Copilot
WebVM2
Virtual machine
WebVM2 virtual machine agent status is not ready. Troubleshoot the issue
Help me copy this VM in any region
Connect
Start
Restart
Stop
Hibernate
Capture
Delete
Refresh
Open in mobile
Feedback
CLI / PS
Essentials
JSON View
Resource group (move) : Student-RG-1569892
Status : Running
Location : Canada Central
Subscription (move) : Seneca College - CSP451NIA - 1001
Subscription ID : 71d310bf-1718-4d11-87d1-99a7d4e2053f
Operating system : Windows
Size : Standard B2s (2 vcpus, 4 GiB memory)
Public IP address : 52.228.31.184
Virtual network/subnet : Student-1569892-vnet/Frontend
DNS name : Not configured
Health state : -
Time created : 7/4/2025, 4:08 pm UTC
Tags (edit) : Deploymentid : 1569892 Launchid : 47902 LaunchType : ON_DEMAND_LAB Templateid : 7633 Tenantid : 353
Properties
Monitoring
Capabilities (8)
Recommendations (3)
Tutorials
Virtual machine
Computer name WebVM2
Operating system Windows
VM generation V2
VM architecture x64
Agent status Not Ready
Agent version Unknown
Hibernation Disabled
Host group -
Host -
Networking
Public IP address 52.228.31.184 (Network interface webvm2349)
130.107.168.221 (Load balancer LB-Frontend)
Public IP address (IPv6) -
Private IP address 10.0.1.5
Private IP address (IPv6) -
Virtual network/subnet Student-1569892-vnet/Frontend
DNS name Configure
Size
7°C
Mostly sunny
Search
ENG
US
1:57 PM
2025-04-07



Load Balancer configuration:




CloudLabs On Demand lab
HTTPRule - Microsoft Azure
portal.azure.com/#view/Microsoft_Azure_Network/LoadBalancingRuleManage.ReactView/loadBalancerId/%2Fsubscriptions%2F71d310bf-1718-4d11-87d1-99a7d4e2053f%2Fresource...
Microsoft Azure
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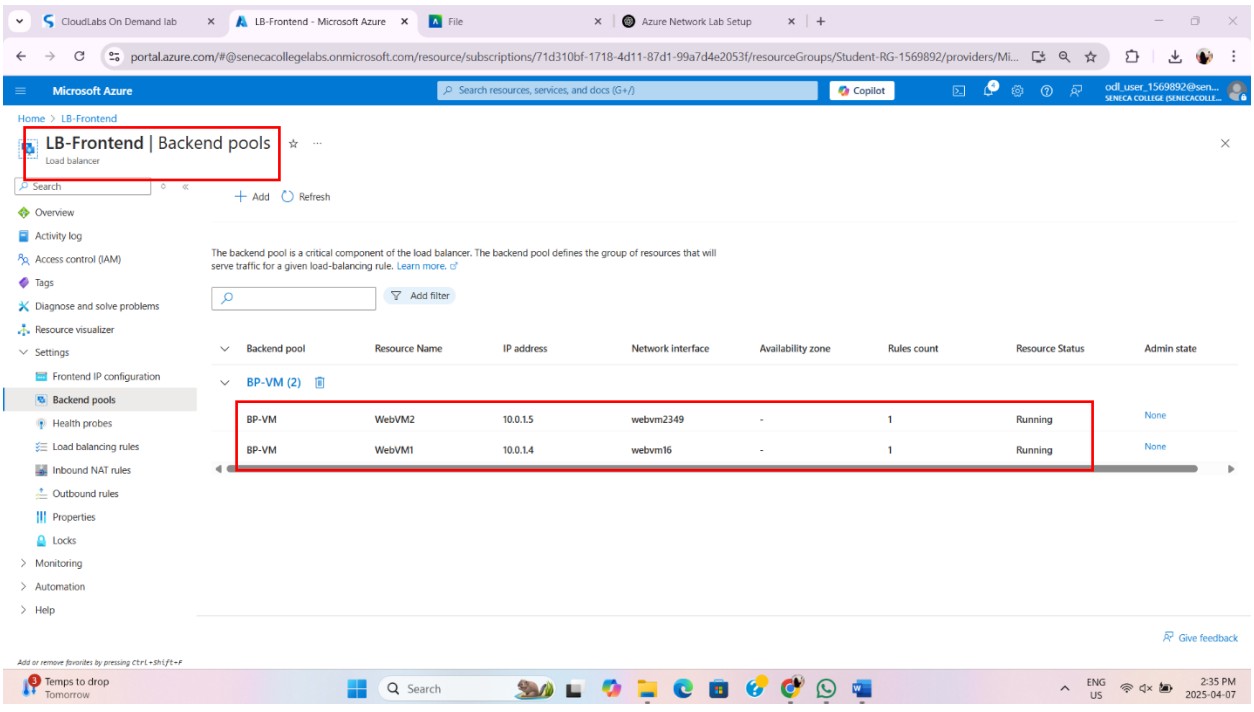
Copilot
Home > Load balancing | Load Balancer > LB-Frontend | Load balancing rules >
HTTPRule
LB-Frontend
backend pool instances. Only backend instances that the health probe considers healthy receive new traffic. Learn more.
Name *
HTTPRule
IP version *
IPv4
IPv6
Frontend IP address *
FrontendConfig (130.107.168.221)
Backend pool *
BP-VM
Protocol
TCP
UDP
Port *
80
Backend port *
80
Health probe *
HP-VM (HTTP:80)
Create new
Session persistence
None
Session persistence specifies that traffic from a client should be handled by the same virtual machine in the backend pool for the duration of a session. Learn more.
Idle timeout (minutes) *
4
Save
Cancel
Give feedback
Top Stories
Search
ENG
2:03 PM


CloudLabs On Demand lab
LB-Frontend - Microsoft Azure
File
Azure Network Lab Setup
portal.azure.com/#@senecacollegelabs.onmicrosoft.com/resource/subscriptions/71d310bf-1718-4d11-87d1-99a7d4e2053f/resourceGroups/Student-RG-1569892/providers/Mi...
Microsoft Azure
Search resources, services, and docs (G+/)
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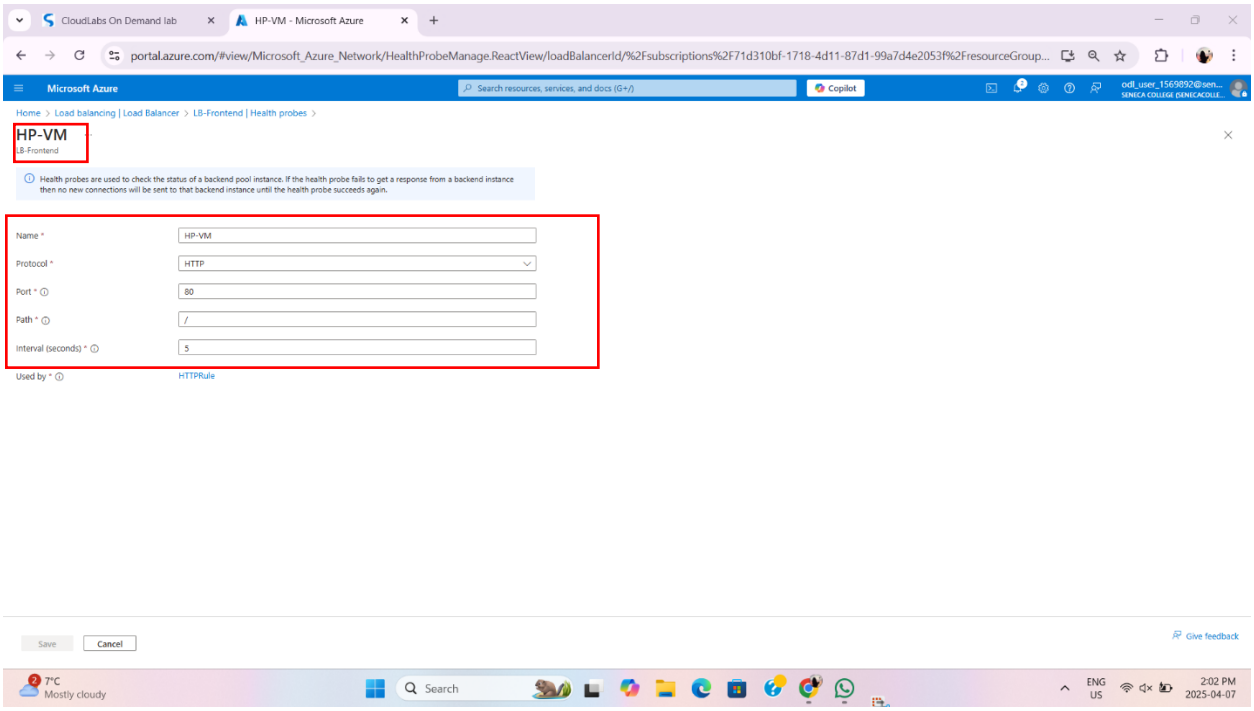
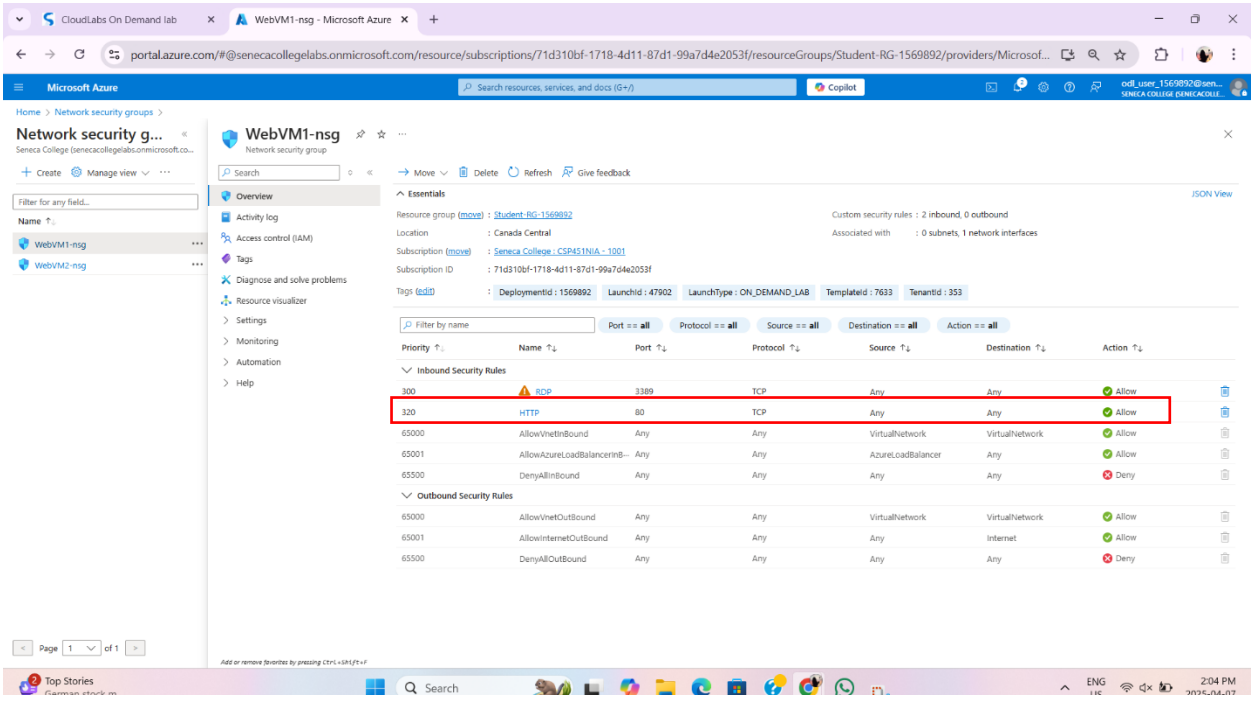
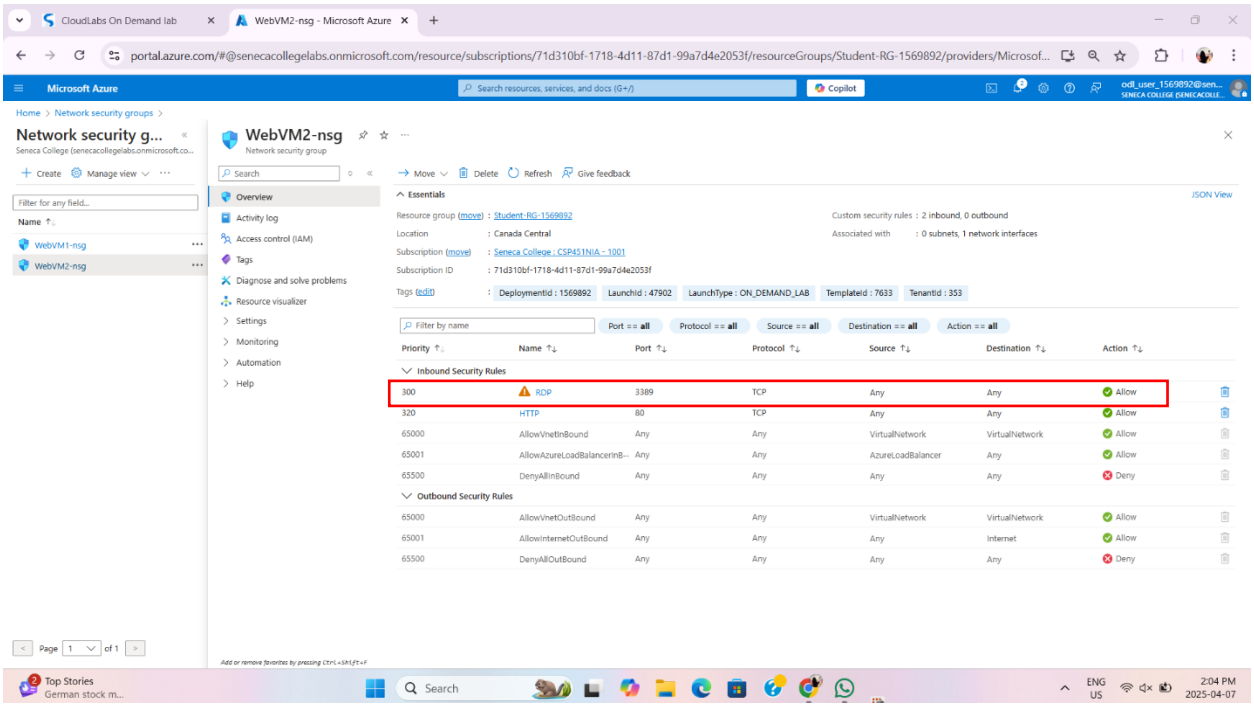
Home > LB-Frontend
LB-Frontend | Backend pools
Load balancer
Search
Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems
Resource visualizer
Settings
Frontend IP configuration
Backend pools
Health probes
Load balancing rules
Inbound NAT rules
Outbound rules
Properties
Locks
Monitoring
Automation
Help
Add
Refresh
The backend pool is a critical component of the load balancer. The backend pool defines the group of resources that will serve traffic for a given load-balancing rule. Learn more.
Add filter
Backend pool
Resource Name
IP address
Network interface
Availability zone
Rules count
Resource Status
Admin state
BP-VM (2)
BP-VM
WebVM2
10.0.1.5
webvm2349
-
1
Running
None
BP-VM
WebVM1
10.0.1.4
webvm16
-
1
Running
None
Give feedback
Add or remove favorites by pressing Ctrl+Shift+F
Temps to drop
Tomorrow
Search
ENG
US
2:35 PM
2025-04-07

Health Probes:



NSGs:



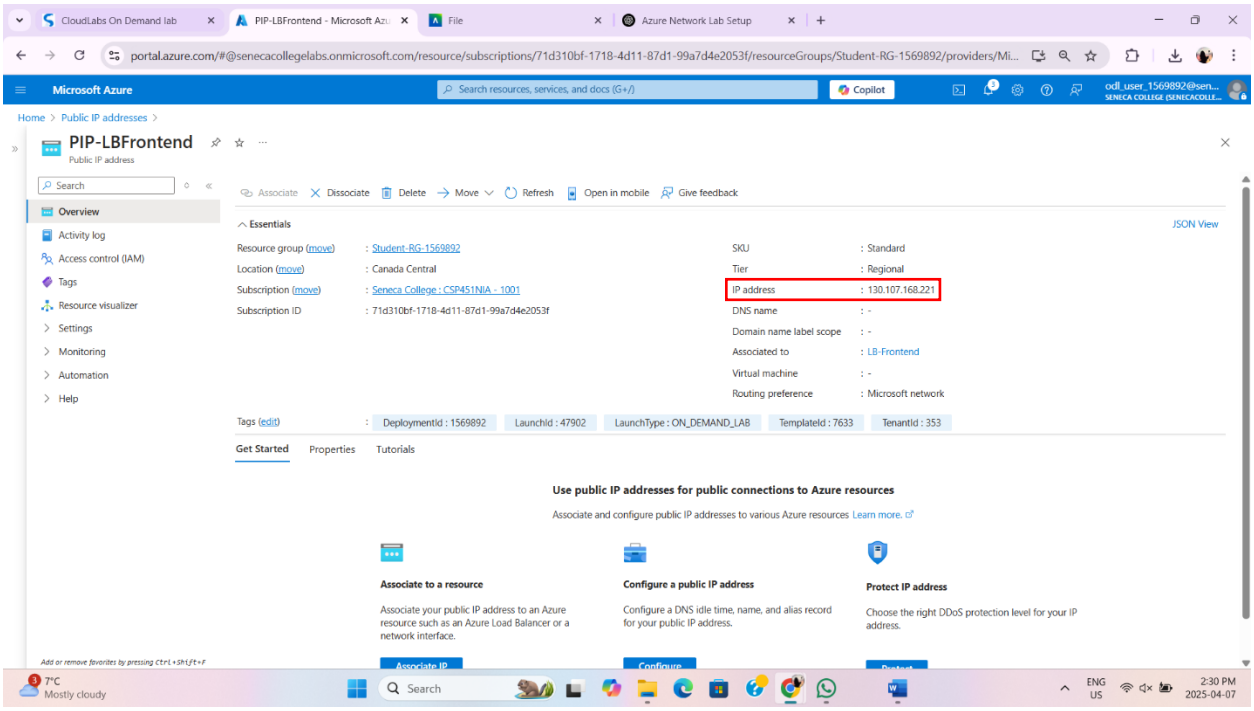


Testing and Validation Logs:

- Both WebVM1 and WebVM2 were configured with IIS and custom HTML pages to verify HTTP traffic.
- Load Balancer was tested using the frontend public IP, with successful responses from both VMs.
- Azure Monitor metrics confirmed healthy traffic flow and VM performance.

Successful HTTP traffic tests to each VM through the load balancer:

The following screenshots show the public ip address and the HTTP traffic tests through both the VMs using that ip address. It also shows if the vm is stopped the other still give response


PIP-LBFrontend - Microsoft Azu
Azure Network Lab Setup
Microsoft Azure
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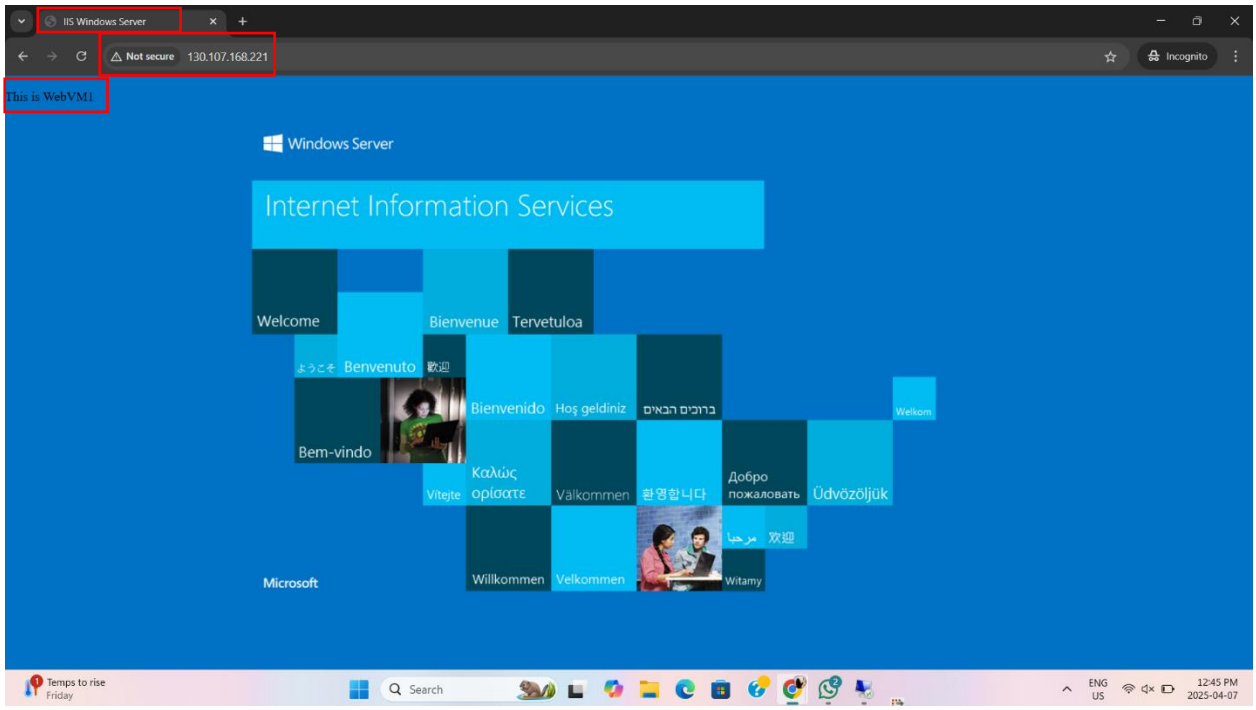
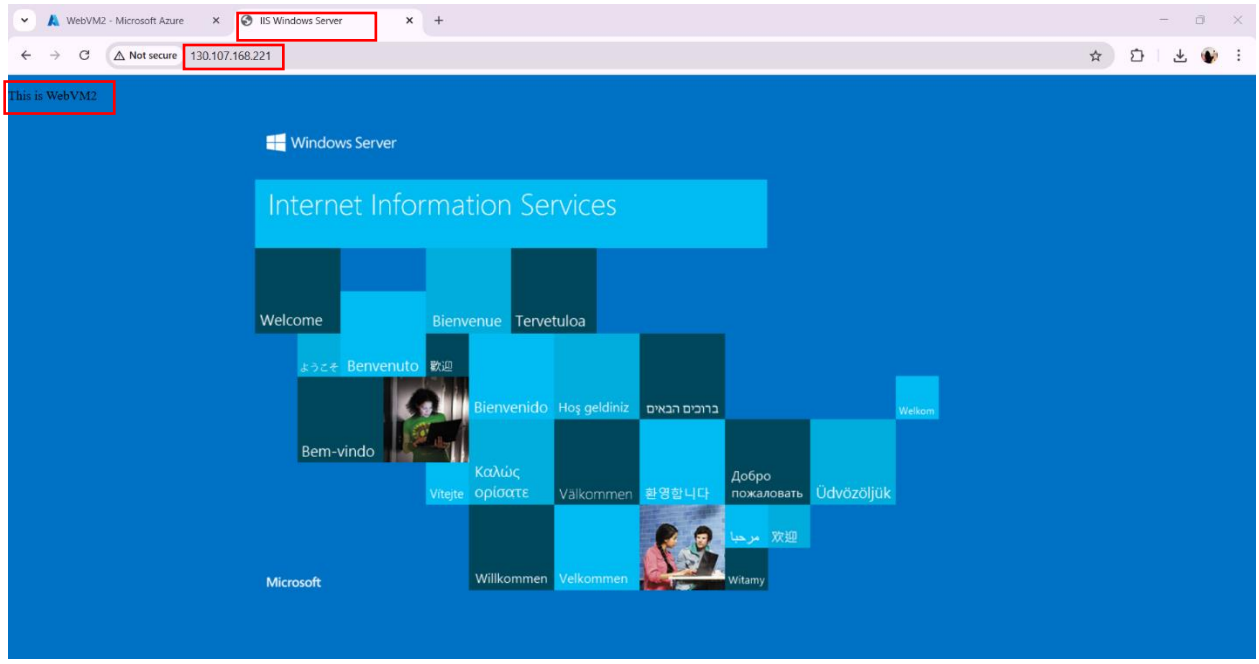
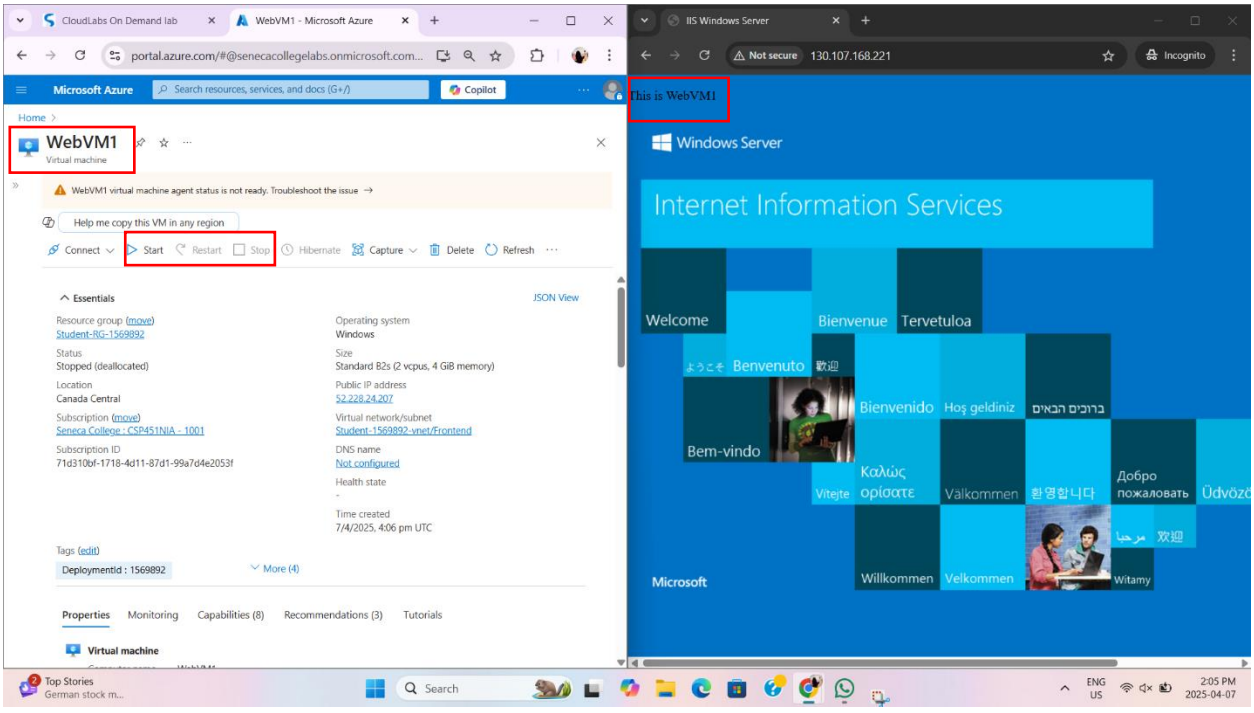
Home > Public IP addresses >
PIP-LBFrontend
Public IP address
Overview
Activity log
Access control (IAM)
Tags
Resource visualizer
Settings
Monitoring
Automation
Help
Associate
Dissociate
Delete
Move
Refresh
Open in mobile
Give feedback
Essentials
JSON View
Resource group (move) : Student-RG-1569892
Location (move) : Canada Central
Subscription (move) : Seneca College : CSP451NIA - 1001
Subscription ID : 71d310bf-1718-4d11-87d1-99a7d4e2053f
SKU : Standard
Tier : Regional
IP address : 130.107.168.221
DNS name : -
Domain name label scope : -
Associated to : LB-Frontend
Virtual machine : -
Routing preference : Microsoft network
Tags (edit) : DeploymentId : 1569892 LaunchId : 47902 LaunchType : ON_DEMAND_LAB TemplateId : 7633 TenantId : 353
Get Started
Properties
Tutorials
Use public IP addresses for public connections to Azure resources
Associate and configure public IP addresses to various Azure resources Learn more.
Associate to a resource
Associate your public IP address to an Azure resource such as an Azure Load Balancer or a network interface.
Configure a public IP address
Configure a DNS idle time, name, and alias record for your public IP address.
Protect IP address
Choose the right DDoS protection level for your IP address.
Associate IP
Configure
Protect
Add or remove favorites by pressing Ctrl+Shift+F
7°C
Mostly cloudy
Search
ENG
US
2:30 PM
2025-04-07


IIS Windows Server
Not secure
130.107.168.221
Incognito
This is WebVM1
Windows Server
Internet Information Services
Welcome
Bienvenue
Tervetuloa
ようこそ
Benvenuto
歡迎
Bem-vindo
Bienvenido
Hoş geldiniz
ברוכים הבאים
Welkom
Vítejte
Καλώς ορίσατε
Välkommen
환영합니다
Добро пожаловать
Üdvözöljük
مرحبا
欢迎
Willkommen
Velkommen
Witamy
Microsoft
Temps to rise
Friday
Search
ENG
US
12:45 PM
2025-04-07


WebVM2 - Microsoft Azure
IIS Windows Server
Not secure
130.107.168.221
This is WebVM2
Windows Server
Internet Information Services
Welcome
Bienvenue
Tervetuloa
ようこそ
Benvenuto
歡迎
Bienvenido
Hoş geldiniz
ברוכים הבאים
Bem-vindo
Καλώς ορίσατε
Välkommen
환영합니다
Добро пожаловать
Üdvözöljük
Vitejte
مرحبا
欢迎
Willkommen
Velkommen
Witamy
Microsoft


CloudLabs On Demand lab
WebVM1 - Microsoft Azure
portal.azure.com/#@senecacollegelabs.onmicrosoft.com...
Microsoft Azure
Search resources, services, and docs (G+/)
Copilot
Home
WebVM1
Virtual machine
WebVM1 virtual machine agent status is not ready. Troubleshoot the issue
Help me copy this VM in any region
Connect
Start
Restart
Stop
Hibernate
Capture
Delete
Refresh
Essentials
JSON View
Resource group (move)
Student-RG-1569892
Status
Stopped (deallocated)
Location
Canada Central
Subscription (move)
Seneca College : CSP451NIA - 1001
Subscription ID
71d310bf-1718-4d11-87d1-99a7d4e2053f
Operating system
Windows
Size
Standard B2s (2 vcpus, 4 GiB memory)
Public IP address
52.228.24.207
Virtual network/subnet
Student-1569892-vnet/Frontend
DNS name
Not configured
Health state
Time created
7/4/2025, 4:06 pm UTC
Tags (edit)
DeploymentId : 1569892
More (4)
Properties
Monitoring
Capabilities (8)
Recommendations (3)
Tutorials
Virtual machine
IIS Windows Server
Not secure
130.107.168.221
Incognito
This is WebVM1
Windows Server
Internet Information Services
Welcome
Bienvenue
Tervetuloa
ようこそ
Benvenuto
歡迎
Bienvenido
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ברוכים הבאים
Bem-vindo
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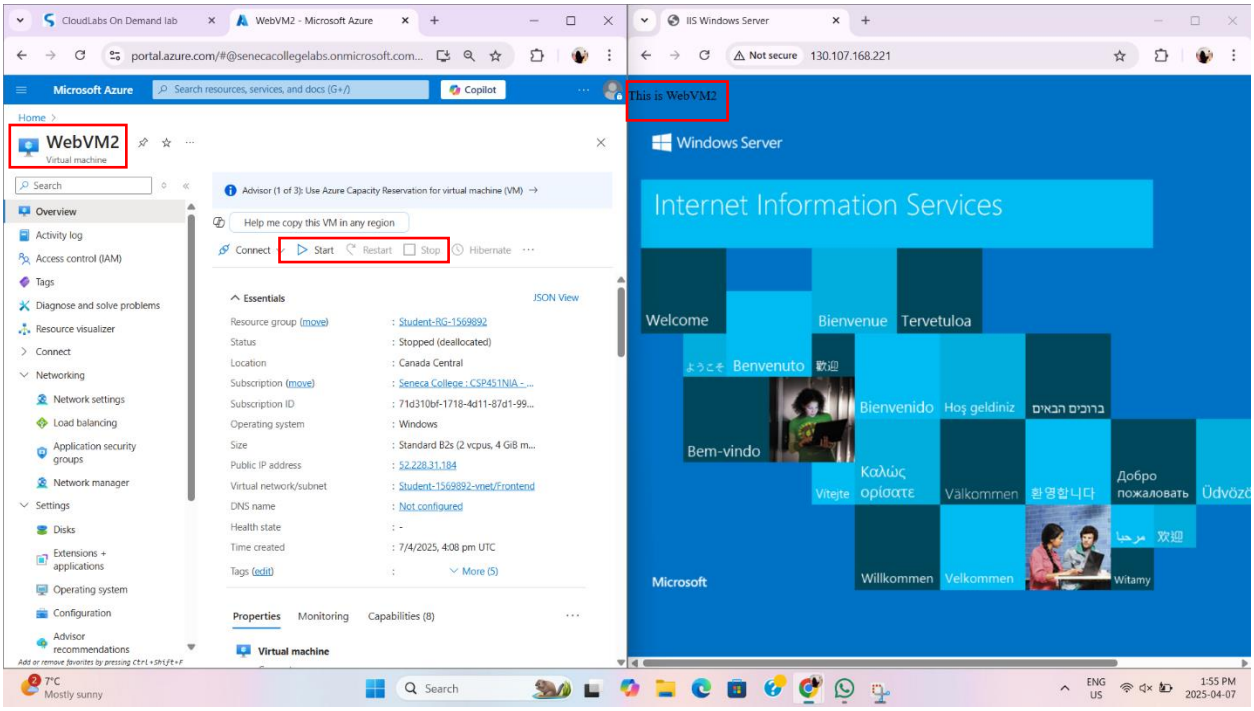
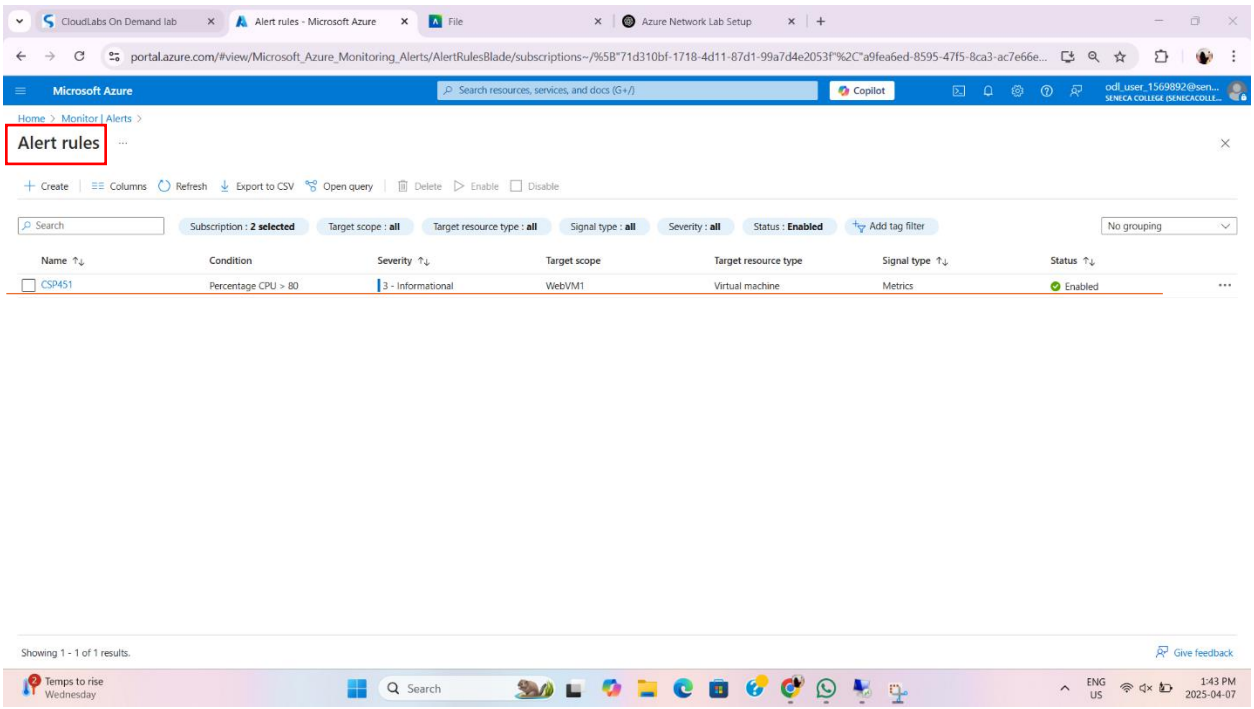
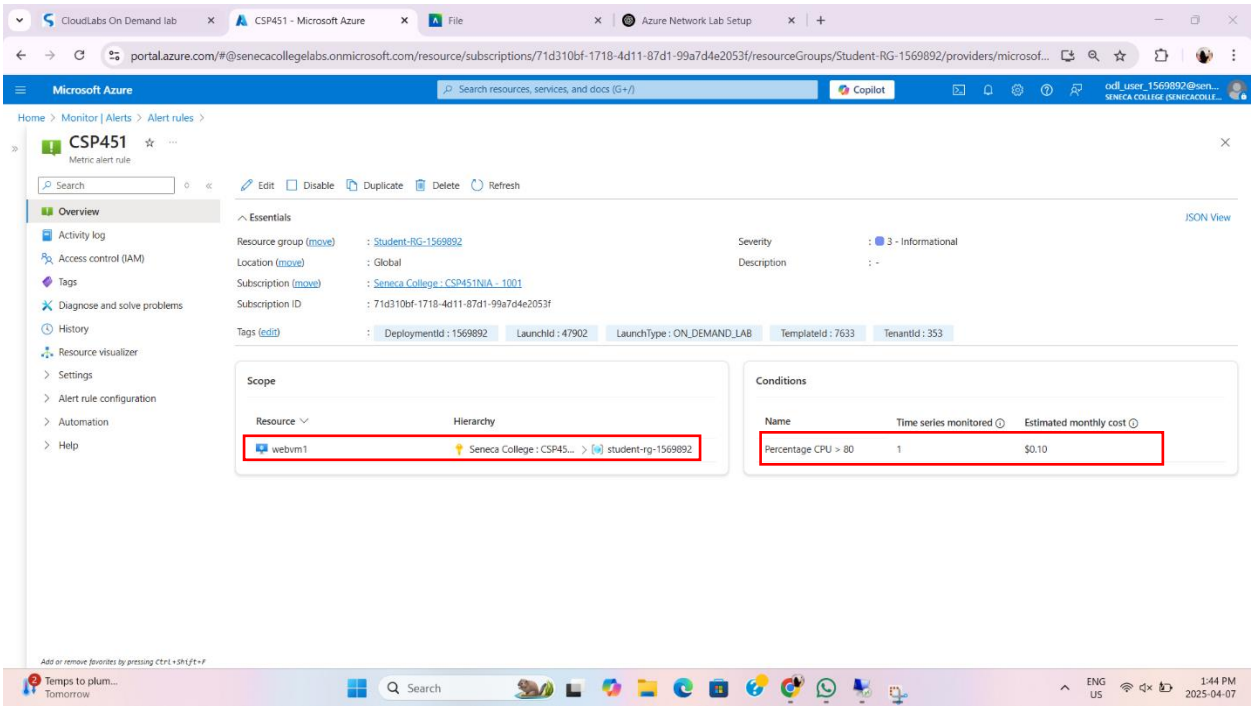
Добро пожаловать
Vitejte
مرحبا
欢迎
Willkommen
Velkommen
Witamy
Microsoft
Top Stories
German stock m...
Search
ENG
US
2:05 PM
2025-04-07



Evidence of logs/metrics from Network Watcher or Monitor:





Challenges and Resolutions

- **Managed vs Unmanaged Disks**: Initially, VMs could not be added to the Availability Set due to managed disk requirements. This was resolved by adjusting the disk settings to use unmanaged disks, or recreating the VMs to match the Availability Set's configuration.
- **Load Balancer Backend Pool Configuration**: Confusion around associating the correct subnet and IP addresses was resolved by carefully reviewing each VM's NIC and ensuring they were attached to the Frontend subnet.
- **Web Server Testing**: Verifying HTTP responses from both VMs required setting up simple test pages. For Windows VMs, IIS was configured and custom HTML was added to the default site for easy identification during testing.

Conclusion

The final network architecture effectively demonstrates scalability and redundancy using native Azure services. The project simulated real-world cloud deployment scenarios with load balancing, monitoring, and high availability setups. The lessons learned, especially around Azure's disk types and load balancer configuration, provided valuable insights for future cloud infrastructure projects.