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# Desarrollo

Siguiendo el planteamiento de la tarea, los pasos a realizar son:

1. Crear la primer máquina virtual para backend.
2. Crear la segunda máquina virtual para backend.
3. Crear la tercer máquina virtual para la base de datos.
4. Configurar las máquinas virtuales para conectarse a la base de datos.
5. Creación y configuración de balanceador de cargas.
6. Pruebas de funcionamiento.

Este orden es general y nos permitirá trabajar ordenadamente con el fin de poder lograr el objetivo planteado en las pruebas a la par que podemos validar el funcionamiento de cada parte de la infraestructura.

## 1. Creación de primer máquina virtual.

Lo primero que vamos a realizar es crear la primer máquina virtual para nuestro grupo de máquinas virtuales dónde se ejecutará la aplicación Java.

### 1.1. Creación de máquina virtual.

Para crear la máquina virtual, primero iremos a la página principal de Azure:

The screenshot shows the Microsoft Azure portal interface. At the top, there's a blue header bar with the Microsoft Azure logo, a search bar, and user information (hortegaa1500@alumno... INSTITUTO POLITÉCNICO NACIONAL). Below the header, the main content area is divided into several sections:

- Azure services:** A row of icons for creating a resource, managing resources, function apps, virtual machines, load balancers, SQL databases, app services, public IP addresses, SSH keys, and more services.
- Resources:** A table showing recent and favorite resources. Recent items include "SistemasDistribuidosResourceGroup" (Resource group), "SistemasDistribuidosVault" (Recovery Services vault), and "T6-2016630495-image-20230508195913" (Image). The table has columns for Name, Type, and Last Viewed.
- Navigate:** Links to Subscriptions, Resource groups, All resources, and Dashboard.
- Tools:** Links to Microsoft Learn, Azure Monitor, Microsoft Defender for Cloud, and Cost Management.

Seleccionaremos la opción de máquinas virtuales:

The screenshot shows the Microsoft Azure portal interface for managing virtual machines. The top navigation bar includes 'Microsoft Azure', a search bar, and user information. Below the navigation is a toolbar with various icons and dropdown menus for actions like 'Create', 'Refresh', and 'Delete'. A filter bar at the top allows searching by 'Subscription', 'Type', 'Resource group', 'Location', and 'Status'. The main content area displays a large icon of a computer monitor with a hexagon on it, followed by the text 'No virtual machines to display'. Below this, there's a brief description: 'Create a virtual machine that runs Linux or Windows. Select an image from the marketplace or use your own customized image.' Two 'Create' buttons are shown: one for 'Windows virtual machines' and one for 'Linux virtual machines'. At the bottom right, there's a 'Give feedback' link.

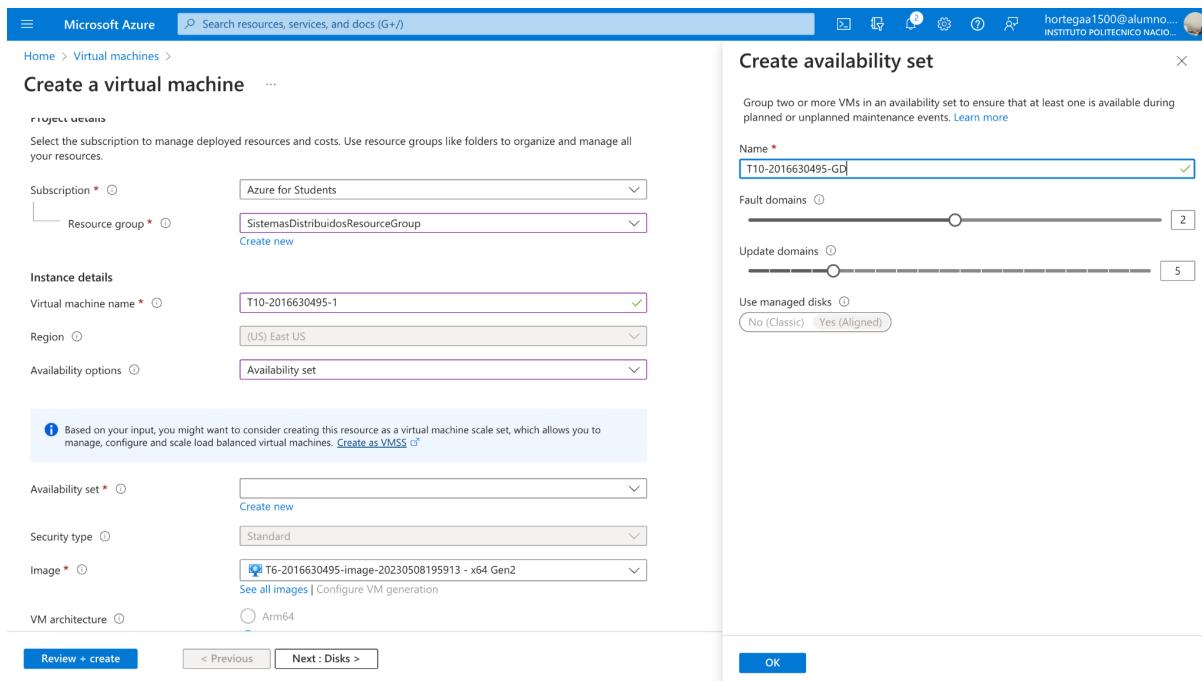
Hacemos click en *Create* y comenzamos a llenar el formulario:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal, specifically the 'Basics' step. The top navigation bar and user information are visible. The main form has tabs for 'Basics', 'Disks', 'Networking', 'Management', 'Monitoring', 'Advanced', 'Tags', and 'Review + create'. The 'Basics' tab is selected. A note at the top says: 'Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. Learn more' with a link. Below this, a message states: 'This subscription may not be eligible to deploy VMs of certain sizes in certain regions.' The 'Project details' section includes fields for 'Subscription' (set to 'Azure for Students') and 'Resource group' (set to 'SistemasDistribuidosResourceGroup'). The 'Instance details' section includes fields for 'Virtual machine name' (set to 'T10-2016630495-1'), 'Region' (set to '(US) East US'), 'Availability options' (set to 'No infrastructure redundancy required'), 'Security type' (set to 'Standard'), and 'Image' (set to 'T6-2016630495-image-20230508195913 - x64 Gen2'). At the bottom, there are buttons for 'Review + create' and 'Next : Disks >'. A 'Give feedback' link is also present.

Aquí fue importante que seleccionáramos el grupo de recursos que hemos utilizado a lo largo del semestre, así como la imagen correspondiente a la tarea 6 con la cual armaremos el resto de la tarea. Para poder usar el balanceador de cargas, debemos usar un *Conjunto de Disponibilidad* (*Availability Set* es el nombre en inglés), el cual crearemos a continuación.

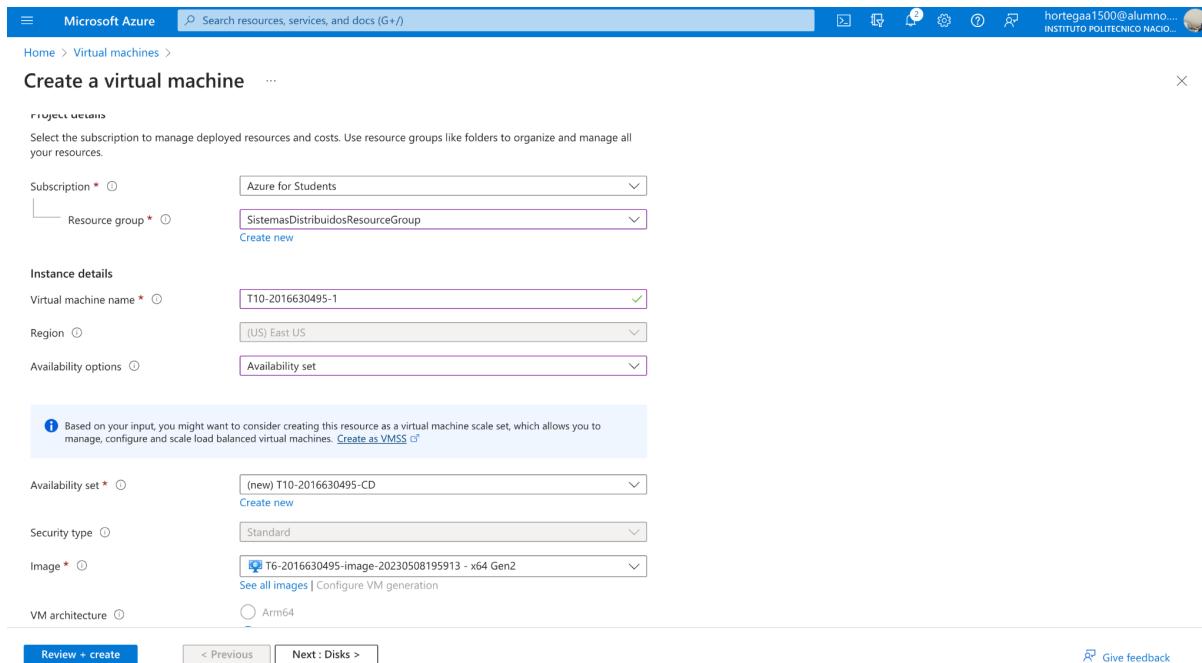
### 1.1.1. Creación de conjunto de disponibilidad.

Usaremos el nombre T10-2016630495-CD para seguir con la nomenclatura que se ha utilizado en las tareas hasta ahora:



The screenshot shows the Microsoft Azure portal interface for creating a virtual machine. On the left, the 'Create a virtual machine' wizard is displayed, with the 'Availability options' step selected. The 'Availability set' dropdown is open, showing '(new) T10-2016630495-CD'. On the right, a separate 'Create availability set' dialog box is open, allowing configuration of the availability set. The 'Name' field is filled with 'T10-2016630495-GD'. Under 'Fault domains', there are two domains. Under 'Update domains', there are five domains. The 'OK' button at the bottom right of the dialog box is highlighted.

Ya con el conjunto de disponibilidad creado lo seleccionamos para nuestra máquina virtual:



The screenshot shows the Microsoft Azure portal interface for creating a virtual machine. The 'Create a virtual machine' wizard is displayed, with the 'Availability options' step selected. The 'Availability set' dropdown is now populated with '(new) T10-2016630495-CD'. The 'OK' button is visible at the bottom right of the dialog box.

Ahora seleccionaremos el tamaño con 2vCPUs y 4GiB de RAM, la llave pública que he estado utilizando todo el semestre y dejaremos abierto el puerto 22 para establecer conexiones por SSH:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'SSH public key'. The 'Size' dropdown is set to 'Standard\_B2s - 2 vcpus, 4 GiB memory (\$30.37/month)'. Under 'Administrator account', 'Authentication type' is set to 'SSH public key'. A note says: '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.' The 'Username' field contains 'humbertowoody'. The 'SSH public key source' dropdown is set to 'Use existing key stored in Azure', and the 'Stored Keys' dropdown shows 'humbertowoody-azure'. In the 'Inbound port rules' section, 'Public inbound ports' is set to 'Allow selected ports' (selected), and 'Select inbound ports' is set to 'SSH (22)'. A note says: 'All traffic from the internet will be blocked by default. You will be able to'. At the bottom are 'Review + create' and 'Next : Disks >' buttons.

Ahora añadiremos un disco de tipo HDD para ahorrar en créditos de Azure:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'Disks'. The 'Disks' tab is selected. A note says: 'Azure VMs have one operating system disk and a temporary disk for short-term storage. You can attach additional data disks. The size of the VM determines the type of storage you can use and the number of data disks allowed. Learn more' (with a link). Under 'VM disk encryption', a note says: 'Azure disk storage encryption automatically encrypts your data stored on Azure managed disks (OS and data disks) at rest by default when persisting it to the cloud.' The 'Encryption at host' checkbox is checked. A note says: 'Encryption at host is not registered for the selected subscription. Learn more about enabling this feature' (with a link). In the 'OS disk' section, 'OS disk type' is set to 'Standard HDD (locally-redundant storage)'. A note says: 'The selected VM size supports premium disks. We recommend Premium SSD for high IOPS workloads. Virtual machines with Premium SSD disks qualify for the 99.9% connectivity SLA.' The 'Delete with VM' checkbox is checked. Under 'Key management', 'Platform-managed key' is selected. Under 'Enable Ultra Disk compatibility', a note says: 'Ultra disk is supported in Availability Zone(s) 1,2,3 for the selected VM size Standard\_B2s.' At the bottom are 'Review + create' and 'Next : Networking >' buttons.

Ahora visualizaremos la configuración de red:

The screenshot shows the 'Networking' tab of the Azure VM creation wizard. It includes fields for selecting a virtual network (T10-2016630495-1-vnet), subnet (default 10.0.0.0/24), and public IP (T10-2016630495-1-ip). It also shows options for NIC network security group (Basic selected) and public inbound ports (Allow selected ports selected, SSH (22) chosen). A note at the bottom states: "⚠️ This will allow all IP addresses to access your virtual machine. This is only recommended for testing. Use the Advanced controls in the Networking tab". Navigation buttons at the bottom include 'Review + create' (highlighted in blue), '< Previous' and 'Next : Management >'.

Ahora daremos click en *Review + create* y observaremos el resumen de la máquina virtual a crear:

The screenshot shows the 'Review + create' tab of the Azure VM creation wizard. It displays validation status ('Validation passed') and summary information: Image T6-2016630495-image-20230508195913, Standard B2s, 2 vcpus, 4 GiB memory. The 'Basics' section lists configuration details like Subscription (Azure for Students), Resource group (SistemasDistribuidosResourceGroup), Virtual machine name (T10-2016630495-1), Region (East US), Availability options (Availability set (new) T10-2016630495-CD), Security type (Standard), Image (T6-2016630495-image-20230508195913 - Gen2), VM architecture (x64), Size (Standard B2s (2 vcpus, 4 GiB memory)), Authentication type (SSH public key), Username (humbertowoody), and Key pair name (humberto@woody-azure). A note at the top of the summary section says: "⚠️ You have set SSH port(s) open to the internet. This is only recommended for testing. If you want to change this setting, go back to Basics tab." Navigation buttons at the bottom include 'Create' (highlighted in blue), '< Previous' and 'Next >', and 'Download a template for automation'. A 'Give feedback' link is also present.

Microsoft Azure  

Home > Virtual machines >

### Create a virtual machine

Validation passed

Public inbound ports: SSH  
Azure Spot: No

**Disks**

OS disk type	Standard HDD LRS
Use managed disks	Yes
Delete OS disk with VM	Enabled
Ephemeral OS disk	No

**Networking**

Virtual network	(new) T10-2016630495-1-vnet
Subnet	(new) default (10.0.0/24)
Public IP	(new) T10-2016630495-1-ip
Accelerated networking	Off
Place this virtual machine behind an existing load balancing solution?	No
Delete public IP and NIC when VM is deleted	Disabled

**Management**

Microsoft Defender for Cloud	Basic (free)
System assigned managed identity	Off

**Actions**

[Create](#) [< Previous](#) [Next >](#) [Download a template for automation](#) [Give feedback](#)

Microsoft Azure  

Home > Virtual machines >

### Create a virtual machine

Validation passed

**Management**

Microsoft Defender for Cloud	Basic (free)
System assigned managed identity	Off
Login with Azure AD	Off
Auto-shutdown	Off
Enable hotpatch	Off
Patch orchestration options	Image Default

**Monitoring**

Alerts	Off
Boot diagnostics	On
Enable OS guest diagnostics	Off

**Advanced**

Extensions	None
VM applications	None
Cloud init	No
User data	No
Disk controller type	SCSI
Proximity placement group	None
Capacity reservation group	None

**Actions**

[Create](#) [< Previous](#) [Next >](#) [Download a template for automation](#) [Give feedback](#)

Haremos click en *Create* y comenzará el despliegue de la aplicación:

The screenshot shows the Microsoft Azure Deployment Overview page for a deployment named 'CreateVm-T6-2016630495-image-20230508195913-20230619190135'. The status bar at the top indicates 'Deployment is in progress'. The main content area displays deployment details for five resources: T10-2016630495-1, t10-2016630495-1286, T10-2016630495-1-vnet, T10-2016630495-1-ip, and T10-2016630495-1-nsg. All resources are in 'Created' or 'OK' status. On the right side, there are promotional links for Microsoft Defender for Cloud, Free Microsoft tutorials, and Work with an expert.

Una vez finalizado, observaremos la siguiente pantalla:

The screenshot shows the Microsoft Azure Deployment Overview page after the deployment has completed. The status bar at the top indicates 'Your deployment is complete'. The main content area displays deployment details for the same five resources, all now in 'OK' status. Below the deployment details, there is a section titled 'Next steps' with three recommended actions: 'Setup auto-shutdown', 'Monitor VM health, performance and network dependencies', and 'Run a script inside the virtual machine', each with a 'Recommended' link. On the right side, there are promotional links for Cost Management, Microsoft Defender for Cloud, Free Microsoft tutorials, and Work with an expert.

Ahora haremos click en nuestra máquina virtual recién creada y observaremos la siguiente página principal de la máquina virtual:

The screenshot shows the Azure portal interface for a virtual machine named 'T10-2016630495-1'. The main navigation bar includes 'Search resources, services, and docs (G+)', 'Home', 'CreateVm-T6-2016630495-image-20230508195913-20230620134226 | Overview', and user information 'hortegaa1500@alumno... INSTITUTO POLITECNICO NACIONAL'. Below the navigation is a toolbar with actions: Connect, Start, Stop, Capture, Delete, Refresh, Open in mobile, Feedback, and CLI / PS.

**Essentials** section details:

- Resource group: SistemasDistribuidosResourceGroup
- Status: Running
- Location: East US
- Subscription: Azure for Students
- Subscription ID: a5d9d675-3ae1-4e2b-95b5-02150d67b8d2
- Operating system: Linux (ubuntu 20.04)
- Size: Standard B2s (2 vcpus, 4 GiB memory)
- Public IP address: 172.190.137.148
- Virtual network/subnet: T10-2016630495-1-vnet/default
- DNS name: Not configured
- Health state: -

**Tags** section: Tags (edit) : Click here to add tags

**Properties** tab is selected, showing the following details:

Virtual machine	Networking	Size
Computer name: T10-2016630495-1	Public IP address: 172.190.137.148 ( Network interface t10-2016630495-1751 )	Size: Standard B2s
Operating system: Linux (ubuntu 20.04)	Public IP address (IPv6): -	vCPUs: 2
Image publisher: -	Private IP address: 10.0.0.4	
Image offer: -	Private IP address (IPv6): -	
Image plan: -	Virtual network/subnet: T10-2016630495-1-vnet/default	
VM generation: V2	DNS name: Configure	
VM architecture: x64		
Agent status: Ready		
Agent version: 2.9.1.1		
Host group: None		
Host: -		

## 1.2. Prueba de conexión.

Para realizar la prueba de conexión estableceremos una conexión SSH con la máquina virtual.

```
> ls
humbertowoody-azure.pem
> ssh -i humbertowoody-azure.pem 172.190.137.148
The authenticity of host '172.190.137.148 (172.190.137.148)' can't be established.
ED25519 key fingerprint is SHA256:1SUzufDs02xtNWP8BlmeSDk17C8v6BzFRBRYjXGfKYw.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '172.190.137.148' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1037-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

 System information as of Tue Jun 20 19:53:21 UTC 2023

 System load:  1.05           Processes:          121
 Usage of /:   8.6% of 28.89GB  Users logged in:    0
 Memory usage: 22%            IPv4 address for eth0: 10.0.0.4
 Swap usage:   0%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
 just raised the bar for easy, resilient and secure K8s cluster deployment.

 https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

3 updates can be applied immediately.
2 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Tue May  9 01:55:13 2023 from 148.204.56.241
humbertowoody@T10-2016630495-1:~$
```

## 2. Creación de segunda máquina virtual.

Ahora crearemos la segunda máquina virtual dónde se ejecutará nuestra aplicación en Java.

### 2.1. Creación de máquina virtual.

Para crear la máquina virtual, primero iremos a la página principal de Azure:

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with icons for search, notifications, and account information. Below it is the 'Azure services' navigation bar with links for creating a resource, virtual machines, all resources, function apps, load balancers, SQL databases, app services, public IP addresses, SSH keys, and more services. The main content area is titled 'Resources' and shows a list of recent resources: T10-2016630495-1 (Virtual machine), SistemasDistribuidosResourceGroup (Resource group), SistemasDistribuidosVault (Recovery Services vault), and T6-2016630495-image-20230508195913 (Image). Below this is a 'See all' link. The 'Navigate' section contains links for Subscriptions, Resource groups, All resources, and Dashboard. The 'Tools' section includes links for Microsoft Learn, Azure Monitor, Microsoft Defender for Cloud, and Cost Management.

Haremos click en *Virtual machines* y observaremos la siguiente pantalla:

The screenshot shows the 'Virtual machines' list page in the Microsoft Azure portal. The top navigation bar includes links for Home, Create, Switch to classic, Reservations, Manage view, Refresh, Export to CSV, Open query, Assign tags, Start, Restart, Stop, Delete, Services, and more. There are also filter options for Name, Type, Subscription, Resource group, Location, and a search bar. The main table displays one record: T10-2016630495-1, which is a Virtual machine of type Azure for Students, located in the SistemasDistribuidosResourceGroup resource group in the East US region, with a status of Running, running on Linux, and having a Standard\_B2s size and a public IP address of 172.190.137.148. At the bottom, there are navigation links for < Previous, Page 1 of 1, Next >, and a 'Give feedback' button.

Ahora haremos click en *Create* y comenzaremos a llenar el formulario usando los mismos criterios para la primer máquina virtual, asegurándonos de que seleccionemos el mismo *Conjunto de Disponibilidad* que creamos para la primer máquina virtual:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The 'Project details' section is visible, showing the subscription 'Azure for Students' and resource group 'SistemasDistribuidosResourceGroup'. The 'Instance details' section shows the virtual machine name 'T10-2016630495-2', region '(US) East US', and availability set 'Availability set'. A note suggests creating a VMSS. The 'Availability set' dropdown shows 'T10-2016630495-CD'. Navigation buttons at the bottom include 'Review + create', '< Previous', 'Next : Disks >', and 'Give feedback'.

Usaremos el mismo usuario y llave pública que hemos utilizado a lo largo del semestre:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The 'Administrator account' section uses 'SSH public key' authentication, selecting 'humbertowoody' from the stored keys. The 'Inbound port rules' section allows selected ports (SSH (22)). A note states that all internet traffic will be blocked by default. Navigation buttons at the bottom include 'Review + create', '< Previous', 'Next : Disks >', and 'Give feedback'.

Seleccionaremos, al igual que con la primer máquina virtual, un disco de tipo HDD para ahorrar créditos en la plataforma de Azure:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'Disks'. The 'Standard HDD (locally-redundant storage)' option is selected for the OS disk type. A note indicates that encryption at host is not registered for the selected subscription. Other options like 'Delete with VM' and 'Key management' are also visible.

En la configuración de red usaremos los mismos criterios de la primer máquina virtual:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'Networking'. The 'Virtual network' dropdown is set to 'T10-2016630495-1-vnet'. Other networking settings like 'Subnet', 'Public IP', and security group are configured. A warning message at the bottom states: '⚠️ This will allow all IP addresses to access your virtual machine. This is only...'. Navigation buttons for 'Review + create' and 'Next : Management >' are at the bottom.

Haremos click en *Review + create* y observaremos el resumen de la máquina que vamos a crear:

The screenshot shows the 'Create a virtual machine' wizard in Microsoft Azure. The current step is 'Basics'. A validation message at the top says 'Validation passed'. A warning message below it states: '⚠ You have set SSH port(s) open to the internet. This is only recommended for testing. If you want to change this setting, go back to Basics tab.' Configuration details include:

Setting	Value
Subscription	Azure for Students
Resource group	SistemasDistribuidosResourceGroup
Virtual machine name	T10-2016630495-2
Region	East US
Availability options	Availability set
Availability set	T10-2016630495-CD
Security type	Standard
Image	T6-2016630495-image-20230508195913 - Gen2
VM architecture	x64
Size	Standard B2s (2 vcpus, 4 GiB memory)
Authentication type	SSH public key
Username	humbertowoody
Key pair name	humbertowoody-azure
Public inbound ports	SSH

At the bottom are buttons for 'Create', '< Previous' and 'Next >', 'Download a template for automation', and 'Give feedback'.

The screenshot shows the 'Create a virtual machine' wizard in Microsoft Azure. The current step is 'Networking'. Configuration details include:

Setting	Value
Virtual network	T10-2016630495-1-vnet
Subnet	default (10.0.0.0/24)
Public IP	(new) T10-2016630495-2-ip
Accelerated networking	Off
Place this virtual machine behind an existing load balancing solution?	No
Delete public IP and NIC when VM is deleted	Disabled

At the bottom are buttons for 'Create', '< Previous' and 'Next >', 'Download a template for automation', and 'Give feedback'.

The screenshot shows the 'Create a virtual machine' configuration page in Microsoft Azure. At the top, there is a green validation bar with the message 'Validation passed'. Below it, the configuration is divided into three sections: Management, Monitoring, and Advanced.

**Management**

Microsoft Defender for Cloud	None
System assigned managed identity	Off
Login with Azure AD	Off
Auto-shutdown	Off
Enable hotpatch	Off
Patch orchestration options	Image Default

**Monitoring**

Alerts	Off
Boot diagnostics	On
Enable OS guest diagnostics	Off

**Advanced**

Extensions	None
VM applications	None
Cloud init	No
User data	No
Disk controller type	SCSI
Proximity placement group	None
Capacity reservation group	None

At the bottom of the page are buttons for 'Create', '< Previous' and 'Next >', 'Download a template for automation', and 'Give feedback'.

Haremos click en *Create* y observaremos la siguiente pantalla:

The screenshot shows the 'Overview' page for a deployment named 'CreateVm-T6-2016630495-image-20230508195913-20230619191757'. The deployment status is shown as 'Deployment is in progress'.

**Deployment details:**

Resource	Type	Status	Operation details
T10-2016630495-2	Microsoft.Compute/virtualMa...	Created	<a href="#">Operation details</a>
t10-2016630495-2677	Microsoft.Network/networklin...	Created	<a href="#">Operation details</a>
T10-2016630495-2-nsg	Microsoft.Network/networkSe...	OK	<a href="#">Operation details</a>
T10-2016630495-2-ip	Microsoft.Network/publicIpA...	OK	<a href="#">Operation details</a>

On the right side of the page, there are promotional links for Microsoft Defender for Cloud, Free Microsoft tutorials, and Work with an expert.

Una vez finalizado el proceso observaremos la siguiente pantalla:

The screenshot shows the Microsoft Azure 'CreateVm-T6-2016630495-image-20230508195913-20230619191757 | Overview' page. The main message is 'Your deployment is complete'. Deployment details include:

- Deployment name: CreateVm-T6-2016630495-image-20230508195...
- Subscription: Azure for Students
- Resource group: SistemasDistribuidosResourceGroup
- Start time: 6/19/2023, 7:22:26 PM
- Correlation ID: 4313d24c-7c79-4daf-8668-544328fd59bf

Deployment details table:

Resource	Type	Status	Operation details
T10-2016630495-2	Microsoft.Compute/virtualMa...	OK	<a href="#">Operation details</a>
t10-2016630495-2677	Microsoft.Network/networkIn...	Created	<a href="#">Operation details</a>
T10-2016630495-2-nsg	Microsoft.Network/networkSe...	OK	<a href="#">Operation details</a>
T10-2016630495-2-ip	Microsoft.Network/publicIPA...	OK	<a href="#">Operation details</a>

Next steps:

- Setup auto-shutdown (Recommended)
- Monitor VM health, performance and network dependencies (Recommended)
- Run a script inside the virtual machine (Recommended)

Buttons: [Go to resource](#) | [Create another VM](#)

Right sidebar sections:

- Cost Management**: Get notified to stay within your budget and prevent unexpected charges on your bill. [Set up cost alerts >](#)
- Microsoft Defender for Cloud**: Secure your apps and infrastructure. [Go to Microsoft Defender for Cloud >](#)
- Free Microsoft tutorials**: [Start learning today >](#)
- Work with an expert**: Azure experts are service provider partners who can help manage your assets on Azure and be your first line of support. [Find an Azure expert >](#)

Haremos click en la máquina virtual y observaremos su página principal con información relevante:

The screenshot shows the Microsoft Azure 'T10-2016630495-2 | Virtual machine' page. The main message is 'T10-2016630495-2 virtual machine agent status is not ready. Troubleshoot the issue →'. VM details table:

Essentials	JSON View
Resource group (move) : <a href="#">SistemasDistribuidosResourceGroup</a>	Operating system : Linux
Status : Running	Size : Standard B2s (2 vcpus, 4 GiB memory)
Location : East US	Public IP address : <a href="#">20.163.149.49</a>
Subscription (move) : <a href="#">Azure for Students</a>	Virtual network/subnet : <a href="#">T10-2016630495-1-vnet/default</a>
Subscription ID : a5d9d675-3ae1-4e2b-95b5-02150d67b8d2	DNS name : <a href="#">Not configured</a>
Tags (edit) : <a href="#">Click here to add tags</a>	Health state : -

Properties tab details:

Virtual machine	Networking
Computer name : T10-2016630495-2	Public IP address : <a href="#">20.163.149.49</a> ( Network interface t10-2016630495-2733 )
Operating system : Linux	Public IP address (IPv6) : -
Image publisher : -	Private IP address : 10.0.0.5
Image offer : -	Private IP address (IPv6) : -
Image plan : -	Virtual network/subnet : <a href="#">T10-2016630495-1-vnet/default</a>
VM generation : V2	DNS name : <a href="#">Configure</a>
VM architecture : x64	
Agent status : Not Ready	
Agent version : Unknown	

Networking tab details:

Size
Size : Standard B2s

## 2.2. Prueba de conexión.

Para realizar la prueba de conexión estableceremos una conexión SSH con la máquina virtual.

```
> ls
humbertowoody-azure.pem
> ssh -i humbertowoody-azure.pem 20.163.149.49
The authenticity of host '20.163.149.49 (20.163.149.49)' can't be established.
ED25519 key fingerprint is SHA256:C+7F110esFdi4v6Vr1lHTQ7DJTvc+vdyfMKoAKI+11I.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '20.163.149.49' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1037-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

System information as of Tue Jun 20 19:58:22 UTC 2023

System load: 1.87          Processes:           121
Usage of /:   8.6% of 28.89GB  Users logged in:      0
Memory usage: 21%          IPv4 address for eth0: 10.0.0.5
Swap usage:   0%

* Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
just raised the bar for easy, resilient and secure K8s cluster deployment.

https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

3 updates can be applied immediately.
2 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Tue May  9 01:55:13 2023 from 148.204.56.241
humbertowoody@T10-2016630495-2:~$ █
```

### 3. Creación de base de datos.

Para la creación de la base de datos se ha optado por la opción de utilizar una tercera máquina virtual basada en la imagen de la tarea 6 para reutilizar la instalación de MySQL presente en dicha imagen.

#### 3.1. Creación de máquina virtual.

Para crear la máquina virtual, primero nos dirigiremos a la página principal de Azure:

The screenshot shows the Microsoft Azure homepage. At the top, there's a navigation bar with icons for search, notifications, and account information. Below it is the 'Azure services' navigation bar with links for creating a resource, virtual machines, all resources, function app, load balancers, SQL databases, app services, public IP addresses, SSH keys, and more services. The main area displays 'Recent' resources, including a virtual machine named 'T10-2016630495-2', a resource group 'SistemasDistribuidosResourceGroup', another virtual machine, a recovery services vault, and an image. There are also links to 'See all' and 'Dashboard'. At the bottom, there's a 'Tools' section with links to Microsoft Learn, Azure Monitor, Microsoft Defender for Cloud, and Cost Management.

Haremos click en *Virtual Machines*:

The screenshot shows the 'Virtual machines' page in Microsoft Azure. The top navigation bar includes 'Home > Virtual machines' and various filtering and sorting options. The main content area displays a table of existing virtual machines. The table has columns for Name, Type, Subscription, Resource group, Location, Status, Operating system, Size, and Public IP address. Two virtual machines are listed: 'T10-2016630495-1' and 'T10-2016630495-2'. Both are of type 'Virtual machine', belong to 'Azure for Students', are located in 'SISTEMASDISTRIBUID...', 'East US', and are running on 'Linux' with 'Standard\_B2s' size and IP addresses '172.190.137.148' and '20.163.149.49'. At the bottom, there are navigation links for '< Previous', 'Page 1 of 1', 'Next >', and a 'Give feedback' button.

Haremos click en *Create* y comenzaremos a llenar los datos de la máquina virtual (aquí no necesitamos que esté en el mismo grupo de disponibilidad):

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The user is on the 'Basics' tab. Key configuration details include:

- Subscription:** Azure for Students
- Resource group:** SistemasDistribuidosResourceGroup
- Virtual machine name:** T10-2016630495-BD
- Region:** (US) East US
- Availability options:** No infrastructure redundancy required
- Security type:** Standard
- Image:** T6-2016630495-image-20230508195913 - x64 Gen2

At the bottom, there are buttons for 'Review + create' and 'Next : Disks >'. A note at the top states: "This subscription may not be eligible to deploy VMs of certain sizes in certain regions."

Seleccionaremos la llave pública que hemos utilizado todo el semestre y dejaremos abierto el puerto 22 para conexiones SSH:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The user is on the 'Administrator account' step. Configuration includes:

- Authentication type:** SSH public key (selected)
- Username:** humbertowoody
- SSH public key source:** Use existing key stored in Azure
- Stored Keys:** humbertowoody-azure

In the 'Inbound port rules' section, the 'Public inbound ports' setting is set to 'Allow selected ports' with port 22 selected. At the bottom, there are buttons for 'Review + create' and 'Next : Disks >'.

Ahora seleccionaremos un disco de tipo HDD para ahorrar un poco en créditos de Azure:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'Disks'. The 'Standard HDD (locally-redundant storage)' option is selected for the OS disk type. A note indicates that encryption at host is not registered for the selected subscription. Other options like 'Delete with VM' and 'Key management' are also visible.

En la configuración de red únicamente permitiremos el acceso al puerto 22 (SSH) para conectarnos públicamente, no es necesario abrir los puertos de base de datos puesto que la comunicación pasará internamente:

The screenshot shows the 'Create a virtual machine' wizard in the Microsoft Azure portal. The current step is 'Networking'. The 'Virtual network' dropdown is set to 'T10-2016630495-1-vnet'. Under 'Public inbound ports', the 'Allow selected ports' option is selected with port 22 chosen. A warning message states: '⚠ This will allow all IP addresses to access your virtual machine. This is only'. Navigation buttons for 'Review + create', '< Previous', and 'Next : Networking >' are at the bottom.

Daremos click en *Review + create* y visualizaremos el resumen de la máquina virtual que vamos a crear:

The screenshot shows the 'Create a virtual machine' wizard in Microsoft Azure. The current step is 'Review + create'. A green validation bar at the top indicates 'Validation passed'. Below it, tabs for Basics, Disks, Networking, Management, Monitoring, Advanced, Tags, and Review + create are shown, with 'Review + create' being the active tab. A warning message in a yellow box states: '⚠ You have set SSH port(s) open to the internet. This is only recommended for testing. If you want to change this setting, go back to Basics tab.' Under the 'Image' section, it shows 'T6-2016630495-image-20230508195913 Standard D2s v3' with '2 vcpus, 8 GiB memory'. The 'Basics' section contains the following configuration:

Subscription	Azure for Students
Resource group	(new) T10-2016630495-BD_group
Virtual machine name	T10-2016630495-BD
Region	East US
Availability options	No infrastructure redundancy required
Security type	Standard
Image	T6-2016630495-image-20230508195913 - Gen2
VM architecture	x64
Size	Standard D2s v3 (2 vcpus, 8 GiB memory)
Authentication type	SSH public key
Username	humbertowoody
Key pair name	humbertowoody-azure
Public inbound ports	SSH

At the bottom, there are buttons for 'Create', '< Previous' and 'Next >', 'Download a template for automation', and 'Give feedback'.

This screenshot continues the 'Review + create' step. The configuration has been updated to include:

Key pair name	humbertowoody-azure
Public inbound ports	SSH
Azure Spot	No

The 'Networking' section now includes:

Virtual network	(new) T10-2016630495-BD-vnet
Subnet	(new) default (10.1.0.0/24)
Public IP	None
Accelerated networking	Off
Place this virtual machine behind an existing load balancing solution?	No
Delete NIC when VM is deleted	Disabled

The 'Management' section includes:

Microsoft Defender for Cloud	Basic (free)
System assigned managed identity	Off

At the bottom, there are buttons for 'Create', '< Previous' and 'Next >', 'Download a template for automation', and 'Give feedback'.

Haremos click en *Create* y comenzará el despliegue de nuestra máquina virtual:

Resource	Type	Status	Operation details
T10-2016630495-BD-vnet	Microsoft.Network/virtualNet...	Created	<a href="#">Operation details</a>
T10-2016630495-BD-nsg	Microsoft.Network/networkSe...	Created	<a href="#">Operation details</a>

Una vez finalizado observaremos la siguiente pantalla:

**CreateVm-T6-2016630495-image-20230508195913-20230620123753 | Overview**

**Your deployment is complete**

Deployment name: CreateVm-T6-2016630495-image-20230508195... Start time: 6/20/2023, 12:44:38 PM  
Subscription: Azure for Students Correlation ID: 34f956e4-004a-4c3f-821d-8188506f2f54

**Deployment details**

**Next steps**

Setup auto-shutdown Recommended  
Monitor VM health, performance and network dependencies Recommended  
Run a script inside the virtual machine Recommended

**Give feedback**  
Tell us about your experience with deployment

**Cost Management**  
Get notified to stay within your budget and prevent unexpected charges on your bill.  
[Set up cost alerts >](#)

**Microsoft Defender for Cloud**  
Secure your apps and infrastructure  
[Go to Microsoft Defender for Cloud >](#)

**Free Microsoft tutorials**  
[Start learning today >](#)

**Work with an expert**  
Azure experts are service provider partners who can help manage your assets on Azure and be your first line of support.  
[Find an Azure expert >](#)

Haremos click en el recurso creado y observaremos su página principal:

**T10-2016630495-BD | Virtual machine**

**Essentials**

Resource group (move)	SistemasDistribuidosResourceGroup	Operating system	: Linux (ubuntu 20.04)
Status	: Running	Size	: Standard D2s v3 (2 vcpus, 8 GiB memory)
Location	: East US	Public IP address	: <a href="#">13.72.112.81</a>
Subscription (move)	: Azure for Students	Virtual network/subnet	: <a href="#">T10-2016630495-1-vnet/default</a>
Subscription ID	: a5d9d675-3ae1-4e2b-95b5-02150d67b8d2	DNS name	: Not configured

**Properties**

Virtual machine	Networking
Computer name	T10-2016630495-BD
Operating system	Linux (ubuntu 20.04)
Image publisher	-
Image offer	-
Image plan	-
VM generation	V2
VM architecture	x64
Agent status	Ready
Agent version	2.9.1
Host group	None
Host	-

Networking	
Public IP address	13.72.112.81 ( Network interface <a href="#">t10-2016630495-bd875</a> )
Public IP address (IPv6)	-
Private IP address	10.0.0.6
Private IP address (IPv6)	-
Virtual network/subnet	<a href="#">T10-2016630495-1-vnet/default</a>
DNS name	<a href="#">Configure</a>

Size	
Size	Standard D2s v3
vCPUs	2
RAM	8 GiB

### 3.2. Prueba de conexión.

Para probar la conectividad con la máquina virtual creada para la base de datos, estableceremos la conectividad mediante un túnel de SSH:

```
> ls
humbertowoody-azure.pem
> ssh -i humbertowoody-azure.pem 13.72.112.81
The authenticity of host '13.72.112.81 (13.72.112.81)' can't be established.
ED25519 key fingerprint is SHA256:m9eFBCYqeq0kwPJhcueqVWLJ2zVeFHWSbPNu0aGV4k.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '13.72.112.81' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1037-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

System information as of Tue Jun 20 20:02:27 UTC 2023

System load: 1.26          Processes:           125
Usage of /:   8.6% of 28.89GB  Users logged in:      0
Memory usage: 11%          IPv4 address for eth0: 10.0.0.6
Swap usage:   0%

* Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
just raised the bar for easy, resilient and secure K8s cluster deployment.

https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

3 updates can be applied immediately.
2 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Tue May  9 01:55:13 2023 from 148.204.56.241
humbertowoody@T10-2016630495-BD:~$ █
```

### 3.3. Prueba de estructura de datos.

Para verificar que la imagen de la tarea 6 que estamos usando contiene el servicio de MySQL con la estructura requerida, nos conectaremos usando la línea de comandos y obtendremos las tablas disponibles.

```
humberto@T10-2016630495-BD:~$ mysql -u hugo -p
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 9
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> show databases;
+-----+
| Database      |
+-----+
| information_schema |
| performance_schema |
| servicio_web     |
+-----+
3 rows in set (0.00 sec)

mysql> use servicio_web;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+-----+
| Tables_in_servicio_web |
+-----+
| fotos_usuarios        |
| usuarios                |
+-----+
2 rows in set (0.00 sec)

mysql> █
```

Como podemos ver, la base de datos está lista. Ahora configuraremos las máquinas virtuales 1 y 2 para conectarse a esta instancia para la base de datos.

## 4. Configuración de aplicación con base de datos.

Al crear las dos máquinas virtuales utilizamos la imagen de la tarea 6, la cual incluye un servidor de MySQL, si ejecutamos TomCat en cada una de las máquinas virtuales, la conexión que establecerá será hacia su base de datos local, en esta sección detendremos ese servidor local de MySQL en cada una, apuntaremos cada una a la base de datos en la tercer máquina virtual y corroborar que funcione.

### 4.1. Configurar conexión remota con servidor MySQL.

Lo primero será configurar la tercer máquina virtual para que acepte conexiones en la red local de Azure, para esto debemos modificar el archivo: /etc/mysql/mysql.conf.d/mysqld.cnf

```
humberto@T10-2016630495-BD:/etc/mysql/mysql.conf.d$ pwd  
/etc/mysql/mysql.conf.d  
humberto@T10-2016630495-BD:/etc/mysql/mysql.conf.d$ ls  
mysql.cnf  mysqld.cnf
```

En este archivo, debemos cambiar la dirección con la que se hace *binding* de 127.0.0.1 (*loopback*) a la dirección IP de la red virtual de Azure (no la IP pública, no necesitamos acceso público a la base de datos). La modificación final será la siguiente, primero encontraremos la línea con la configuración:

```
# Instead of skip-networking the default is now to listen only on  
# localhost which is more compatible and is not less secure.  
bind-address          = 127.0.0.1  
mysqld-bind-address  = 127.0.0.1
```

La cambiaremos a:

```
# Instead of skip-networking the default is now to listen only on  
# localhost which is more compatible and is not less secure.  
#bind-address          = 127.0.0.1  
#mysqld-bind-address  = 127.0.0.1  
bind-address          = 10.0.0.6  
mysqld-bind-address  = 10.0.0.6
```

Reiniciaremos el servicio:

```
humberto@T10-2016630495-BD:~$ sudo service mysql restart
humberto@T10-2016630495-BD:~$ service status mysql
status: unrecognized service
humberto@T10-2016630495-BD:~$ service mysql status
● mysql.service - MySQL Community Server
    Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor>
              Active: active (running) since Tue 2023-06-20 20:32:34 UTC; 11s ago
                Process: 2075 ExecStartPre=/usr/share/mysql/mysql-systemd-start pre>
              Main PID: 2084 (mysqld)
                Status: "Server is operational"
                  Tasks: 38 (limit: 9531)
                 Memory: 370.7M
                   CPU: 0.000 CPU(s) since start
                     CGroup: /system.slice/mysql.service
                               └─2084 /usr/sbin/mysqld

Jun 20 20:32:33 T10-2016630495-BD systemd[1]: Starting MySQL Community >
Jun 20 20:32:34 T10-2016630495-BD systemd[1]: Started MySQL Community S>
lines 1-13/13 (END)
```

Ahora crearemos un usuario con el mismo nombre del que creamos en la tarea 6: "hugo", con la única diferencia de que no será hugo@localhost sino hugo@%, con lo cual permitimos que el usuario hugo se pueda conectar desde cualquier host:

```
mysql> create user 'hugo'@'%' identified by '1234567';
Query OK, 0 rows affected (0.09 sec)

mysql> grant all on servicio.* to hugo@'%';
Query OK, 0 rows affected (0.03 sec)

mysql> exit
Bye
humberto@T10-2016630495-BD:~$
```

Hecho esto, ahora probaremos la conexión desde alguna máquina virtual:

```
humbertowoodby@T10-2016630495-2:~$ mysql -u hugo -p -h 10.0.0.6
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 9
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> show databases;
+-----+
| Database      |
+-----+
| information_schema |
| performance_schema |
| servicio_web     |
+-----+
3 rows in set (0.00 sec)

mysql> use servicio_web;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+-----+
| Tables_in_servicio_web |
+-----+
| fotos_usuarios        |
| usuarios                |
+-----+
2 rows in set (0.01 sec)

mysql> █
```

*Nota: como dato curioso, estuve un rato tratando de ver por qué no funcionaba que el usuario leyera la base de datos y resultó ser porque me estaba equivocando de nombre de base de datos. Lo menciono porque tuve que borrar y volver a crear el usuario “hugo” y, aunque no tiene impacto en el funcionamiento*

#### 4.1. Detener servicios en máquinas virtuales de aplicación.

Ahora que sabemos que las máquinas virtuales de aplicación tienen conectividad con la base de datos, detendremos los servidores de MySQL en cada una de las máquinas virtuales.

Deteniendo el servicio en la primer máquina virtual:

```
humberto@T10-2016630495-1:~$ systemctl status mysql
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor presen>
  Active: active (running) since Tue 2023-06-20 19:52:20 UTC; 1h 26min ago
    Main PID: 1214 (mysqld)
      Status: "Server is operational"
        Tasks: 37 (limit: 4699)
       Memory: 458.9M
         CGroup: /system.slice/mysql.service
                   └─1214 /usr/sbin/mysqld

Jun 20 19:52:00 T10-2016630495-1 systemd[1]: Starting MySQL Community Server.>
Jun 20 19:52:20 T10-2016630495-1 systemd[1]: Started MySQL Community Server.
humberto@T10-2016630495-1:~$ sudo systemctl disable mysql
Synchronizing state of mysql.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install disable mysql
Removed /etc/systemd/system/multi-user.target.wants/mysql.service.
humberto@T10-2016630495-1:~$ sudo systemctl stop mysql
humberto@T10-2016630495-1:~$ systemctl status mysql
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; disabled; vendor presen>
  Active: inactive (dead)

Jun 20 19:52:00 T10-2016630495-1 systemd[1]: Starting MySQL Community Server.>
Jun 20 19:52:20 T10-2016630495-1 systemd[1]: Started MySQL Community Server.
Jun 20 21:18:37 T10-2016630495-1 systemd[1]: Stopping MySQL Community Server.>
Jun 20 21:18:38 T10-2016630495-1 systemd[1]: mysql.service: Succeeded.
Jun 20 21:18:38 T10-2016630495-1 systemd[1]: Stopped MySQL Community Server.
[lines 1-9/9 (END)]
```

Deteniendo el servicio en la segunda máquina virtual:

```
humberto@T10-2016630495-2:~$ sudo systemctl status mysql
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; enabled; vendor>
  Active: active (running) since Tue 2023-06-20 19:57:52 UTC; 1h 17m>
    Main PID: 1218 (mysqld)
      Status: "Server is operational"
        Tasks: 37 (limit: 4699)
       Memory: 458.4M
      CGroup: /system.slice/mysql.service
              └─1218 /usr/sbin/mysqld

Jun 20 19:57:29 T10-2016630495-2 systemd[1]: Starting MySQL Community S>
Jun 20 19:57:52 T10-2016630495-2 systemd[1]: Started MySQL Community Se>
humberto@T10-2016630495-2:~$ sudo systemctl disable mysql
Synchronizing state of mysql.service with SysV service script with /lib/systemd/s
ystemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install disable mysql
Removed /etc/systemd/system/multi-user.target.wants/mysql.service.
humberto@T10-2016630495-2:~$ sudo systemctl status mysql
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; disabled; vendor>
  Active: active (running) since Tue 2023-06-20 19:57:52 UTC; 1h 19m>
    Main PID: 1218 (mysqld)
      Status: "Server is operational"
        Tasks: 37 (limit: 4699)
       Memory: 458.4M
      CGroup: /system.slice/mysql.service
              └─1218 /usr/sbin/mysqld

Jun 20 19:57:29 T10-2016630495-2 systemd[1]: Starting MySQL Community S>
Jun 20 19:57:52 T10-2016630495-2 systemd[1]: Started MySQL Community Se>
humberto@T10-2016630495-2:~$ sudo systemctl stop mysql
humberto@T10-2016630495-2:~$ sudo systemctl status mysql
● mysql.service - MySQL Community Server
  Loaded: loaded (/lib/systemd/system/mysql.service; disabled; vendor>
  Active: inactive (dead)

Jun 20 19:57:29 T10-2016630495-2 systemd[1]: Starting MySQL Community S>
Jun 20 19:57:52 T10-2016630495-2 systemd[1]: Started MySQL Community Se>
Jun 20 21:17:25 T10-2016630495-2 systemd[1]: Stopping MySQL Community S>
Jun 20 21:17:26 T10-2016630495-2 systemd[1]: mysql.service: Succeeded.
Jun 20 21:17:26 T10-2016630495-2 systemd[1]: Stopped MySQL Community Se>
humberto@T10-2016630495-2:~$ █
```

## 4.2. Configurar dirección de nueva base de datos.

Ahora que ya no corre MySQL en ninguna de las máquinas virtuales, vamos a modificar el archivo de configuración de conexión para Java (context.xml) con los parámetros de conexión de la nueva base de datos.

La ruta del archivo en ambas máquinas virtuales es la siguiente (las capturas corresponden a la primer máquina virtual):

```
humberto@T10-2016630495-1:~/META-INF$ pwd  
/home/humberto/META-INF  
humberto@T10-2016630495-1:~/META-INF$ ls  
context.xml  
humberto@T10-2016630495-1:~/META-INF$ █
```

Modificaremos la cadena de conexión de la siguiente forma para que en lugar de localhost utilice la IP interna de Azure:

```
<Context>  
    <Resource name="jdbc/datasource_Servicio" auth="Container" type="javax.sql.DataSource"  
        maxActive="100" maxIdle="30" maxWait="10000"  
        username="hugo" password="1234567"  
        driverClassName="com.mysql.cj.jdbc.Driver"  
        url="jdbc:mysql://localhost/servicio_web?serverTimezone=UTC"/>  
</Context>
```

Ahora con la IP en ambas máquinas virtuales:

```
humberto@T10-2016630495-2:~$ cat META-INF/context.xml  
<Context>  
    <Resource name="jdbc/datasource_Servicio" auth="Container"  
    type="javax.sql.DataSource"  
        maxActive="100" maxIdle="30" maxWait="10000"  
        username="hugo" password="1234567"  
        driverClassName="com.mysql.cj.jdbc.Driver"  
        url="jdbc:mysql://10.0.0.6/servicio_web?serverTimez  
one=UTC"/>  
</Context>  
humberto@T10-2016630495-2:~$ █  
humberto@T10-2016630495-1:~$ cat META-INF/context.xml  
<Context>  
    <Resource name="jdbc/datasource_Servicio" auth="Container" type="jav  
ax.sql.DataSource"  
        maxActive="100" maxIdle="30" maxWait="10000"  
        username="hugo" password="1234567"  
        driverClassName="com.mysql.cj.jdbc.Driver"  
        url="jdbc:mysql://10.0.0.6/servicio_web?serverTimezone=UTC"/>  
</Context>  
humberto@T10-2016630495-1:~$ █
```

## 4.3. Prueba conectividad entre las máquinas virtuales.

Para probar la conectividad, ejecutaremos el comando de conexión de MySQL primero para probar la conectividad más básica:

```
humberto@T10-2016630495-2:~$ mysql -u hugo -p -h 10.0.0.6  
Enter password:  
Welcome to the MySQL monitor. Commands end with ; or \g.  
Your MySQL connection id is 11  
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)  
  
Copyright (c) 2000, 2023, Oracle and/or its affiliates.  
  
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affiliates. Other names may be trademarks of their respective  
owners.  
  
Type 'help;' or '\h' for help. Type '\c' to clear the current input  
statement.  
  
mysql> █  
humberto@T10-2016630495-1:~$ mysql -u hugo -p -h 10.0.0.6  
Enter password:  
Welcome to the MySQL monitor. Commands end with ; or \g.  
Your MySQL connection id is 10  
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)  
  
Copyright (c) 2000, 2023, Oracle and/or its affiliates.  
  
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affiliates. Other names may be trademarks of their respective  
owners.  
  
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.  
  
mysql> █
```

Dado que realizamos modificaciones en `context.xml`, ahora compilaremos de nuevo el archivo WAR y desplegaremos el servicio usando los comandos proporcionados por el profesor en la tarea 6 (estos comandos se ejecutarán en ambas máquinas virtuales):

```
humberto@T10-2016630495-2:~$ cp servicio_json/*.class WEB-INF/classes/servicio_json/
humberto@T10-2016630495-2:~$ 
humberto@T10-2016630495-2:~$ jar cvf Servicio.war WEB-INF META-INF
added manifest
adding: WEB-INF/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/web.xml(in = 656) (out= 294)(deflated 55%)
adding: WEB-INF/classes/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/classes/servicio_url/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/classes/servicio_json/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/classes/servicio_json/Usuario.class(in = 435) (out= 295)(deflated 32%)
adding: WEB-INF/classes/servicio_json/AdaptadorGsonBase64.class(in = 1805) (out= 741)(deflated 58%)
adding: WEB-INF/classes/servicio_json/ParamBorraUsuario.class(in = 259) (out= 205)(deflated 20%)
adding: WEB-INF/classes/servicio_json/ParamConsultaUsuario.class(in = 265) (out= 209)(deflated 21%)
adding: WEB-INF/classes/servicio_json/ParamAltaUsuario.class(in = 264) (out= 198)(deflated 25%)
adding: WEB-INF/classes/servicio_json/Servicio.class(in = 8552) (out= 3930)(deflated 54%)
adding: WEB-INF/classes/servicio_json/ParamModificaUsuario.class(in = 272) (out= 204)(deflated 25%)
adding: WEB-INF/classes/servicio_json/Error.class(in = 284) (out= 220)(deflated 22%)
ignoring entry META-INF/
adding: META-INF/context.xml(in = 302) (out= 216)(deflated 28%)
humberto@T10-2016630495-2:~$ cp Servicio.war $CATALINA_HOME/webapps/.
humberto@T10-2016630495-2:~$ sh $CATALINA_HOME/bin/catalina.sh start
rt
Using CATALINA_BASE: /home/humbertowoodby/apache-tomcat-8.5.88
Using CATALINA_HOME: /home/humbertowoodby/apache-tomcat-8.5.88
Using CATALINA_TMPDIR: /home/humbertowoodby/apache-tomcat-8.5.88/temp
Using JRE_HOME: /usr/lib/jvm/java-8-openjdk-amd64
Using CLASSPATH: /home/humbertowoodby/apache-tomcat-8.5.88/bin/bootstrap.jar:/home/humbertowoodby/apache-tomcat-8.5.88/bin/tomcat-juli.jar
Using CATALINA_OPTS:
Tomcat started.
humberto@T10-2016630495-2:~$ 

mysql> exit
Bye
humberto@T10-2016630495-1:~$ cp servicio_json/*.class WEB-INF/classes/servicio_json/
humberto@T10-2016630495-1:~$ jar cvf Servicio.war WEB-INF META-INF
added manifest
adding: WEB-INF/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/web.xml(in = 656) (out= 294)(deflated 55%)
adding: WEB-INF/classes/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/classes/servicio_url/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/classes/servicio_json/(in = 0) (out= 0)(stored 0%)
adding: WEB-INF/classes/servicio_json/Usuario.class(in = 435) (out= 295)(deflated 32%)
adding: WEB-INF/classes/servicio_json/AdaptadorGsonBase64.class(in = 1805) (out= 741)(deflated 58%)
adding: WEB-INF/classes/servicio_json/ParamBorraUsuario.class(in = 259) (out= 205)(deflated 20%)
adding: WEB-INF/classes/servicio_json/ParamConsultaUsuario.class(in = 265) (out= 209)(deflated 21%)
adding: WEB-INF/classes/servicio_json/ParamAltaUsuario.class(in = 264) (out= 198)(deflated 25%)
adding: WEB-INF/classes/servicio_json/Servicio.class(in = 8552) (out= 3930)(deflated 54%)
adding: WEB-INF/classes/servicio_json/ParamModificaUsuario.class(in = 272) (out= 204)(deflated 25%)
adding: WEB-INF/classes/servicio_json/Error.class(in = 284) (out= 220)(deflated 22%)
ignoring entry META-INF/
adding: META-INF/context.xml(in = 302) (out= 216)(deflated 28%)
humberto@T10-2016630495-1:~$ cp Servicio.war $CATALINA_HOME/webapps/.
humberto@T10-2016630495-1:~$ sh $CATALINA_HOME/bin/catalina.sh start
Using CATALINA_BASE: /home/humbertowoodby/apache-tomcat-8.5.88
Using CATALINA_HOME: /home/humbertowoodby/apache-tomcat-8.5.88
Using CATALINA_TMPDIR: /home/humbertowoodby/apache-tomcat-8.5.88/temp
Using JRE_HOME: /usr/lib/jvm/java-8-openjdk-amd64
Using CLASSPATH: /home/humbertowoodby/apache-tomcat-8.5.88/bin/bootstrap.jar:/home/humbertowoodby/apache-tomcat-8.5.88/bin/tomcat-juli.jar
Using CATALINA_OPTS:
Tomcat started.
humberto@T10-2016630495-1:~$ 
```

Ahora probaremos que la aplicación en cada máquina virtual pueda acceder a la base de datos, para esto usaremos un túnel de SSH para acceder al servicio en cada máquina virtual, esto puesto que me da muchísima flojera abrir el puerto en cada máquina virtual solo para realizar esta prueba.

#### 4.3.1. Prueba de primer máquina virtual.

Abrimos el túnel SSH con la máquina virtual:

```
> ssh -L 8080:localhost:8080 -i humberto@az-ubuntu.pem 172.190.137.148
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1037-azure x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

 System information as of Tue Jun 20 21:34:03 UTC 2023

 System load:  0.01           Processes:          114
 Usage of /:   9.0% of 28.89GB  Users logged in:    0
 Memory usage: 17%
 Swap usage:   0%
                                         IPv4 address for eth0: 10.0.0.4

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s just raised the bar for easy, resilient and secure K8s cluster deployment.

 https://ubuntu.com/engage/secure-kubernetes-at-the-edge

 Expanded Security Maintenance for Applications is not enabled.

 1 update can be applied immediately.
 To see these additional updates run: apt list --upgradable

 Enable ESM Apps to receive additional future security updates.
 See https://ubuntu.com/esm or run: sudo pro status

 New release '22.04.2 LTS' available.
 Run 'do-release-upgrade' to upgrade to it.

Last login: Tue Jun 20 21:31:53 2023 from 148.204.56.241
humberto@T10-2016630495-1:~$ 
```

Para verificar que funcione, nos conectaremos (desde la primer máquina virtual) a nuestra base de datos y consultaremos los usuarios existentes en la aplicación:

```
humbertowoody@T10-2016630495-1:~$ mysql -u hugo -p -h 10.0.0.6
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 12
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)

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owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> use servicio_web;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

Database changed
mysql> show tables;
+----------------+
| Tables_in_servicio_web |
+-----+
| fotos_usuarios      |
| usuarios             |
+-----+
2 rows in set (0.00 sec)

mysql> select * from usuarios;
Empty set (0.00 sec)

mysql>
```

Ahora accederemos a la aplicación usando la ruta <http://localhost:8080> que viajará a través del túnel SSH y crearemos un usuario:

localhost:8080/prueba\_json.html

**Alta de usuario**

Email \*  
prueba@dominio.net

Nombre \*  
Humberto

Apellido paterno \*  
Ortega

Apellido materno  
Alcocer

Fecha de nacimiento \*  
20 / 06 / 2023 15 : 37

Teléfono  
1234123412

Género  
Masculino

  
Choose Files credito2.jpg

**Acciones**

Agregar usuario  
Limpiar pantalla  
Regresar

A lo que nos responde el siguiente mensaje:

localhost:8080 says  
OK

**Alta de usuario**

Nombre \*  
Humberto

Apellido paterno \*  
Ortega

Apellido materno  
Alcocer

Fecha de nacimiento \*  
20 / 06 / 2023 15 : 37

Teléfono  
1234123412

Género  
Masculino

  
Choose Files credito2.jpg

**Acciones**

Agregar usuario  
Limpiar pantalla  
Regresar

Y en la base de datos se observa el insert:

```
Enter password:  
Welcome to the MySQL monitor. Commands end with ; or \g.  
Your MySQL connection id is 12  
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)  
  
Copyright (c) 2000, 2023, Oracle and/or its affiliates.  
  
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affiliates. Other names may be trademarks of their respective  
owners.  
  
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.  
  
mysql> use servicio_web;  
Reading table information for completion of table and column names  
You can turn off this feature to get a quicker startup with -A  
  
Database changed  
mysql> show tables;  
+-----+  
| Tables_in_servicio_web |  
+-----+  
| fotos_usuarios |  
| usuarios |  
+-----+  
2 rows in set (0.00 sec)  
  
mysql> select * from usuarios;  
Empty set (0.00 sec)  
  
mysql> select * from usuarios;  
+-----+-----+-----+-----+  
| id_usuario | email | nombre | apellido_paterno | apellido_materno |  
| fecha_nacimiento | telefono | genero |  
+-----+-----+-----+-----+  
| 5 | prueba@dominio.net | Humberto | Ortega | Alcocer |  
| 2023-06-20 21:37:00 | 1234123412 | M |  
+-----+-----+-----+-----+  
1 row in set (0.00 sec)  
  
mysql> █
```

Con esto ya probamos que nuestra primer máquina virtual está funcionando.

#### 4.3.2. Prueba de segunda máquina virtual.

Para probar la segunda máquina virtual, comenzaremos abriendo el túnel de SSH para realizar las pruebas, a su vez, aprovechamos para conectarnos a la base de datos y confirmar que tenemos acceso y que los datos que creó la aplicación en la primer máquina virtual son leídos adecuadamente desde aquí:

```
> ssh -L 8080:localhost:8080 -i humberto_ubuntu.pem 20.163.149.49
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1037-azure x86_64)

 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage

 System information as of Tue Jun 20 21:42:27 UTC 2023

 System load: 0.02      Processes:           112
 Usage of /: 9.6% of 28.89GB   Users logged in:       0
 Memory usage: 16%          IPv4 address for eth0: 10.0.0.5
 Swap usage:  0%

 * Strictly confined Kubernetes makes edge and IoT secure. Learn how MicroK8s
 just raised the bar for easy, resilient and secure K8s cluster deployment.

 https://ubuntu.com/engage/secure-kubernetes-at-the-edge

Expanded Security Maintenance for Applications is not enabled.

1 update can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

New release '22.04.2 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Last login: Tue Jun 20 21:42:17 2023 from 148.204.56.241
humberto_ubuntu@T10-2016630495-2:~$ mysql -u hugo -p -h 10.0.0.6
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 15
Server version: 8.0.33-0ubuntu0.20.04.1 (Ubuntu)

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owners.

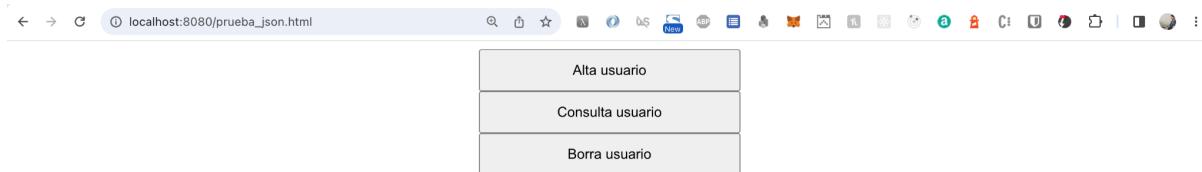
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> use servicio_web;
Reading table information for completion of table and column names
You can turn off this feature to get a quicker startup with -A

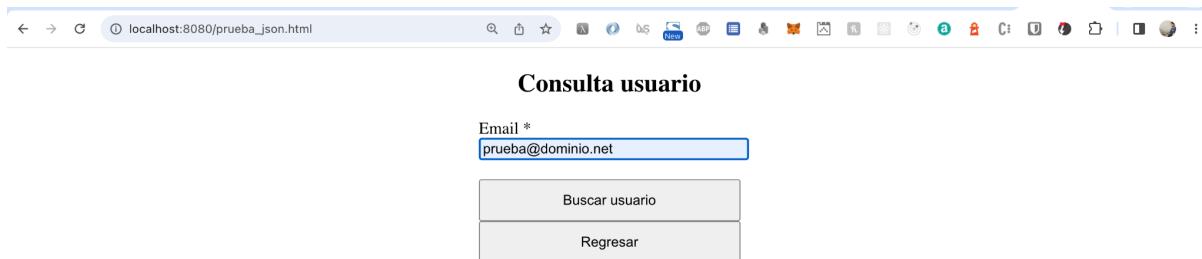
Database changed
mysql> select * from usuarios;
+-----+-----+-----+-----+-----+-----+-----+
| id_usuario | email        | nombre    | apellido_paterno | apellido_materno | fecha_nacimiento | telefono | genero |
+-----+-----+-----+-----+-----+-----+-----+
|      5 | prueba@dominio.net | Humberto | Ortega          | Alcocer         | 2023-06-20 21:37:00 | 1234123412 | M      |
+-----+-----+-----+-----+-----+-----+-----+
1 row in set (0.00 sec)

mysql>
```

Ahora accederemos a la página localmente para confirmar que TomCat se esté ejecutando en la segunda máquina virtual:



Ahora iremos a “Consulta usuario” y trataremos de consultar el usuario que creamos anteriormente:



Al introducir el campo, la aplicación nos redirige a la vista original a modo de modificar los datos:

The screenshot shows a web browser window with the URL `localhost:8080/prueba_json.html`. The page title is "Modifica usuario". The form contains the following fields:

- Email \*: `prueba@dominio.net`
- Nombre \*: `Humberto`
- Apellido paterno \*: `Ortega`
- Apellido materno: `Alcocer`
- Fecha de nacimiento \*: `20 / 06 / 2023 15 : 37`
- Teléfono: `1234123412`
- Género:  
Masculino
- Photo preview: A small thumbnail image of a person holding a white device.
- File input: `Choose Files`, `No file chosen`, `Quitar foto`

At the bottom of the form are two buttons:

- Guardar cambios
- Regresar

Con esto hemos confirmado que ambas máquinas virtuales cuentan con la aplicación ejecutándose y con conectividad a la base de datos.

## 5. Creación de balanceador de cargas.

Para crear el balanceador de cargas debemos primero asegurarnos que nuestras máquinas virtuales cumplan todos los requisitos necesarios y luego crearemos los recursos para que el balanceador de cargas sea funcional.

### 5.1. Eliminación de IPs públicas.

Lo primero que debemos hacer es eliminar las direcciones IP públicas de cada máquina virtual, esto puesto que es requerido para poder crear un balanceador de carga.

La implicación más evidente de realizar esto será que perderemos contacto con nuestras máquinas virtuales, de ahí que se hayan hecho pruebas extensivas previas a este paso puesto que de aquí en adelante será imposible\* conectarse a las máquinas virtuales para diagnosticar y corregir errores.

#### 5.1.1. Eliminar IP pública de primer máquina virtual.

Para eliminar la IP pública de la primera máquina virtual primero iremos al recurso en Azure:

The screenshot shows the Microsoft Azure portal interface for managing a virtual machine. The top navigation bar includes 'Search resources, services, and docs (G+)', 'hortega1500@alumno...', and 'INSTITUTO POLITÉCNICO NACIONAL'. The main page title is 'Home > Virtual machines > T10-2016630495-1'. The left sidebar lists sections like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings, Networking, Connect, Disks, Size, Microsoft Defender for Cloud, Advisor recommendations, Extensions + applications, Availability + scaling, Configuration, Identity, Properties, Locks, and Operations. The 'Overview' tab is selected. The main content area displays the 'Essentials' and 'Properties' sections. In the 'Essentials' section, under 'Networking', it shows a Public IP address of 172.190.137.148. The 'Properties' section includes tabs for Virtual machine, Monitoring, Capabilities (7), Recommendations, and Tutorials. The 'Virtual machine' tab shows details such as Computer name (T10-2016630495-1), Operating system (Linux (ubuntu 20.04)), and VM generation (V2). The 'Networking' tab shows the same networking information. The 'Size' tab indicates a Standard B2s size with 2 vCPUs. A note in the 'Tags' section says 'Click here to add tags'.

## Iremos al apartado de Networking:

**T10-2016630495-1 | Networking**

**t10-2016630495-1751**

**Network Interface:** t10-2016630495-1751    **Effective security rules**    **Troubleshoot VM connection issues**    **Topology**

Virtual network/subnet: T10-2016630495-1-vnet/default    NIC Public IP: 172.190.137.148    NIC Private IP: 10.0.0.4    Accelerated networking: Disabled

Priority	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	Allow
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInBound	Any	Any	Any	Any	Deny

## Haremos click en la dirección IP:

**T10-2016630495-1-ip**

**Public IP address**

**Overview**

Resource group (move) : SistemasDistribuidosResourceGroup    SKU : Standard  
Location (move) : East US    Tier : Regional  
Subscription (move) : Azure for Students    IP address : 172.190.137.148  
Subscription ID : a5d9d675-3ae1-4e2b-95b5-02150d67b8d2    DNS name : -  
Associated to : t10-2016630495-1751    Virtual machine : T10-2016630495-1  
Routing preference : Microsoft network

**Tags (edit)** : Click here to add tags

**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. [Associate IP](#)

**Configure a public IP address**  
Configure a DNS idle time, name, and alias record for your public IP address. [Configure](#)

**Protect IP address**  
Choose the right DDoS protection level for your IP address. [Protect](#)

Haremos click en *Dissociate* para disociarla de la máquina virtual:

The screenshot shows the Azure portal interface for a public IP address named 'T10-2016630495-1-ip'. In the center, a modal dialog titled 'Dissociation confirmation' is displayed, asking if the user wants to permanently dissociate the public IP address from the network interface card. Below the dialog, there are three main sections: 'Associate to a resource', 'Configure a public IP address', and 'Protect IP address'. The 'Associate to' section shows the current association to 't10-2016630495-1751'. The 'Properties' tab is selected in the main view.

Haremos click en Yes y comenzará la operación, al finalizar, observaremos la sección “Associated to” en la página principal que ya no mostrará que está asociada a la interfaz de red de la primer máquina virtual:

The screenshot shows the Azure portal interface for the same public IP address 'T10-2016630495-1-ip'. The 'Associated to' field in the 'Properties' tab is now empty, indicating that the IP address is no longer associated with any network interface cards. The rest of the properties listed include Resource GUID, IP address, IP address version, Provisioning state, Allocation method, and Idle timeout.

Ahora haremos click en *Delete* para eliminar la dirección IP puesto que ya no la vamos a utilizar:

The screenshot shows the Microsoft Azure portal interface for managing a public IP address named 'T10-2016630495-1-ip'. The 'Properties' tab is selected. A modal dialog box titled 'Delete public IP address' asks 'Do you want to delete the public IP address 'T10-2016630495-1-ip?' with 'Yes' and 'No' buttons. The IP address details shown include Resource GUID (3b7182a3-d246-4), IP address (172.190.137.148), IP address version (IPv4), Provisioning state (Succeeded), Allocation method (Static), and Idle timeout (4). The status bar at the bottom right indicates 'Unprotected' and 'Network inherited protection'.

Se nos mostrará la siguiente confirmación al finalizar de eliminar la dirección IP:

The screenshot shows the Microsoft Azure portal for a virtual machine named 'T10-2016630495-1'. The 'Networking' section is selected. It shows a table of inbound port rules for a network security group (T10-2016630495-1-nsg) attached to a network interface (t10-2016630495-1751). The table includes columns for Priority, Name, Port, and Protocol. A note states: 'Impacts 0 subnets, 1 network interfaces'. Below the table, there are sections for 'Need help?', 'Quickstart: Create a public load balancer to load balance Virtual Machines', and 'Quickstart: Direct web traffic with Azure Application Gateway'. On the right, a 'Notifications' sidebar lists several events: 'Deleted public IP address' (successful deletion of the IP address), 'Saved network interface' (successful save of changes to the network interface), 'Failed to delete public IP address' (failure due to allocation to resource), and 'Deployment succeeded' (deployment of a VM image was successful). Buttons for 'Go to resource' and 'Pin to dashboard' are also present.

### 5.1.1. Eliminar IP pública de segunda máquina virtual.

Para eliminar la IP pública de la segunda máquina virtual primero iremos a la página principal de dicha máquina virtual:

The screenshot shows the Azure portal interface for a virtual machine named "T10-2016630495-2". In the "Networking" section, the "Public IP address" field is highlighted in blue. The value shown is "20.163.149.49". Other details visible include the operating system as Linux (ubuntu 20.04), size as Standard B2s (2 vcpus, 4 GiB memory), and a DNS name of "Not configured".

Ahora haremos click en el apartado *Networking*:

The screenshot shows the Azure portal interface for the same virtual machine, now with the "Networking" tab selected. Under the "Inbound port rules" section, there is a table listing five rules. The last rule, "DenyAllInBound", has a red "Deny" icon. A blue callout box points to the "Add inbound port rule" button at the top right of the table area.

Priority	Name	Port	Protocol	Source	Destination	Action
300	SSH	22	TCP	Any	Any	<span style="color: green;">Allow</span>
65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	<span style="color: green;">Allow</span>
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer	Any	<span style="color: green;">Allow</span>
65500	DenyAllInBound	Any	Any	Any	Any	<span style="color: red;">Deny</span>

Ahora haremos click en la dirección IP asociada a nuestra tarjeta de red:

The screenshot shows the Microsoft Azure portal interface. At the top, there's a search bar and a navigation bar with links for Home, Virtual machines, T10-2016630495-2 Networking, and a user profile. Below the navigation is a title bar for 'T10-2016630495-2-ip' with a Public IP address. The main content area has a left sidebar with sections like Overview, Activity log, Access control (IAM), Tags, Settings, Configuration, Properties, Locks, Monitoring, Insights, Alerts, Metrics, Diagnostic settings, Automation, Tasks (preview), Export template, Support + troubleshooting, and New Support Request. The right side shows the 'Essentials' section with details such as Resource group (SistemasDistribuidosResourceGroup), Location (East US), Subscription (Azure for Students), and SKU (Standard). It also lists IP address (20.163.149.49), DNS name, Associated to (t10-2016630495-2733), Virtual machine (T10-2016630495-2), and Routing preference (Microsoft network). Below this, there's a 'Tags (edit)' section with a link to 'Click here to add tags'. At the bottom, there are three buttons: 'Associate IP', 'Configure', and 'Protect'. A 'Get Started' tab is selected.

Haremos click en *Dissociate* para que comience a desasociarse la dirección IP de la máquina virtual:

The screenshot shows the Microsoft Azure portal interface again, but this time a 'Dissociation confirmation' dialog box is overlaid on the page. The dialog contains the text: 'This action will permanently dissociate the public IP address 'T10-2016630495-2-ip' from network interface card 't10-2016630495-2733''. It has two buttons: 'Yes' (highlighted) and 'No'. The background of the portal shows the same 'Overview' page for the virtual machine, with the 'Dissociate' button now highlighted in the top navigation bar.

Haremos click en Yes y comenzará la operación, al finalizar, observaremos la sección “Associated to” en la página principal que ya no mostrará que está asociada a la interfaz de red de la primer máquina virtual:

The screenshot shows the Azure portal interface for managing a public IP address. The main title is "T10-2016630495-2-ip". The "Properties" tab is selected. In the "Essentials" section, there is a table with various details. One row in this table, specifically the "Associated to" row, is highlighted with a red box. The "Associated to" column shows the value "T10-2016630495-2". Other columns in this row include "SKU: Standard", "Tier: Regional", "IP address: 20.163.149.49", "DNS name: -", and "Virtual machine: T10-2016630495-2". The "DDoS Protection" section indicates "Unprotected" status.

Ahora haremos click en *Delete*:

The screenshot shows the Azure portal interface again, this time with a modal dialog box titled "Delete public IP address". The dialog contains the message "Do you want to delete the public IP address 'T10-2016630495-2-ip?'". There are two buttons at the bottom: "Yes" and "No". The "Yes" button is highlighted with a red box. The background of the portal shows the same IP address configuration page as the previous screenshot, with the "Associated to" field now empty.

Haremos click en Yes y se nos confirmará en la siguiente pantalla que se ha realizado la eliminación correctamente:

The screenshot shows the Azure portal interface for a virtual machine named 'T10-2016630495-2'. In the 'Networking' section, under 'Network Interface: t10-2016630495-2733', the 'NIC Public IP' dropdown is set to '10.0.0.5'. This value is highlighted with a red box. The 'Virtual network/subnet' is listed as 'T10-2016630495-1-vnet/default'. Other tabs like 'Effective security rules', 'Troubleshoot VM connection issues', and 'Topology' are visible.

Lo muestro así porque sin querer piqué refrescar en el navegador y ya no se pudo observar la notificación de confirmación de la operación pero si se eliminó la dirección IP pública.

## 5.2. Crear balanceador de cargas.

Para crear el balanceador de cargas, lo primero será ir a la página inicial de Azure:

The screenshot shows the main Azure portal page. Under 'Azure services', there are links for 'Create a resource', 'Virtual machines', 'Resource groups', 'All resources', 'Function App', 'Load balancers', 'SQL databases', 'App Services', 'Public IP addresses', and 'More services'. The 'Resources' section has tabs for 'Recent' (which is selected) and 'Favorite'. It lists recent resources: 'T10-2016630495-2', 'T10-2016630495-2-ip', 'T10-2016630495-1', 't10-2016630495-1751', 'T10-2016630495-BD', 'SistemasDistribuidosResourceGroup', 'NetworkWatcherRG', 'SistemasDistribuidosVault', and 'T6-2016630495-image-20230508195913'. At the bottom, there are navigation links for 'Gobernance', 'Resource groups', 'All resources', and 'Dashboards'.

Ahora seleccionaremos la opción de *Load Balancers*:

The screenshot shows the Microsoft Azure portal interface for the Load Balancer service. The top navigation bar includes 'Microsoft Azure', a search bar, and user information. Below it, the breadcrumb navigation shows 'Home > Load balancing'. The main title 'Load balancing | Load Balancer' is centered above a search bar and filter options. On the left, a sidebar lists 'Load Balancing Services' with 'Load Balancer' selected. The main content area displays a large diamond icon with arrows pointing inwards, indicating 'No load balancers to display'. A descriptive text explains the benefits of built-in load balancing for creating highly-available and scalable applications. A prominent blue button labeled 'Create load balancer' is at the bottom.

Haremos click en *Create load balancer* y comenzaremos a llenar los datos:

The screenshot shows the 'Create load balancer' wizard in the Microsoft Azure portal. The first step, 'Project details', is displayed. It requires filling in 'Subscription' (set to 'Azure for Students') and 'Resource group' (set to 'SistemasDistribuidosResourceGroup'). Below these, 'Instance details' are configured: 'Name' is 'T10-2016630495-BC', 'Region' is 'East US', and 'SKU' is set to 'Basic' (with a note about its retirement). The 'Type' is 'Public', and the 'Tier' is 'Regional'. Navigation buttons at the bottom include 'Review + create', '< Previous', 'Next : Frontend IP configuration >', 'Download a template for automation', and 'Give feedback'.

Ahora haremos click en *Frontend IP Configuration* en la que observaremos la siguiente pantalla:

The screenshot shows the Microsoft Azure 'Create load balancer' wizard. The current step is 'Frontend IP configuration'. The interface includes tabs for Basics, Frontend IP configuration (which is selected), Backend pools, Inbound rules, Outbound rules, Tags, and Review + create. A note states: 'A frontend IP configuration is an IP address used for inbound and/or outbound communication as defined within load balancing, inbound NAT, and outbound rules.' Below this is a section titled '+ Add a frontend IP configuration' with fields for 'Name' and 'IP address'. A note says 'Add a frontend IP to get started'. At the bottom are buttons for 'Review + create', '< Previous', 'Next : Backend pools >', 'Download a template for automation', and 'Give feedback'.

Como no contamos con ninguna configuración de IP de front-end, haremos click en el botón *Add a frontend IP configuration* y comenzaremos a llenar los datos. Como no contamos con una IP pública, la crearemos en el mismo formulario.

The screenshot shows the Microsoft Azure 'Create load balancer' wizard at the 'Frontend IP configuration' step. A modal dialog is open titled 'Add frontend IP configuration' with the following fields:

- Name: T10-2016630495-CIPFE
- IP version: IPv4 (radio button selected)
- Public IP address: Choose public IP address (dropdown menu)
- Add a public IP address sub-dialog:
  - Name: T10-2016630495-IP
  - SKU: Standard (radio button)
  - Tier: Regional (radio button selected)
  - Assignment: Dynamic (radio button selected)

At the bottom of the dialog are 'OK' and 'Cancel' buttons. The main wizard page has buttons for 'Review + create', '< Previous', 'Next : Backend pools >', 'Download a template for automation', and 'Give feedback'. A large blue 'Add' button is visible on the right side of the main page.

Al finalizar de llenar el formulario, se observará la siguiente pantalla:

The screenshot shows the Microsoft Azure portal interface for creating a load balancer. The top navigation bar includes 'Microsoft Azure', a search bar, and user account information. The main title is 'Create load balancer'. The current step is 'Frontend IP configuration'. Below the title, there is a note: 'A frontend IP configuration is an IP address used for inbound and/or outbound communication as defined within load balancing, inbound NAT, and outbound rules.' A button '+ Add a frontend IP configuration' is present. A table lists one entry: 'T10-2016630495-CPFFE' under 'Name' and 'T10-2016630495-IP (To be created)' under 'IP address'. At the bottom, there are buttons for 'Review + create', '< Previous', 'Next : Backend pools >', 'Download a template for automation', and 'Give feedback'.

Ahora haremos click en *Backend pools* y observaremos la siguiente pantalla:

The screenshot shows the continuation of the Microsoft Azure 'Create load balancer' wizard. The title 'Create load balancer' remains at the top. The current step is 'Backend pools'. A note states: 'A backend pool is a collection of resources to which your load balancer can send traffic. A backend pool can contain virtual machines, virtual machine scale sets, and containers.' A button '+ Add a backend pool' is available. A table header for 'Backend pools' includes columns: Name, Virtual network, Resource Name, Network interface, IP address, and Availability zone. Below the table, it says 'Add a backend pool to get started'. At the bottom, there are buttons for 'Review + create', '< Previous', 'Next : Inbound rules >', 'Download a template for automation', and 'Give feedback'.

Como no contamos con un grupo de backend, lo crearemos, haciendo click en *Add backend pool*, colocaremos el nombre designado por el profesor, seleccionaremos la red virtual que utilizamos para todos los recursos que creamos:

The screenshot shows the 'Add backend pool' configuration page in the Microsoft Azure portal. At the top, there's a navigation bar with 'Microsoft Azure' and a search bar. Below it, the URL is 'Home > Load balancing | Load Balancer > Create load balancer > Add backend pool'. The main form has a 'Name' field set to 'T10-2016630495-GBE' and a 'Virtual network' dropdown showing 'T10-2016630495-1-vnet (SistemasDistribuidosResourceGroup)'. A 'IP configurations' section contains a note about location requirements and a table with columns: Resource Name, Resource group, Type, IP configuration, IP Address, and Availability set. There are 'Add' and 'Remove' buttons. At the bottom are 'Save', 'Cancel', and 'Give feedback' buttons.

Para añadir máquinas virtuales, haremos click en *+Add* y visualizaremos el siguiente formulario:

The screenshot shows the 'Add IP configurations to backend pool' configuration page. It includes a 'Name' field with 'T10-2016630495-GBE' and a 'Virtual network' dropdown with 'T10-2016630495-1-vnet'. A 'IP configurations' section with a note about location requirements is present. Below is a table listing two 'Virtual machine' resources: 'T10-2016630495-1' and 'T10-2016630495-2', each associated with 'SISTEMASDISTRIBUIDOSRESOURCERGROUP', 'Virtual machine' type, 'ipconfig1' IP config, and IP addresses '10.0.0.4' and '10.0.0.5' respectively. The table has columns: Resource Name, Resource group, Type, IP configuration, IP Address, Availability set, and Tags. Buttons for 'Add' and 'Remove' are available. At the bottom are 'Save', 'Cancel', 'Add', 'Give feedback' buttons, and a note about location requirements.

Seleccionaremos ambas y haremos click en *Add* con lo que se mostrará la siguiente pantalla:

The screenshot shows the 'Add backend pool' configuration screen in Microsoft Azure. At the top, there are fields for 'Name' (T10-2016630495-GBE) and 'Virtual network' (T10-2016630495-1-vnet). Below these, the 'IP configurations' section indicates that IP configurations must be in the same location as the load balancer. A table lists two virtual machines: T10-2016630495-1 and T10-2016630495-2, both associated with the 'SISTEMASDISTRIBUIDOSRESOURCEGR0' resource group. The table includes columns for Resource Name, Resource group, Type, IP configuration, IP Address, and Availability set. At the bottom, there are 'Save', 'Cancel', and 'Give feedback' buttons.

Haremos click en *Save* y observaremos el resumen de nuestro grupo de backend:

The screenshot shows the 'Create load balancer' summary page. The 'Backend pools' tab is selected. It displays a table of resources under the 'T10-2016630495-GBE' pool. The table columns are Name, Virtual network, Resource Name, Network interface, IP address, and Availability zone. Two entries are listed: T10-2016630495-1-vnet (IP 10.0.0.4) and T10-2016630495-2-vnet (IP 10.0.0.5). At the bottom, there are navigation links for 'Review + create', '< Previous', 'Next : Inbound rules >', 'Download a template for automation', and 'Give feedback'.

Ahora haremos click en *Next: Inbound rules* para configurar de una vez las reglas de balanceado de cargas, sondeo de estado y demás. Esta es la vista inicial:

The screenshot shows the Microsoft Azure 'Create load balancer' interface. At the top, there's a navigation bar with 'Microsoft Azure' and a search bar. Below it, the breadcrumb navigation shows 'Home > Load balancing | Load Balancer > Create load balancer'. The main content area has tabs for 'Basics', 'Frontend IP configuration', 'Backend pools', 'Inbound rules' (which is selected and highlighted in blue), 'Outbound rules', 'Tags', and 'Review + create'. Under the 'Inbound rules' section, there's a sub-section titled 'Load balancing rule' with a note: '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. The load balancing rule uses a health probe to determine which backend instances are eligible to receive traffic.' A button '+ Add a load balancing rule' is present. Below this, there are two tables for 'Name ↑' and 'Frontend IP configuration ↑↓', 'Backend pool ↑↓', 'Health probe ↑↓', 'Frontend Port ↑↓', and 'Backend port ↑↓'. A note 'Add a rule to get started' is shown. Another section for 'Inbound NAT rule' follows, with a note: 'An inbound NAT rule forwards incoming traffic sent to a selected IP address and port combination to a specific virtual machine.' A button '+ Add an inbound nat rule' is present. Below this is another table for 'Name ↑↓', 'Frontend IP configuration ↑↓', 'Service ↑↓', 'Target ↑↓', and 'Frontend Port ↑↓'. A note 'Add a rule to get started' is shown. At the bottom, there are buttons for 'Review + create', '< Previous', 'Next : Outbound rule >', 'Download a template for automation', and 'Give feedback'.

Ahora haremos click en *+Add a load balancing rule* y comenzaremos a llenar el formulario:

The screenshot shows the 'Add load balancing rule' configuration form. At the top, there's a navigation bar with 'Microsoft Azure' and a search bar. Below it, the breadcrumb navigation shows 'Home > Load balancing | Load Balancer > Create load balancer'. The main content area has tabs for 'Basics', 'Frontend IP configuration', 'Backend pools', 'Inbound rules' (selected and highlighted in blue), 'Outbound rules', 'Tags', and 'Review + create'. Under the 'Inbound rules' section, there's a sub-section titled 'Load balancing rule' with a note: '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.' A button '+ Add a load balancing rule' is present. Below this, there are two tables for 'Name ↑↓', 'Frontend IP configuration ↑↓', 'Backend pool ↑↓', and 'Health probe ↑↓'. A note 'Add a rule to get started' is shown. Another section for 'Inbound NAT rule' follows, with a note: 'An inbound NAT rule forwards incoming traffic sent to a selected IP address and port combination to a specific virtual machine.' A button '+ Add an inbound nat rule' is present. Below this is another table for 'Name ↑↓', 'Frontend IP configuration ↑↓', 'Service ↑↓', and 'Target ↑↓'. A note 'Add a rule to get started' is shown. On the right side of the form, there are input fields for 'Name \*' (T10-2016630495-REC), 'IP Version \*' (IPv4 selected), 'Frontend IP address \*' (T10-2016630495-CIPFE (To be created)), 'Backend pool \*' (T10-2016630495-GBE), 'Protocol' (TCP selected), 'Port \*' (8080), 'Backend port \*' (8080), 'Health probe \*' (No existing probes), 'Session persistence' (None), 'Idle timeout (minutes) \*' (4), and 'Enable Floating IP' (unchecked). At the bottom, there are buttons for 'Save', 'Cancel', and 'Give feedback'.

Al llegar a la sección de *Health probe* haremos click en *Create new* y comenzaremos a llenar los datos para nuestro nuevo sondeo de estado:

The screenshot shows the Microsoft Azure portal interface for creating a load balancer. The main navigation bar includes 'Microsoft Azure' and a search bar. Below it, the breadcrumb navigation shows 'Home > Load balancing | Load Balancer > Create load balancer'. The main content area has tabs for 'Basics', 'Frontend IP configuration', 'Backend pools', 'Inbound rules' (which is selected), 'Outbound rules', 'Tags', and 'Review + create'. The 'Inbound rules' section contains two sections: 'Load balancing rule' and 'Inbound NAT rule'. The 'Load balancing rule' section is expanded, showing fields for 'Name' (T10-2016630495-SE), 'Protocol' (TCP), 'Port' (8080), 'Interval (seconds)' (5), 'Used by' (Not used), and a 'Save' button. To the right, a detailed configuration dialog is open for 'Add load balancing rule', showing fields for 'Name' (T10-2016630495-SE), 'Protocol' (TCP), 'Port' (8080), 'Interval (seconds)' (5), 'Used by' (Not used), and a 'Save' button. The 'Inbound NAT rule' section is collapsed.

Con lo que ahora podremos seleccionar el nuevo sondeo de estado de las opciones disponibles y observamos el siguiente formulario final:

This screenshot shows the final configuration of the 'Inbound rules' tab. The 'Load balancing rule' section is fully populated with the values from the previous screenshot. The 'Inbound NAT rule' section is collapsed. The bottom of the page includes navigation buttons ('Review + create', '< Previous', 'Next : Outbound rule >', 'Download a template for automation', 'Give feedback') and a 'Save' button.

Hacemos click en Save (en el formulario) y observaremos la pantalla con la información recién introducida:

The screenshot shows the Microsoft Azure 'Create load balancer' wizard at the 'Inbound rules' step. At the top, there are tabs for Basics, Frontend IP configuration, Backend pools, Inbound rules (which is selected), Outbound rules, Tags, and Review + create. Below the tabs, there's a section titled 'Load balancing rule' with a note: '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. The load balancing rule uses a health probe to determine which backend instances are eligible to receive traffic.' A button '+ Add a load balancing rule' is present. A single rule is listed: Name: T10-2016630495-REC, Frontend IP configuration: T10-2016630495-CIPFE, Backend pool: T10-2016630495-GBE, Health probe: T10-2016630495-SE, Frontend Port: 8080, Backend port: 8080. Below this, there's a section for 'Inbound NAT rule' with a note: 'An inbound NAT rule forwards incoming traffic sent to a selected IP address and port combination to a specific virtual machine.' A button '+ Add an inbound nat rule' is shown. A link 'Add a rule to get started' is available. At the bottom, there are buttons for 'Review + create', '< Previous', 'Next : Outbound rule >', 'Download a template for automation', and 'Give feedback'.

Haremos click en *Review + create* y observaremos el siguiente resumen de nuestro nuevo balanceador de cargas a crear:

The screenshot shows the Microsoft Azure 'Create load balancer' wizard at the 'Review + create' step. At the top, there are tabs for Basics, Frontend IP configuration, Backend pools, Inbound rules, Outbound rules, Tags, and Review + create (which is selected). A green bar at the top indicates 'Validation passed'. The 'Basics' section shows the following details: Subscription: Azure for Students, Resource group: SistemasDistribuidosResourceGroup, Name: T10-2016630495-BC, Region: East US, SKU: Basic, Tier: Regional, Type: Public. The 'Frontend IP configuration' section shows: Frontend IP configuration name: T10-2016630495-CIPFE, Frontend IP configuration IP address: To be created. The 'Backend pools' section shows: Backend pool name: T10-2016630495-GBE. The 'Inbound rules' section shows: Load balancing rule name: T10-2016630495-REC, Health probe name: T10-2016630495-SE. The 'Outbound rules' section has a note: 'None'. At the bottom, there are buttons for 'Create', '< Previous', 'Next >', 'Download a template for automation', and 'Give feedback'.

Ahora iniciará el despliegue de nuestro balanceador de cargas:

The screenshot shows the Microsoft Azure Deployment Overview page for a deployment named "Microsoft.LoadBalancer-20230620163829". The deployment status is "Deployment is in progress". The deployment details table lists four resources: NicUpdate-cb3017d2-20fc-41 (Deployment, Created), NicUpdate-95d7cd96-1eda-4 (Deployment, Created), T10-2016630495-BC (Load balancer, Created), and T10-2016630495-IP (Public IP address, OK). The deployment started at 6/20/2023, 4:56:26 PM.

Así se observa el despliegue finalizado:

The screenshot shows the Microsoft Azure Deployment Overview page for the same deployment. The deployment status is now "Your deployment is complete". The deployment details table shows the same four resources: NicUpdate-cb3017d2-20fc-41 (Deployment, OK), NicUpdate-95d7cd96-1eda-4 (Deployment, OK), T10-2016630495-BC (Load balancer, Created), and T10-2016630495-IP (Public IP address, OK). The deployment started at 6/20/2023, 4:56:26 PM.

Ahora haremos click al balanceador de cargas recién creado y observaremos su información general:

**T10-2016630495-BC** Load balancer

Learn about the benefits of upgrading to Standard SKU →

**Essentials**

Resource group ( <a href="#">move</a> ) : <a href="#">SistemasDistribuidosResourceGroup</a>	Backend pool : T10-2016630495-GBE (2 virtual machines)
Location : East US	Load balancing rule : T10-2016630495-REC (Tcp/8080)
Subscription ( <a href="#">move</a> ) : <a href="#">Azure for Students</a>	Health probe : T10-2016630495-SE (Tcp:8080)
Subscription ID : a5d9d675-3ae1-4e2b-95b5-02150d67b8d2	NAT rules : 0 inbound
SKU : Basic	Tier : Regional
Tags ( <a href="#">edit</a> ) : Click here to add tags	

**Configure high availability and scalability for your applications**

Create highly-available and scalable applications in minutes by using built-in load balancing for cloud services and virtual machines. Azure Load Balancer supports TCP/UDP-based protocols and protocols used for real-time voice and video messaging applications. [Learn more](#)

**Balance IPv4 and IPv6 addresses**

Native dual-stack endpoints help meet regulatory requirements and address the fast-growing number of devices in mobile and IoT. [Learn more](#)

**Build highly reliable applications**

Load Balancer improves application uptime by routing traffic to healthy nodes. [Learn more](#)

**Secure your networks**

Control network traffic and protect private networks using built-in network address translation (NAT). [Learn more](#)

**See more**

[View frontend IP configuration](#) [View health probes](#) [View inbound NAT rules](#)

Haremos click en See more a fin de que nos muestre la configuración de dirección IP asignada:

**T10-2016630495-BC** Load balancer

Learn about the benefits of upgrading to Standard SKU →

**Essentials**

Resource group ( <a href="#">move</a> ) : <a href="#">SistemasDistribuidosResourceGroup</a>	Backend pool : T10-2016630495-GBE (2 virtual machines)
Location : East US	Load balancing rule : T10-2016630495-REC (Tcp/8080)
Subscription ( <a href="#">move</a> ) : <a href="#">Azure for Students</a>	Health probe : T10-2016630495-SE (Tcp:8080)
Subscription ID : a5d9d675-3ae1-4e2b-95b5-02150d67b8d2	NAT rules : 0 inbound
SKU : Basic	Tier : Regional
Tags ( <a href="#">edit</a> ) : Click here to add tags	Public IP address : <a href="#">172.174.79.98 (T10-2016630495-IP)</a>

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**See less**

[View frontend IP configuration](#) [View health probes](#) [View inbound NAT rules](#)

Ahora introduciremos dicha IP en nuestro navegador y verificaremos que nos muestre el contenido:



Con esto hemos verificado que nuestro balanceador de cargas está dirigiendo el tráfico exitosamente entre nuestra dirección IP pública a nuestro grupo de recursos de backend interno.

## 6. Pruebas de funcionamiento.

A continuación se realizarán las pruebas planteadas por el profesor para validar que nuestro servicio opera como es esperado.

### 6.1. Conectividad general.

Utilizando un teléfono inteligente o una tableta, ingresar la siguiente URL en un navegador: [http://ip-del-balanceador-de-carga/prueba\\_json.html](http://ip-del-balanceador-de-carga/prueba_json.html).

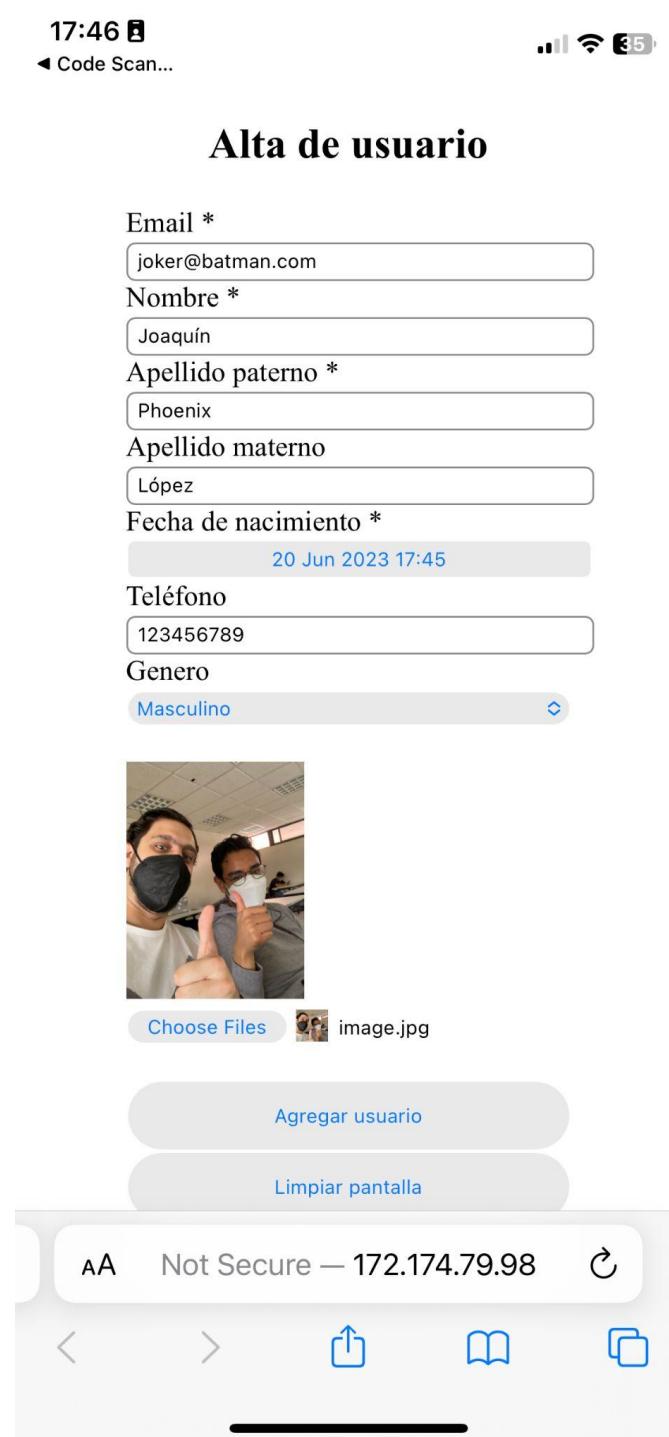
En mi caso, la dirección será: [http://172.174.79.98:8080/prueba\\_json.html](http://172.174.79.98:8080/prueba_json.html)



## 6.2. Crear un usuario.

Dar clic en el botón “Alta usuario” para dar de alta un nuevo usuario. Capturar los campos y dar clic en el botón “Alta”. No ingresar datos personales.

Pantalla con datos:



Choose Files image.jpg

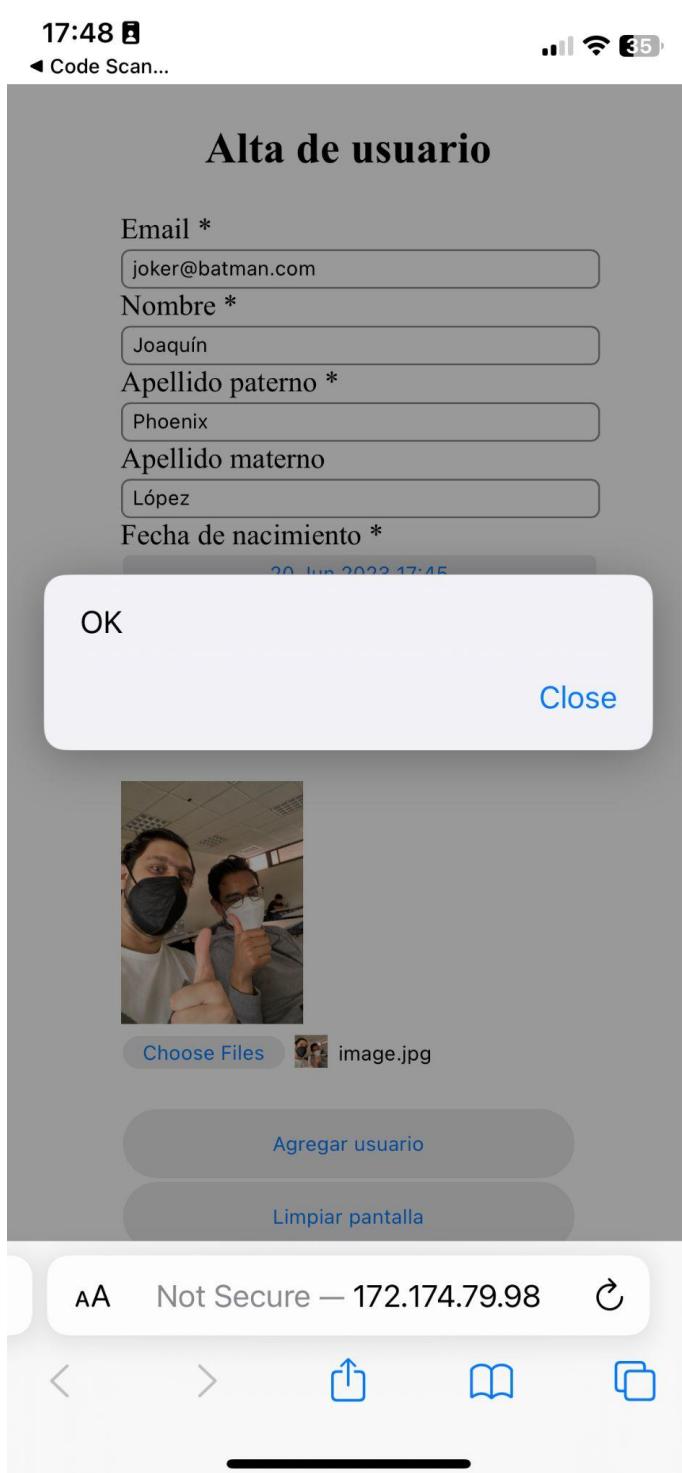
Agregar usuario

Limpiar pantalla

AA Not Secure — 172.174.79.98

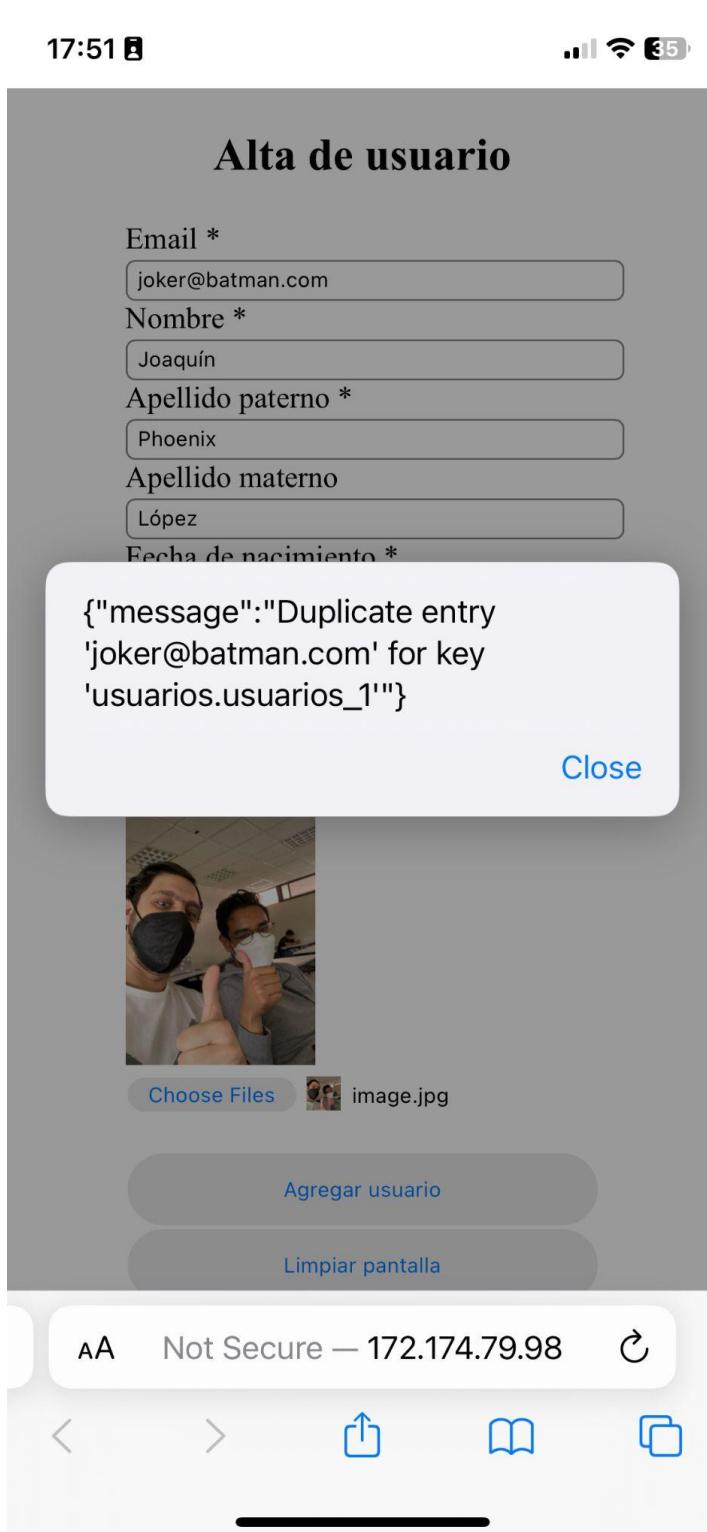


Confirmación de captura de datos:



### 6.3. Validación de email único para usuarios.

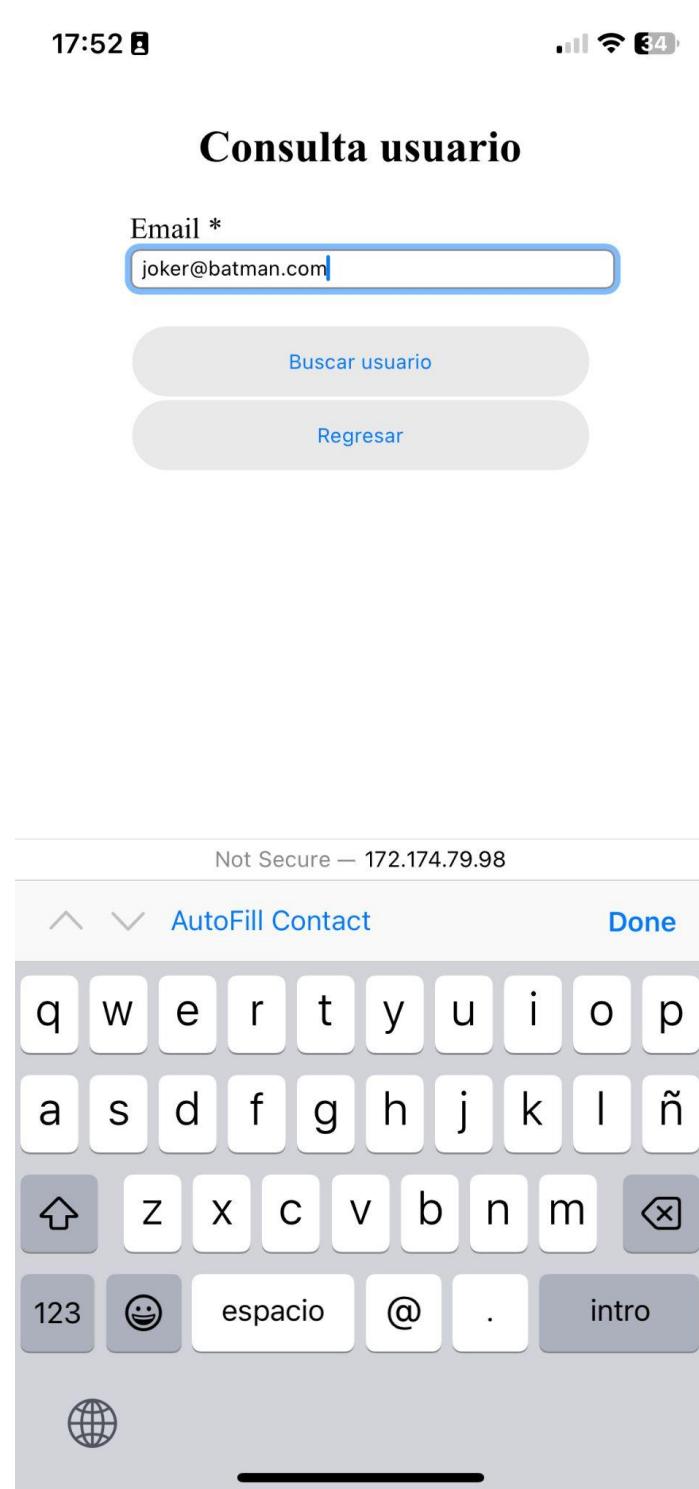
Intentar dar de alta otro usuario con el mismo email (se deberá mostrar una ventana de error indicando que el email ya existe).



## 6.4. Consultar un usuario.

Dar clic en el botón “Consulta usuario” para consultar el usuario dado de alta en el paso 2. Capturar el email y dar clic en el botón “Consulta”.

Antes de presionar *Buscar usuario*:



Después de hacer click en *Consultar usuario*:

17:53 4G 34%

## Modifica usuario

Email \*

Nombre \*

Apellido paterno \*

Apellido materno

Fecha de nacimiento \*

20 Jun 2023 17:45

Teléfono

Genero

Masculino



Choose Files no files selected

Quitar foto

Guardar cambios

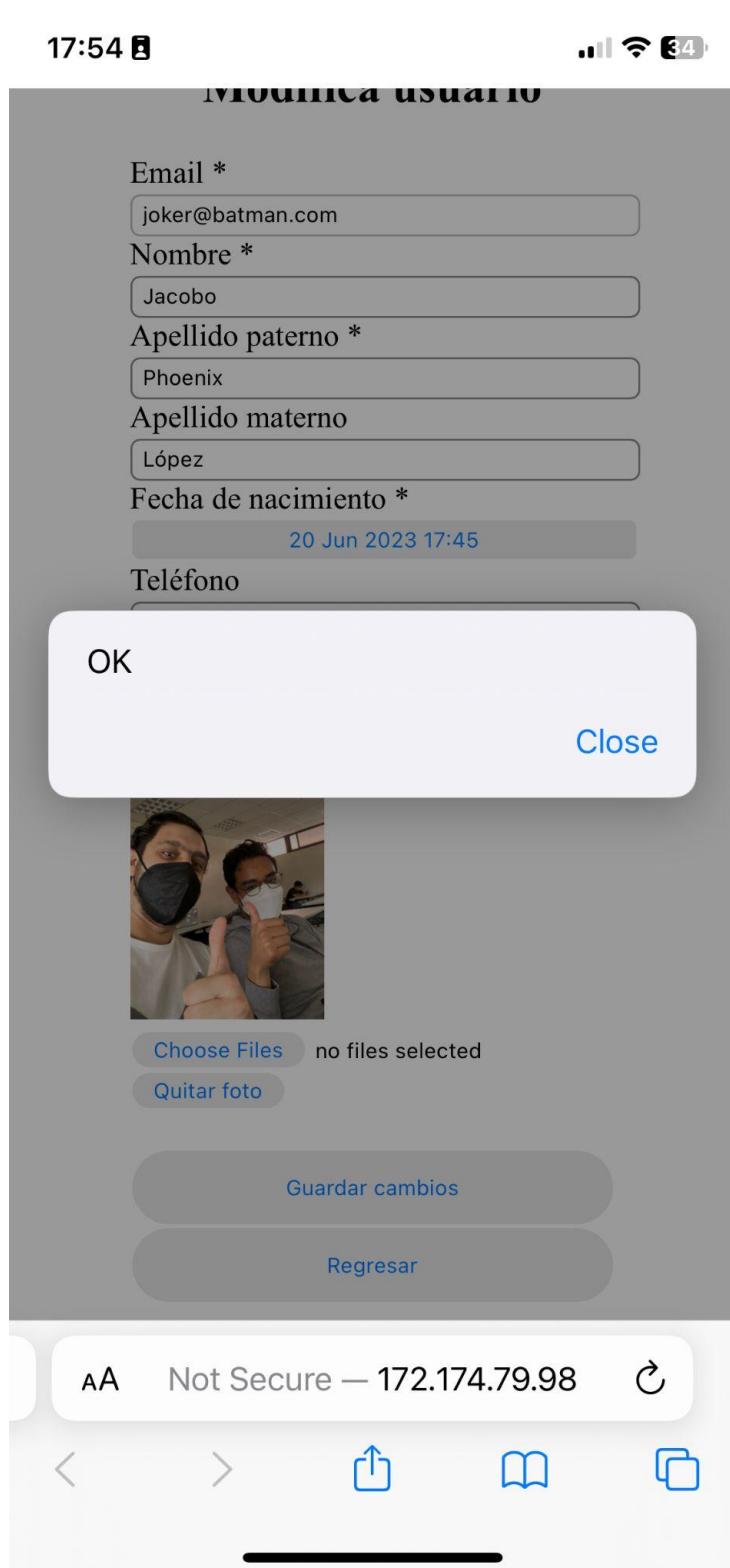
AA Not Secure — 172.174.79.98

< >   

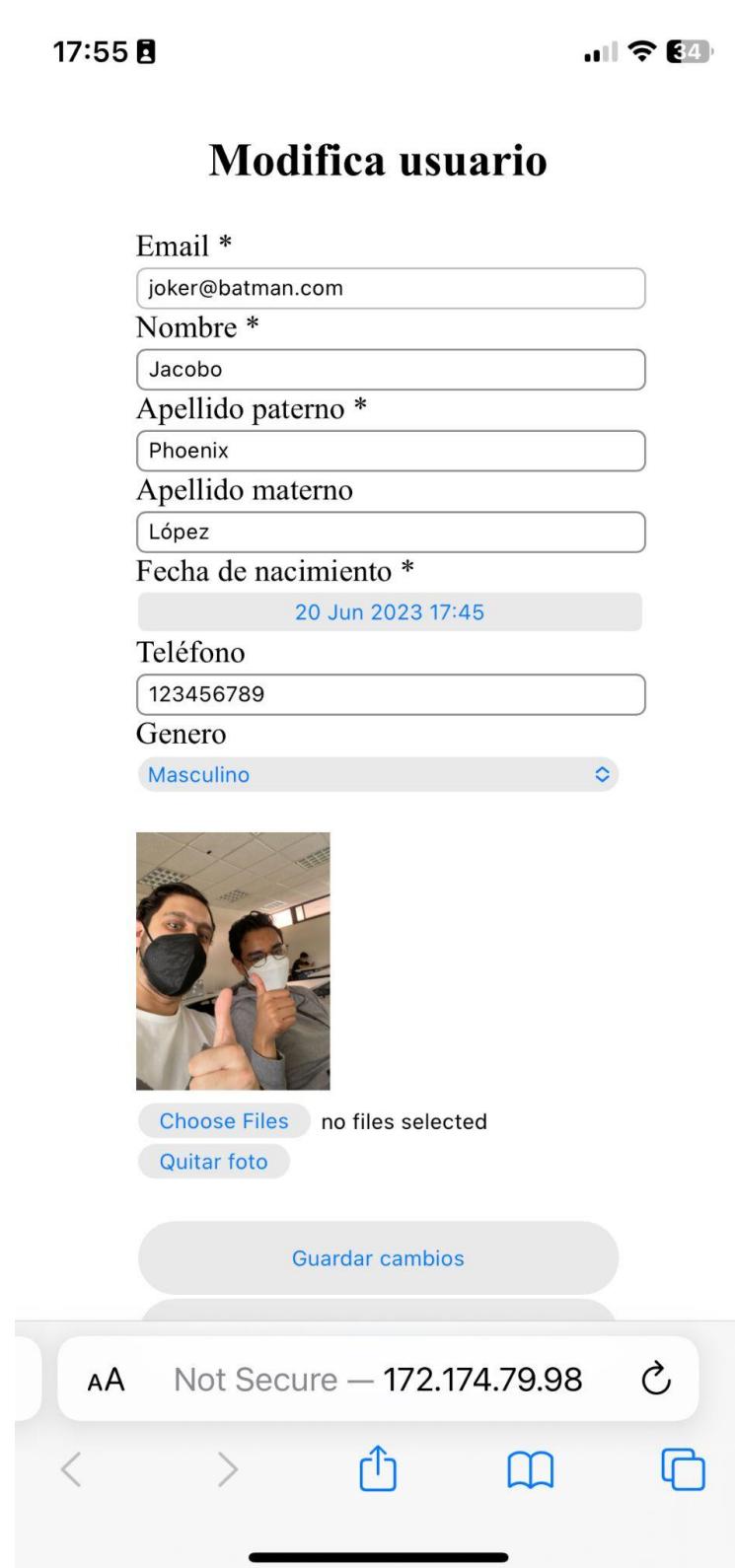
## 6.5. Modificar datos del usuario.

Modificar algún dato del usuario y dar clic en el botón “Modifica”.

Se modificará el nombre de Joaquín a Jacobo:



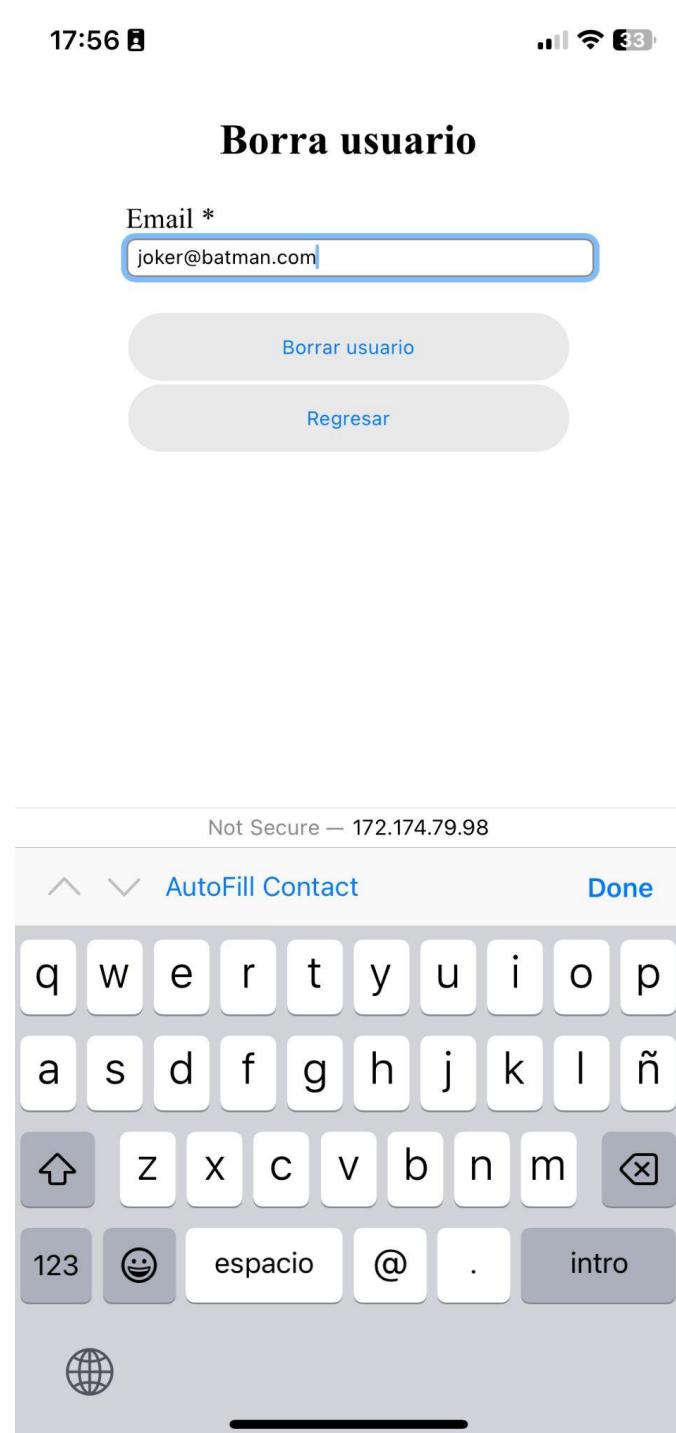
6.6. Recargar la página para verificar los datos modificados.  
Recargar la página actual y consultar el usuario modificado, para verificar que la modificación se realizó.



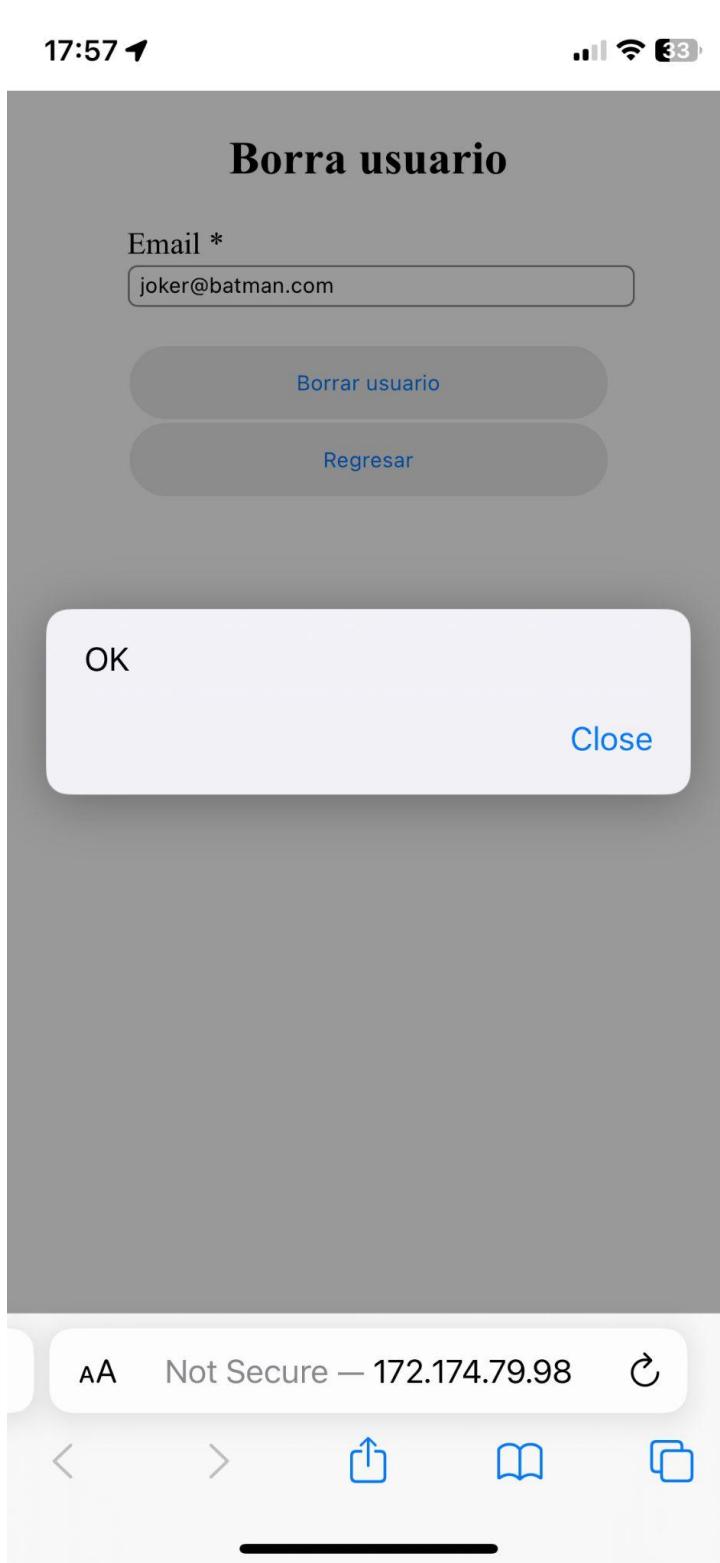
## 6.7. Borrar el usuario.

Dar clic en el botón “Borra usuario” para borrar el usuario. Capturar el email del usuario borrado y dar clic en el botón “Consulta”.

Al introducir los datos en el campo:



Al hacer click en *Borrar* se observa la siguiente notificación:



## Conclusión

El balanceo de cargas es uno de los conceptos más importantes del uso de la nube. En esta tarea pude probar todos los elementos de la nube, desde máquinas virtuales hasta la configuración IP del balanceador de carga. Me dió mucho gusto poder comprender cómo se interconectan todos los elementos entre sí, así como poder visualizar los resultados.

Disfruté mucho esta materia, muchas gracias por todo profesor.

– Humberto Alejandro Ortega Alcocer.