



## Compte Rendu de Travaux Pratiques

# Compte Rendu - Travaux Pratiques En Cloud & Virtualisation

Filière : Réseaux Informatiques & Télécommunications

Niveau : 4<sup>ème</sup> Année

Sujet :

## TP3 : Load Balancers & VMSS

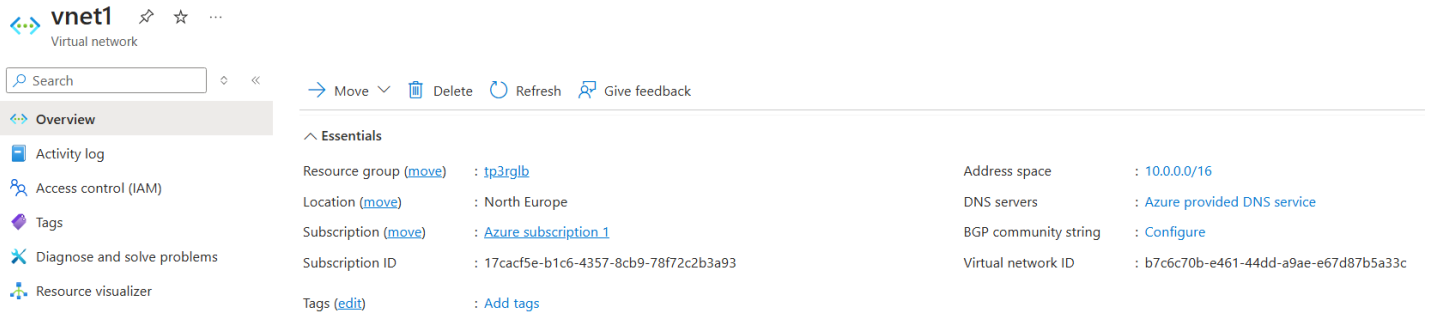
Réalisé par :

**Zied KHARRAT**  
**Nidhal JABNOUNI**  
**Yassine BELARBI**

Année Universitaire : 2024-25

# TASK 01

1. We have successfully created the VN vnet1 in the tp3rglb RG.



**vnet1** Virtual network

Search

Move Delete Refresh Give feedback

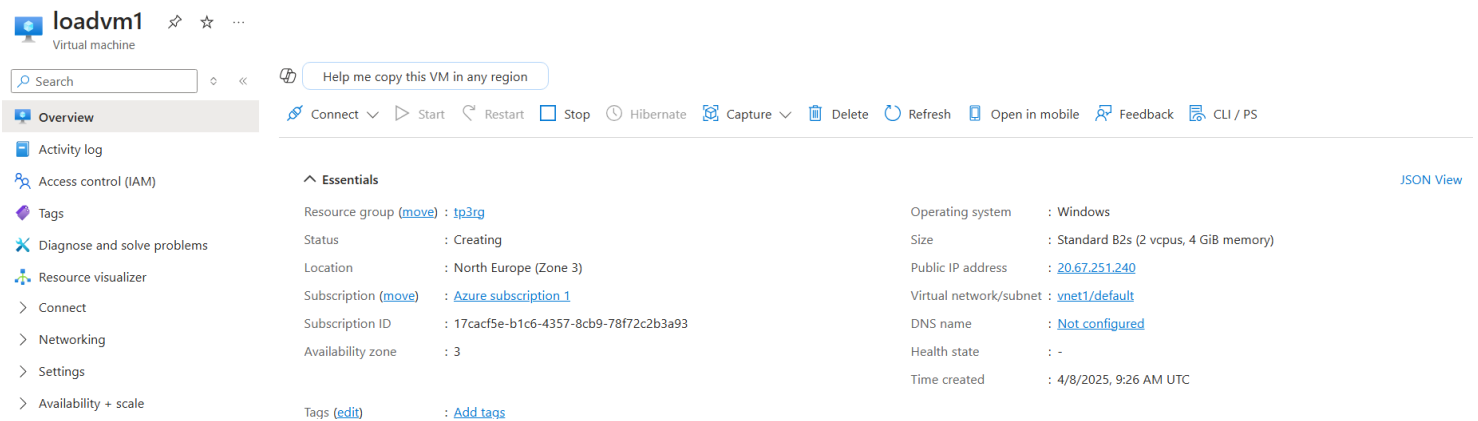
**Overview**

- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems
- Resource visualizer

**Essentials**

Resource group (move)	: tp3rglb	Address space	: 10.0.0.0/16
Location (move)	: North Europe	DNS servers	: Azure provided DNS service
Subscription (move)	: Azure subscription 1	BGP community string	: Configure
Subscription ID	: 17cacf5e-b1c6-4357-8cb9-78f72c2b3a93	Virtual network ID	: b7c6c70b-e461-44dd-a9ae-e67d87b5a33c
Tags (edit)	: Add tags		

2. We have successfully deployed loadvm1 with the required settings.



**loadvm1** Virtual machine

Search

Help me copy this VM in any region

Connect Start Restart Stop Hibernate Capture Delete Refresh Open in mobile Feedback CLI / PS

**Overview**

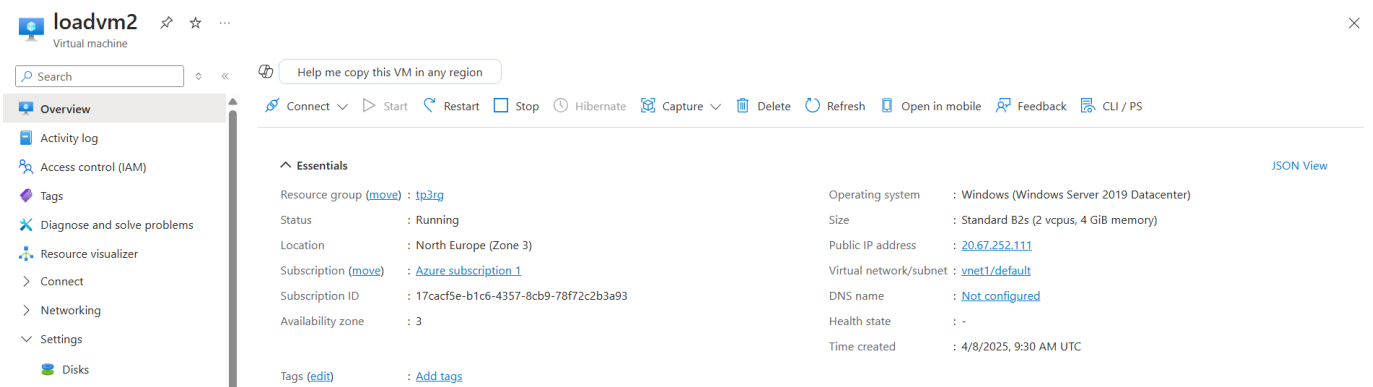
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems
- Resource visualizer
- Connect
- Networking
- Settings
- Availability + scale

**Essentials**

Resource group (move)	: tp3rg	Operating system	: Windows
Status	: Creating	Size	: Standard B2s (2 vcpus, 4 GiB memory)
Location	: North Europe (Zone 3)	Public IP address	: 20.67.251.240
Subscription (move)	: Azure subscription 1	Virtual network/subnet	: vnet1/default
Subscription ID	: 17cacf5e-b1c6-4357-8cb9-78f72c2b3a93	DNS name	: Not configured
Availability zone	: 3	Health state	: -
Tags (edit)	: Add tags	Time created	: 4/8/2025, 9:26 AM UTC

JSON View

3. We have successfully deployed loadvm2 with the required settings.



**loadvm2** Virtual machine

Search

Help me copy this VM in any region

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
- Resource visualizer
- Connect
- Networking
- Settings
- Disks

**Essentials**

Resource group (move)	: tp3rg	Operating system	: Windows (Windows Server 2019 Datacenter)
Status	: Running	Size	: Standard B2s (2 vcpus, 4 GiB memory)
Location	: North Europe (Zone 3)	Public IP address	: 20.67.252.111
Subscription (move)	: Azure subscription 1	Virtual network/subnet	: vnet1/default
Subscription ID	: 17cacf5e-b1c6-4357-8cb9-78f72c2b3a93	DNS name	: Not configured
Availability zone	: 3	Health state	: -
Tags (edit)	: Add tags	Time created	: 4/8/2025, 9:30 AM UTC

JSON View

4/5. We created the necessary container to add the custom script extension, then added the Install\_IIS.ps1 script. **This script will allow us to install a Windows web server on the two machines.**

container1

Container

Upload

Refresh

Give feedback

Authentication method: Access key (Switch to Microsoft Entra user account)

Location: container1

Search blobs by prefix (case-sensitive)

Show deleted blobs

Add filter

Name	Modified	Access tier	Archive status	Blob type	Size	Lease state
install_IIS.ps1	4/8/2025, 10:35:34 AM			Block blob	244 B	Available

Extensions

VM Applications

Add

Refresh

Update

Enable automatic upgrade

Disable automatic upgrade

Feedback

Search to filter items...

Showing all 1 items

	Name	Type	Version	Latest Version	Status	Automatic upgrade status
<input type="checkbox"/>	CustomScriptExtension	Microsoft.Compute.Cust...	1.10.20	1.10.20.0	Provisioning failed	Not supported

6. We have successfully created the load balancer with the specified settings, this standard LB will be used to distribute traffic (load-balancing) between loadvm01 and loadvm02.

standardloadbalancer

Load balancer

Search

Move

Delete

Refresh

Give feedback

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Resource visualizer

Settings

Monitoring

Insights

D diagnostic settings

Logs

Alerts

Metrics

Automation

Essentials

Resource group (move) tp3rg

Location North Europe

Subscription (move) Azure subscription 1

Subscription ID 17cacf5e-b1c6-4357-8cb9-78f72c2b3a93

SKU Standard

Tags (edit) Add tags

See less

Backend pool PoolA (2 virtual machines)

Load balancing rule RuleA (Tcp/80)

Health probe ProbeA (Http:80)

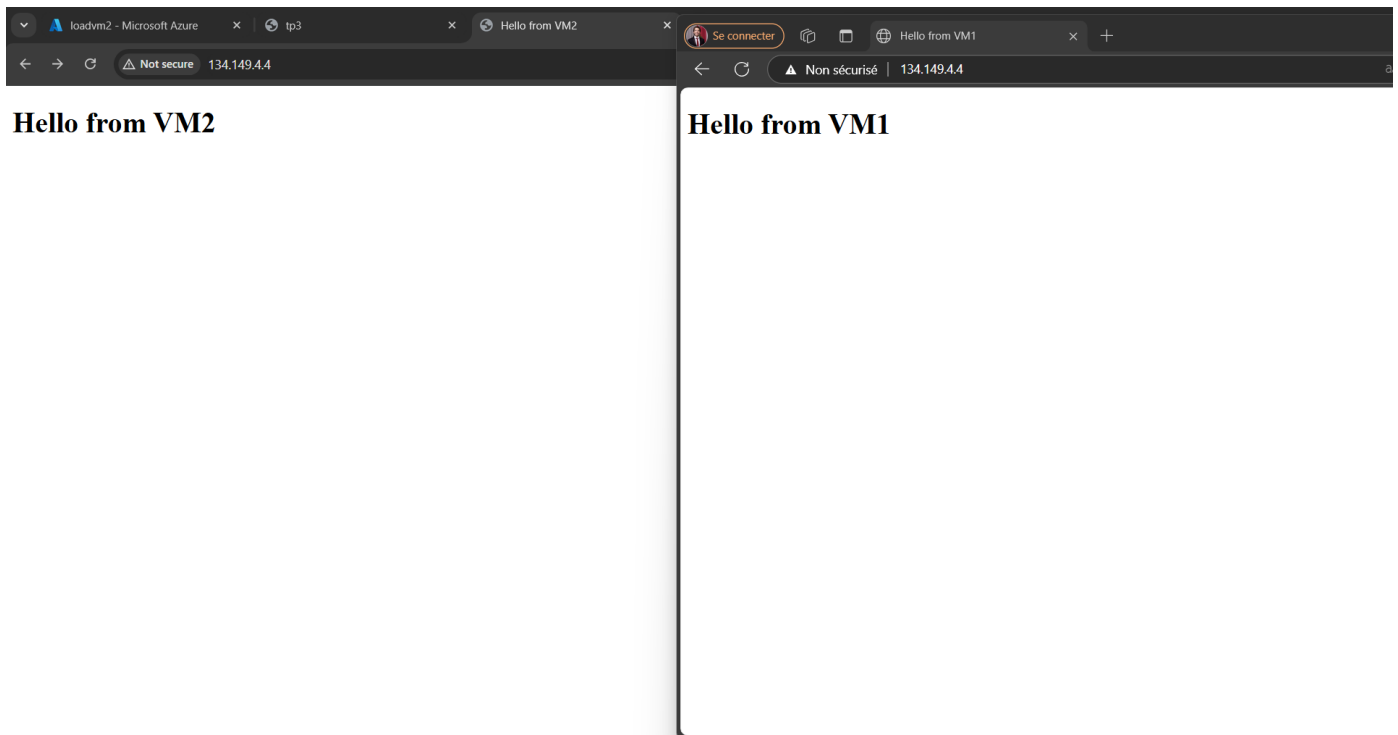
Inbound NAT rules None

Outbound rules None

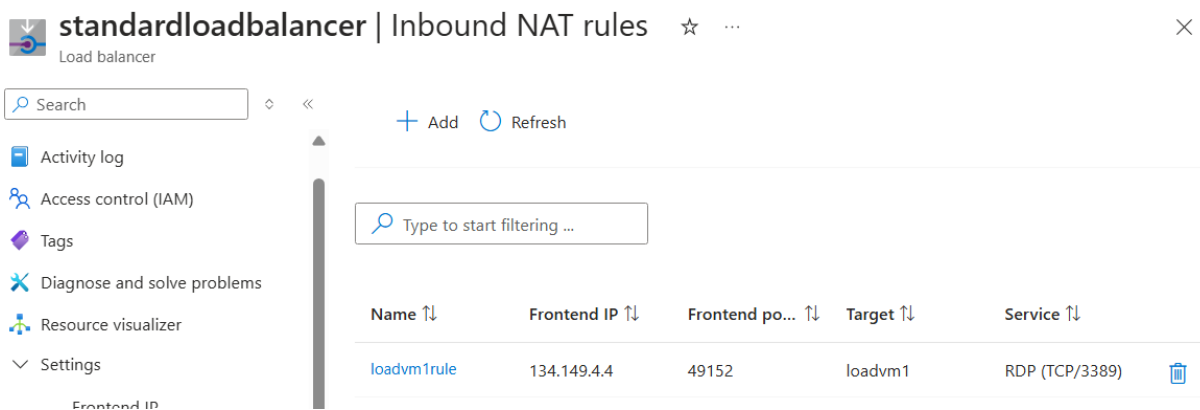
Tier Regional

Public IP address 134.149.4.4 (loadfrontendip)

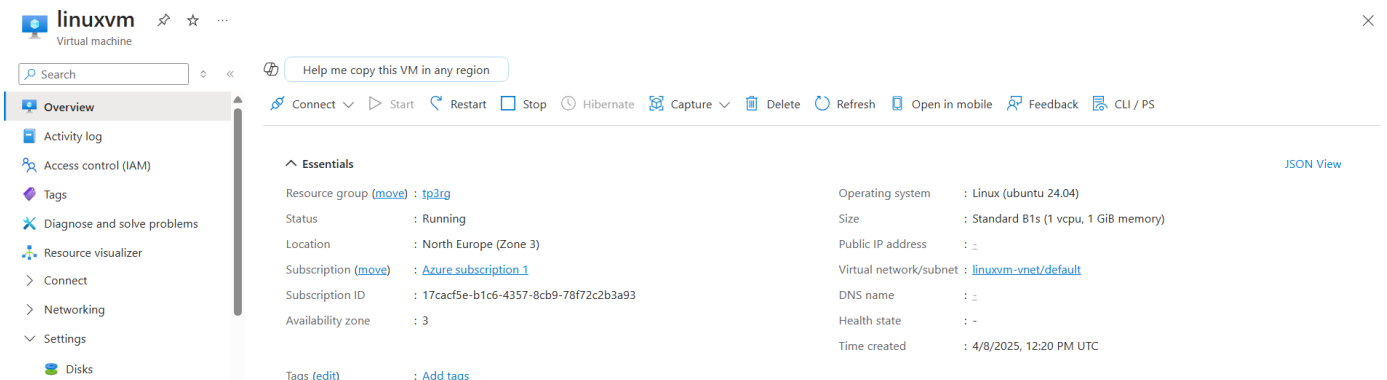
7. We managed to access the LB's public IP using 2 different browsers, for Chrome, we were redirected to VM1, while for Edge, we were redirected to VM2 (**We had to configure different index.html pages for each of the VMs first.**).



8. We successfully added an Inbound NAT rule with the specified settings to connect to loadvm1. This was done to allow the load balancer to route RDP traffic on port 49152 to the virtual machine's port 3389, ensuring secure remote access. **This step utilizes non-reserved ports for private communication.**



11. We successfully created the Linux VM using the provided settings.



12. We successfully established an SSH connection via PuTTY to our VM and installed the nginx web server, as shown below.

```
zied@linuxvm: ~  
No user sessions are running outdated binaries.  
No VM guests are running outdated hypervisor (qemu) binaries on this host.  
zied@linuxvm:~$ nginx  
2025/04/08 14:51:18 [warn] 2919#2919: the "user" directive makes sense only if t  
he master process runs with super-user privileges, ignored in /etc/nginx/nginx.c  
onf:1  
2025/04/08 14:51:18 [emerg] 2919#2919: open() "/var/log/nginx/error.log" failed  
(13: Permission denied)  
zied@linuxvm:~$ sudo nginx  
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)  
nginx: [emerg] bind() to [::]:80 failed (98: Address already in use)  
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)  
nginx: [emerg] bind() to [::]:80 failed (98: Address already in use)  
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)  
nginx: [emerg] bind() to [::]:80 failed (98: Address already in use)  
nginx: [emerg] bind() to 0.0.0.0:80 failed (98: Address already in use)  
nginx: [emerg] bind() to [::]:80 failed (98: Address already in use)  
nginx: [emerg] still could not bind()  
zied@linuxvm:~$ nginx -v  
nginx version: nginx/1.24.0 (Ubuntu)  
zied@linuxvm:~$
```

13. We created a new backend pool PoolB and added linuxvm to separate it from PoolA, since each load balancing rule can only use one backend pool at a time.

14. We added RuleB with port 8080 to avoid conflict with RuleA (which uses port 80), and mapped it to PoolB with ProbeA to handle traffic correctly.

[Home](#) > [Load balancing | Load Balancer](#) > [standardloadbalancer | Load balancing rules](#) >

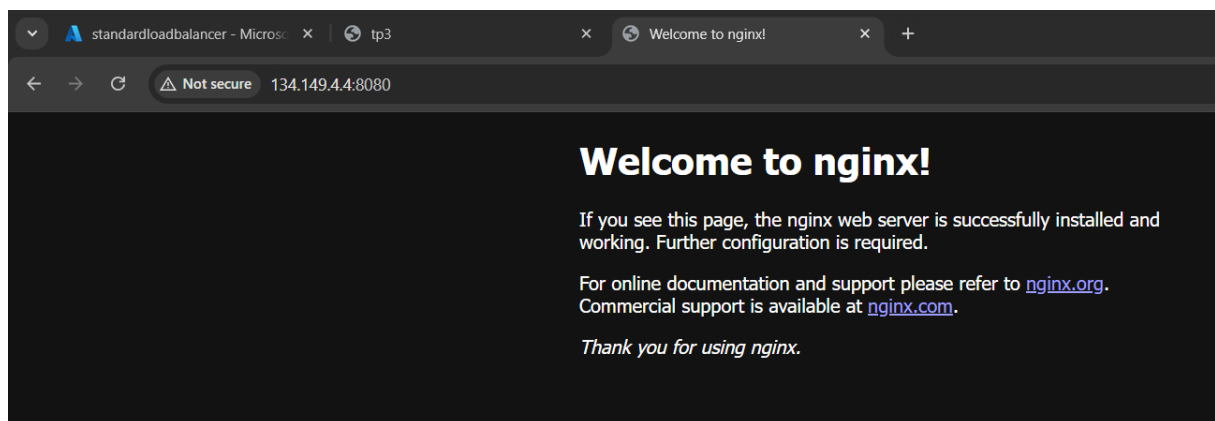
## RuleB

standardloadbalancer

A load balancing rule distributes incoming traffic that is sent to a selected IP address and port combination across a group of backend pool instances. Only backend instances that the health probe considers healthy receive new traffic. [Learn more.](#)

Name *	RuleB
IP version *	<input checked="" type="radio"/> IPv4 <input type="radio"/> IPv6
Frontend IP address * ⓘ	loadfrontendip (134.149.4.4) ▼
Backend pool * ⓘ	PoolB ▼
Protocol	<input checked="" type="radio"/> TCP <input type="radio"/> UDP
Port *	8080
Backend port * ⓘ	79

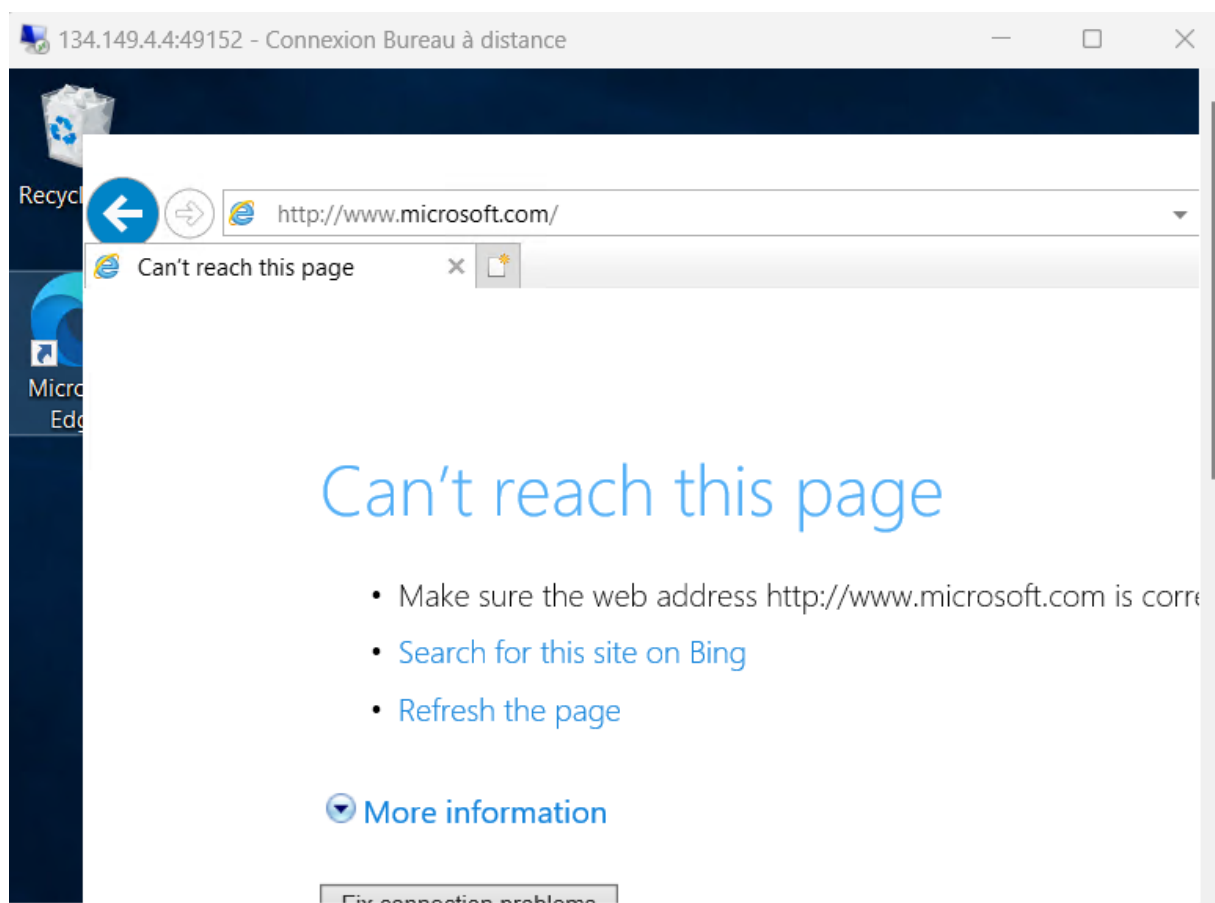
15. We were successfully redirected to the nginx server, our configuration works correctly.



16. The VM loadvm2 was successfully removed from PoolA

Backend pool	Resource Name	IP address	Network interface	Availability zone	Rules count	Resource Status	Admin state
PoolA (1)							
PoolA	loadvm1	10.0.0.4	loadvm1746_z3	3	1	Running	None
PoolB (1)							
PoolB	linuxvm	10.0.0.6	linuxvm57_z3	3	1	Running	None

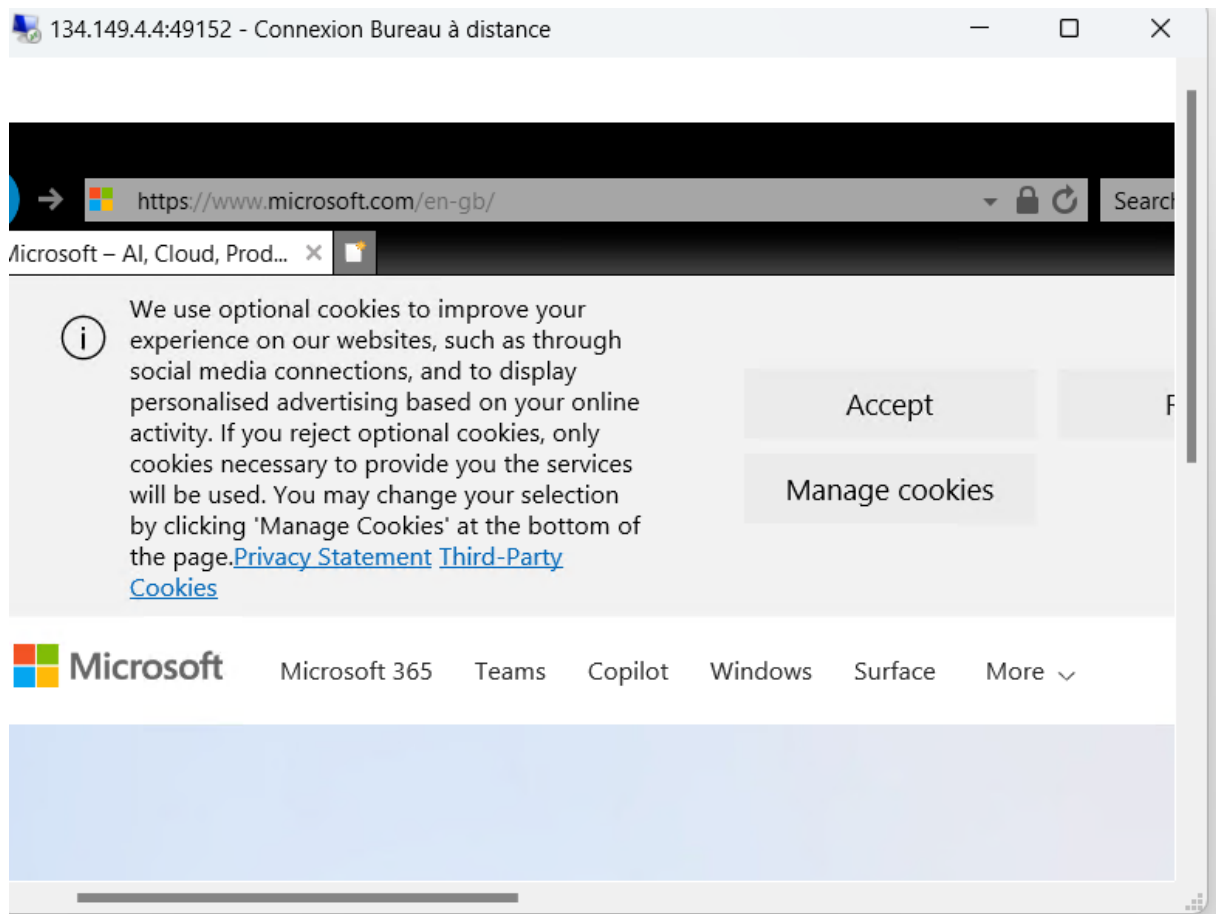
17. The website is indeed unreachable, confirming that we need to setup the outbound rules for the LB.



18. We have successfully created the necessary outbound rule, this allowed us to access a website on the internet via the VM.

Use outbound rules to configure the outbound network address translation (NAT) for all virtual machines in the backend pool. To create an outbound rule, the load balancer SKU must be standard and the frontend IP configuration must have at least one public IP address. [Learn more about outbound connectivity](#)

<input type="text" value="Filter by name..."/>	Frontend IP address : all	Backend pool : all	Protocol : all		
Name	Frontend IP address	Backend pool	Protocol	Ports per insta...	Delete
OutRuleloadvm1	loadfrontendip	PoolA (1 instances)	Tcp	16	





## TASK 02

1/2. We have successfully created the VMSS along with the load balancer. We can indeed see that the necessary configurations, including the health probe, load balancing rule, and inbound NAT rule that are connected to the instance in the VMSS, have been set up automatically.

The screenshot displays the Azure portal interface for a Virtual Machine Scale Set named 'scaleset'. The left sidebar shows the 'Overview' tab selected, with options for Activity log, Access control (IAM), Tags, Diagnose and solve problems, Instances, Resource visualizer, and Networking. The main content area is divided into 'Essentials' and a detailed configuration table. The 'Essentials' section shows the Resource group as 'scaleset\_group', Status as '1 out of 1 succeeded', Location as 'North Europe', Subscription as 'Azure subscription 1', and Subscription ID as '17cacf5e-b1c6-4357-8cb9-78f72c2b3a93'. The configuration table on the right lists: Operating system: Windows, Size: Standard\_B1s (1 instance), Public IP address: 13.74.184.184, Public IP address (IPv6): -, Virtual network/subnet: vnet-northeurope/snet-northeurope-1, Orchestration mode: Flexible, and Time created: 4/9/2025, 10:25 AM UTC.

Property	Value
Resource group	<a href="#">scaleset_group</a>
Status	1 out of 1 succeeded
Location	North Europe
Subscription	<a href="#">Azure subscription 1</a>
Subscription ID	17cacf5e-b1c6-4357-8cb9-78f72c2b3a93
Operating system	Windows
Size	Standard_B1s (1 instance)
Public IP address	13.74.184.184
Public IP address (IPv6)	-
Virtual network/subnet	vnet-northeurope/snet-northeurope-1
Orchestration mode	Flexible
Time created	4/9/2025, 10:25 AM UTC

The screenshot displays the Azure portal interface for a Load Balancer named 'standardloadbalancer'. The left sidebar shows the 'Overview' tab selected, with options for Activity log, Access control (IAM), Tags, Diagnose and solve problems, Resource visualizer, Settings, Frontend IP configuration, Backend pools, and Health probes. The main content area is divided into 'Essentials' and a detailed configuration table. The 'Essentials' section shows the Resource group as 'scaleset\_group', Location as 'North Europe', Subscription as 'Azure subscription 1', and Subscription ID as '17cacf5e-b1c6-4357-8cb9-78f72c2b3a93'. The configuration table on the right lists: Backend pool: [bepool \(1 virtual machine\)](#), Load balancing rule: [standardloadbalancer-lbrule01 \(Tcp/80\)](#), Health probe: [standardloadbalancer-probe01 \(Tcp:80\)](#), Inbound NAT rules: [standardloadbalancer-natRule01](#), and Outbound rules: None. A 'JSON View' link is visible in the top right corner.

Property	Value
Resource group	<a href="#">scaleset_group</a>
Location	North Europe
Subscription	<a href="#">Azure subscription 1</a>
Subscription ID	17cacf5e-b1c6-4357-8cb9-78f72c2b3a93
SKU	Standard
Backend pool	<a href="#">bepool (1 virtual machine)</a>
Load balancing rule	<a href="#">standardloadbalancer-lbrule01 (Tcp/80)</a>
Health probe	<a href="#">standardloadbalancer-probe01 (Tcp:80)</a>
Inbound NAT rules	<a href="#">standardloadbalancer-natRule01</a>
Outbound rules	None

3. We used the **install\_IIS.ps1** script to install the IIS extension on the VMSS to enable web server functionality. Then, we upgraded the instance to apply the extension, ensuring the changes took effect on the running VM.

Extensions

VM Applications

Add

Refresh

Update

Enable automatic upgrade

Disable automatic upgrade

Feedback

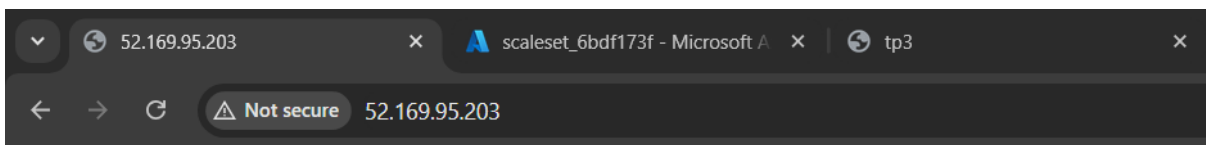
The Log Analytics agents (OMS/MMA) will reach end of support by August 2024. [Azure Monitor agent](#) is the recommended replacement

Search to filter items...

Showing all 2 items

<input type="checkbox"/>	Name	Type	Version	Latest Version	Automatic upgrade status
<input type="checkbox"/>	<a href="#">HealthExtension</a>	ApplicationHealthWind...	1.0	2.0 (Update Available)	Disabled
<input type="checkbox"/>	<a href="#">CustomScriptExtension</a>	CustomScriptExtension	1.9	1.10 (Update Available)	Not supported

4. We managed to access the VMSS instance via the load balancer's public IP, our configuration works.



Hello from VMSS instance!

**standardlb**  
Load balancer

[Move](#) [Delete](#) [Refresh](#) [Give feedback](#)

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

Essentials

Resource group [\(move\)](#)  
[scaleset\\_group\\_04091350](#)

Location  
North Europe

Subscription [\(move\)](#)  
[Azure subscription 1](#)

Subscription ID  
17cacf5e-b1c6-4357-8cb9-78f72c2b3a93

SKU  
Standard

Tags [\(edit\)](#)  
[Add tags](#)

[See less](#)

Backend pool  
[bepool \(1 virtual machine\)](#)

Load balancing rule  
[standardlb-lbrule01 \(Tcp/80\)](#)

Health probe  
[standardlb-probe01 \(Tcp:80\)](#)

Inbound NAT rules  
[standardlb-natRule01](#)

Outbound rules  
[None](#)

Tier  
Regional

Public IP address  
[52.169.95.203 \(standardlb-publicip\)](#)

[JSON](#)

5. We configured custom autoscaling for a Virtual Machine Scale Set (VMSS) based on CPU usage. Specifically, we set a rule to increase the instance count by 1 if CPU percentage exceeds 0% for 1 minute, allowing us to quickly trigger autoscaling for testing purposes.

Home > scaleset

## scaleset | Scaling

Virtual machine scale set

Search

Save Discard Refresh Logs Feedback

- Network manager
- Settings
  - Disks
  - Extensions + applications
  - Operating system
  - Configuration
  - Properties
  - Locks
- Availability + scale
  - Scaling**
  - Availability
  - Size
- Security
  - Identity
  - Microsoft Defender for Cloud
- Operations

### Default \* Auto created default scale condition

Delete warning

Scale mode

Rules

Scale out

When scaleset (Maximum) Percenta... Increase cou

+ Add a rule

Instance limits

Schedule

The very last or default recurrence rule cannot be deleted. Instead, you can disable autoscale to turn off autoscale.

Scale based on a metric Scale to a specific instance count

It is recommended to have at least one scale in rule. To create new rules, click [Add a rule](#)

Minimum \* 1 Maximum \* 1

Default \* 1

This scale condition is executed when none of the other scale condition(s) match

+ Add a scale condition

The new machines have been created successfully, but one failed to start due to reaching the public IP limit in Azure (2 VMs + one LB).

Home > scaleset

scaleset | Instances

Virtual machine scale set

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

**Instances**

Resource visualizer

Search

Edit columns

Refresh

Export to CSV

Open query

Assign tags

Start

Restart

Filter for any field...

Status equals all

Add filter

Showing 1 to 3 of 3 records.

No grouping

List view

<input type="checkbox"/>	Name ↑↓	Computer name ↑↓	Status ↑↓	Type ↑↓	Provisioning
<input type="checkbox"/>	scaleset_50ad10c2		Running	VM	Succeeded
<input type="checkbox"/>	scaleset_6bdf173f	scalesetvTXHX6N	Running	VM	Succeeded
<input type="checkbox"/>	scaleset_93fbcce		Failed	VM	Failed

⊗ Cannot create more than 3 public IP addresses for this subscription in this region. [Learn more about common virtual machine error codes.](#)

## Details

Error code	PublicIPCountLimitReached
Provisioning state	⊗ Failed
Provisioning state error code	ProvisioningState/failed/PublicIPCountLimitReached
Guest agent status	Unknown

## TASK 03

1. We created the extra subnet for the Application Gateway.

+ Subnet
Refresh
Manage users
Delete


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.

Search subnets

<input type="checkbox"/>	Name ↑	IPv4	IPv6	Available IPs	Delegated to	Security group	Route table		
<input type="checkbox"/>	default	10.0.0.0/24	-	251	-	-	-		
<input type="checkbox"/>	appSubnet	10.0.1.0/24	-	251	-	-	-		

2. We successfully created the 2 VMs.

Home > Compute infrastructure



Compute infrastructure | Virtual machines

✱ ...

Search

Virtual machines

Get started

Overview

All resources

Infrastructure

Virtual machines

Virtual Machine Scale Set (VMSS)

Compute Fleet (preview)

Disks + images

Capacity + placement

+ Create

Switch to classic

Reservations

Manage view

Refresh

Export to CSV

Open query

Assign tags

Start

Restart

Stop

...

Filter for any field...

Subscription equals all

Type equals all

Resource group equals all



Location equals all

Add filter

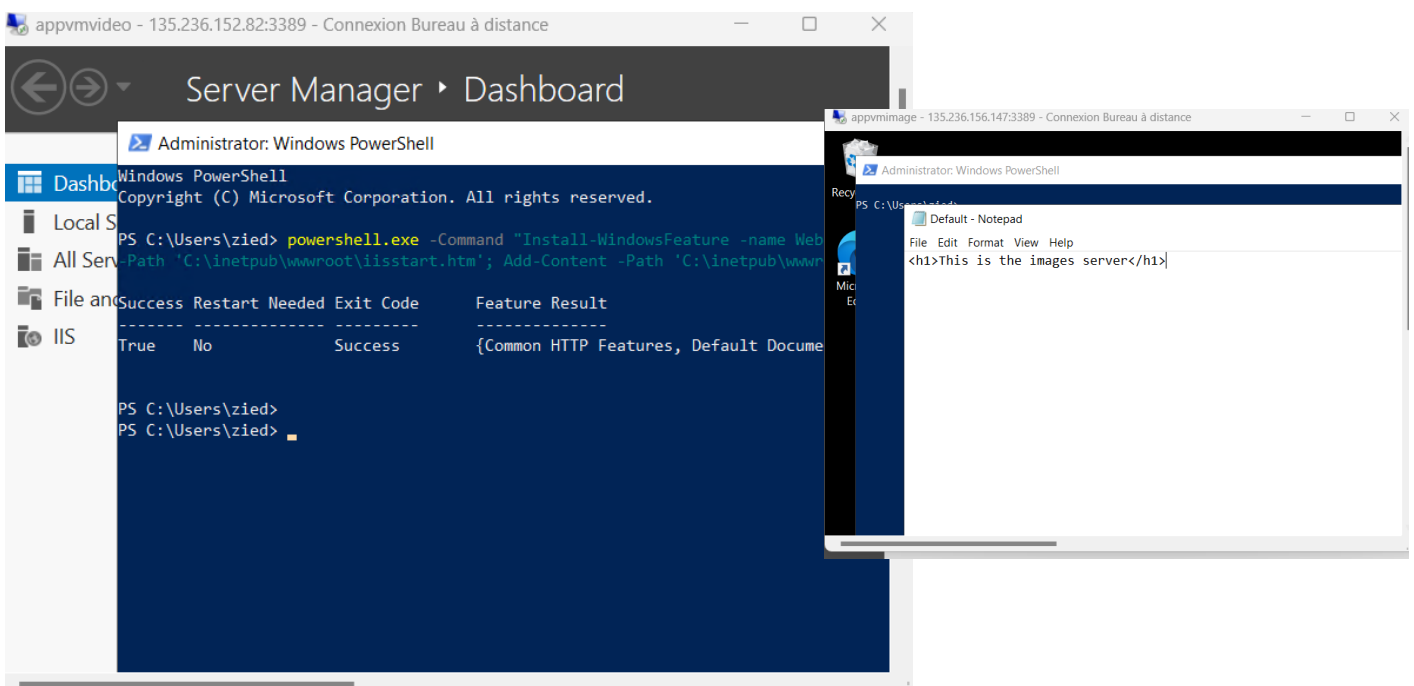
No grouping

List view

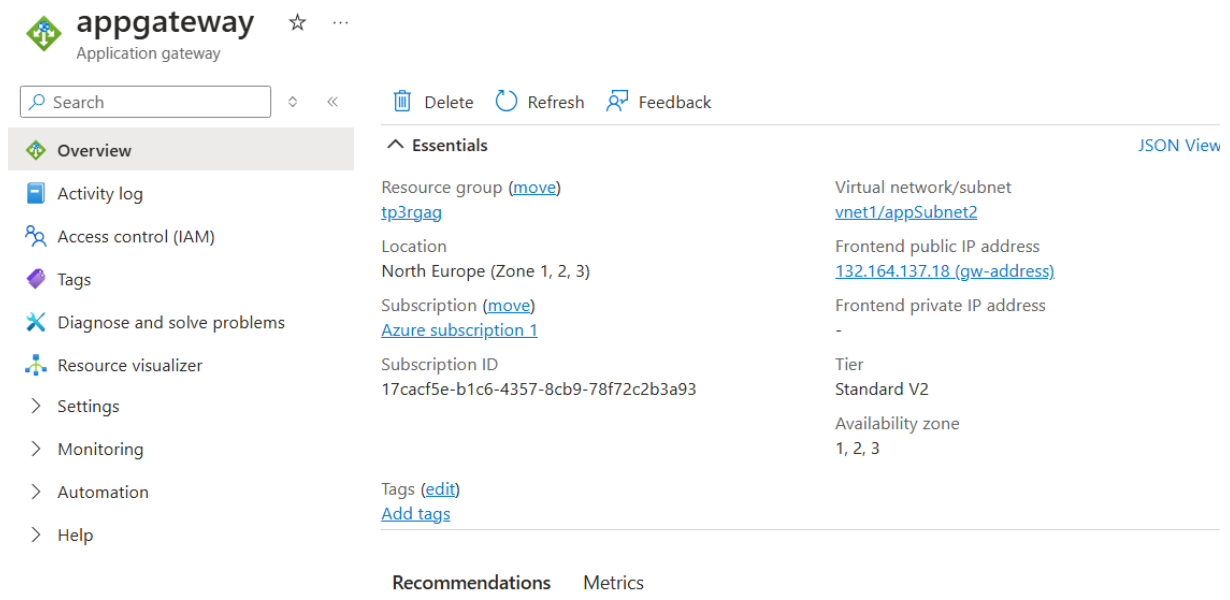
Showing 1 to 2 of 2 records.

Name	Subscription	Resource group	Location	Status	Operating system	Size	Public IP address
 appvmimage	Azure subscription 1	tp3rgag	North Europe	Running	Windows	Standard_B2s	135.236.156.147
 appvmvideo	Azure subscription 1	tp3rgag	North Europe	Running	Windows	Standard_B2s	135.236.152.82

3. We installed IIS and added the Default.html page for each VM.



- We successfully created the application gateway with the correct settings. We tested the Application Gateway by accessing the frontend IP in a browser. Based on the URL path, it correctly routed requests to the corresponding backend VMs—/images/ to the image server and /videos/ to the video server.



The screenshot shows the Azure portal interface for an 'appgateway' resource. The left sidebar contains a navigation menu with options: Overview (selected), Activity log, Access control (IAM), Tags, Diagnose and solve problems, Resource visualizer, Settings, Monitoring, Automation, and Help. The main content area is titled 'Essentials' and displays key resource information in a table-like format:

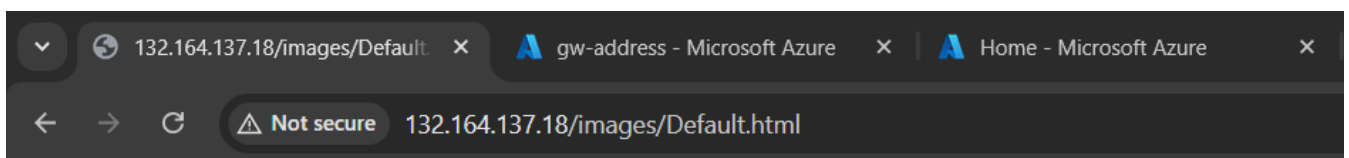
Property	Value
Resource group	<a href="#">tp3rgag</a> (move)
Location	North Europe (Zone 1, 2, 3)
Subscription	<a href="#">Azure subscription 1</a> (move)
Subscription ID	17cacf5e-b1c6-4357-8cb9-78f72c2b3a93
Virtual network/subnet	<a href="#">vnet1/appSubnet2</a>
Frontend public IP address	<a href="#">132.164.137.18</a> (gw-address)
Frontend private IP address	-
Tier	Standard V2
Availability zone	1, 2, 3

Below the Essentials section, there are links for 'Tags (edit)' and 'Add tags'. At the bottom, there are tabs for 'Recommendations' and 'Metrics'.

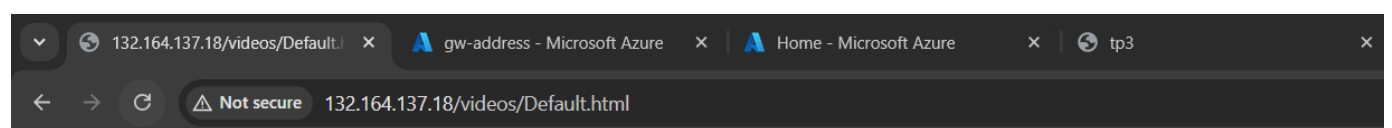


Your resource is following Light best practices.

- We tested the Application Gateway by accessing the frontend IP in a browser. Based on the URL path, it correctly routed requests to the corresponding backend VMs—/images/ to the image server and /videos/ to the video server.



**This is the images server**



**This is the videos server**



6. We successfully deleted the resource group.

### Delete a resource group








×


The following resource group and all its dependent resources will be permanently deleted.

**Resource group to be deleted**

 tp3rgag 

**Dependent resources to be deleted (13)**  
All dependent resources, including hidden types, are shown

Name	Resource type
 appgateway	Application gateway
 appvmimage	Virtual machine
 appvmimage-ip	Public IP address
 appvmimage-nsg	Network security group
 appvmimage306_z3	Network interface
 appvmimage_OsDisk_1_a03ab163388f45c7bfc	Disk
 appvmvideo	Virtual machine

☐ Apply force delete for selected Virtual machines and Virtual machine scale sets 

Enter resource group name to confirm deletion \*

## Conclusion:

During this lab, we gained **hands-on experience with key Azure networking and compute services**, including **Standard Load Balancers**, **Virtual Machine Scale Sets (VMSS)**, and **Azure Application Gateways**. We learned how to set up a load balancer to distribute traffic across multiple virtual machines and how to configure NAT rules to enable targeted access to individual instances. We explored backend pools and health probes, and saw how **routing decisions can be managed at both the network and application layer**. Additionally, we configured a VMSS and applied **auto-scaling rules based on performance metrics**, understanding how Azure adapts to demand in real time. Finally, we implemented an Application Gateway with path-based routing to **deliver content from distinct backend services**, reinforcing the concept of **intelligent traffic distribution based on URLs**. These exercises strengthened our understanding of **scalable, high-availability architecture in the cloud**.