



**IT4090**  
**Cloud Computing**  
**4<sup>th</sup> Year, 2<sup>nd</sup> Semester**

Azure Lab 3

**Create a virtual network**

Submitted to  
Sri Lanka Institute of Information Technology

**IT21510380**

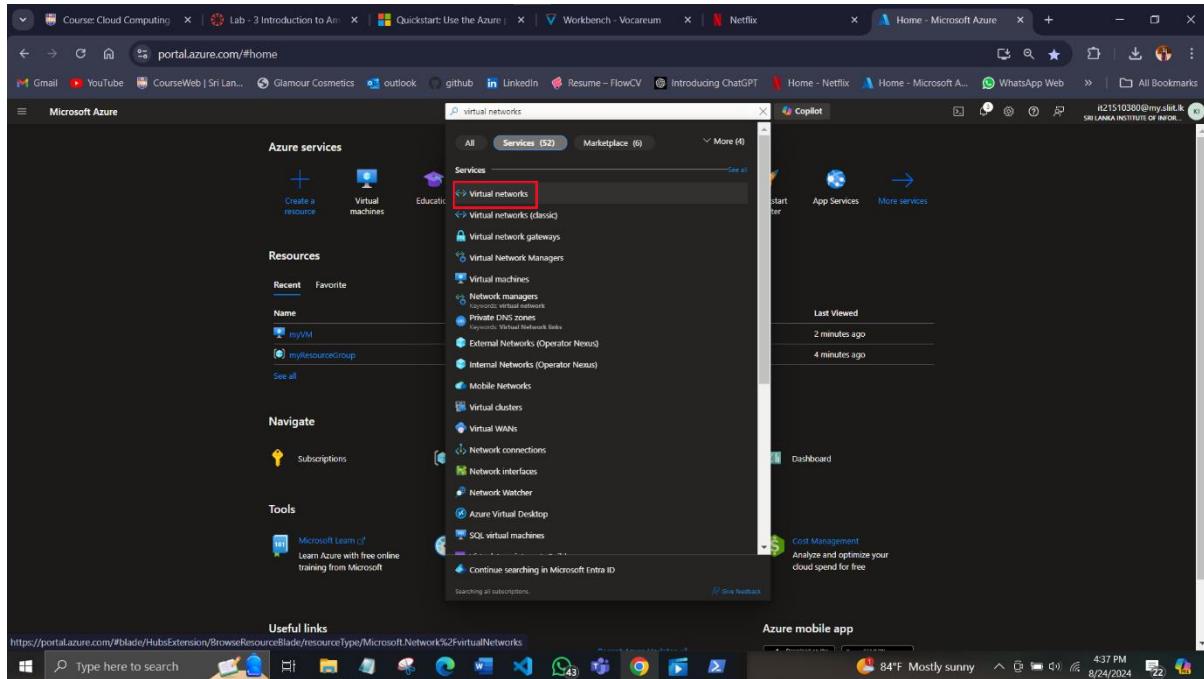
In partial fulfillment of the requirements for the  
Bachelor of Science Special Honors Degree in Information Technology

August 2024

# Create a virtual network and an Azure Bastion host

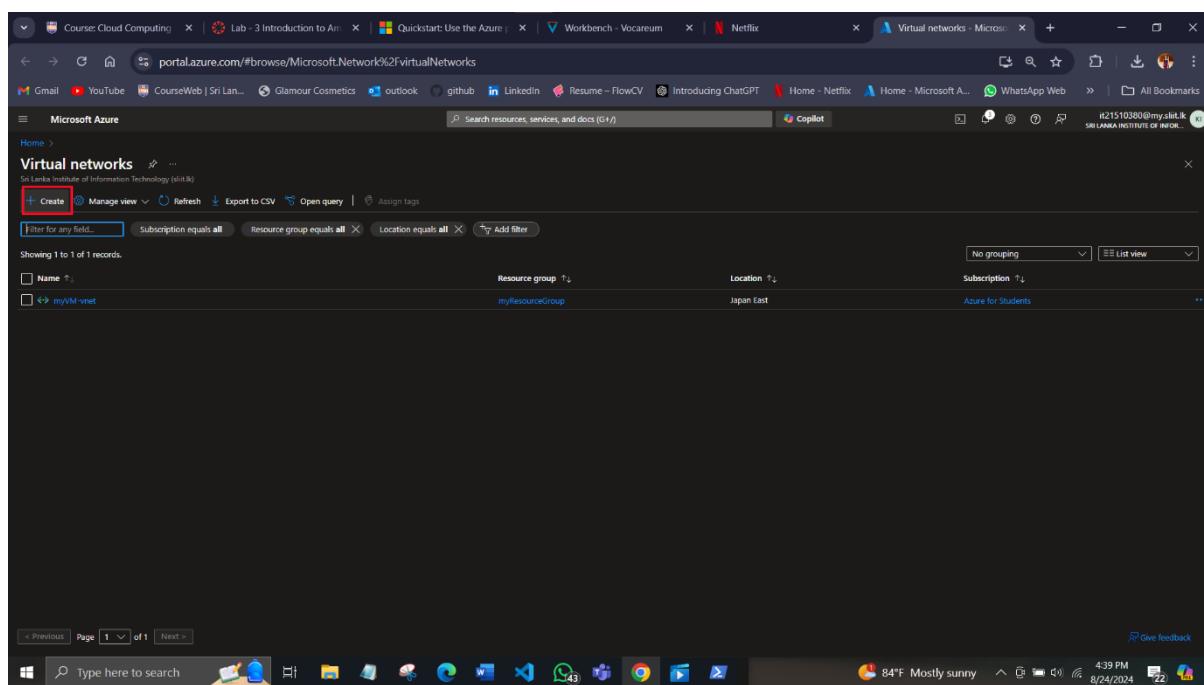
Follow these steps:

1. In the portal, search for and select **Virtual networks**.



The screenshot shows the Microsoft Azure portal interface. The search bar at the top contains the text "virtual networks". Below the search bar, the "Services" section is selected in the navigation menu. A red box highlights the "Virtual networks" link under the "Services" category. Other options listed include Services (52), Marketplace (6), and More (4). To the right of the search bar, there are sections for "Copilot", "Last viewed", and "Cost Management". The bottom of the screen shows the Windows taskbar with various pinned icons.

2. On the **Virtual Networks** page, select **+ Create**.



The screenshot shows the "Virtual networks" page in the Microsoft Azure portal. The top navigation bar has "Virtual networks" selected. A red box highlights the "+ Create" button in the top-left corner of the main content area. The page displays a single record: "myVM-vnet" under "Name", "myResourceGroup" under "Resource group", "Japan East" under "Location", and "Azure for Students" under "Subscription". The bottom of the screen shows the Windows taskbar with various pinned icons.

3. On the **Basics** tab of **Create Virtual Network**, enter, or select the following information:

**Project details**

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

Subscription: Azure for Students

Resource group: (New) test-rg

Virtual network name: vnet-1

Region: (US) East US 2

Review + create

4. Select **Next** to proceed to the **Security** tab.
5. In the **Azure Bastion** section, select **Enable Azure Bastion**.
6. In **Azure Bastion**, enter or select the following information

**Virtual network encryption**

**Azure Bastion**

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

Enable Azure Bastion

Azure Bastion host name: bastion

Azure Bastion public IP address: (New) public-ip-bastion

**Azure Firewall**

Azure Firewall is a managed cloud-based network security service that protects your Azure Virtual Network resources. [Learn more](#)

Enable Azure Firewall

Review + create

7. Select **Next** to proceed to the **IP Addresses** tab.
8. In the address space box in **Subnets**, select the **default** subnet.
9. In the **Edit subnet**, enter or select the following information:
10. Select **Save**.
11. Select **Review + create** at the bottom of the window. When validation passes, select **Create**.

**Edit subnet**

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

Subnet purpose	<input type="button" value="Default"/>
Name *	subnet-1
IPv4	Include an IPv4 address space
IPv4 address range	<input type="button" value="10.0.0.0/16"/> 10.0.0.0 - 10.0.255.255
Starting address	10.0.0.0
Size	/24 (256 addresses)
Subnet address range	10.0.0.0 - 10.0.255.255
IPv6	Include an IPv6 address space
<input type="checkbox"/> This virtual network has no IPv6 address ranges.	
<b>Private subnet</b> <a href="#">Learn more ↗</a>	
Private subnets enhance security by not providing default outbound access. To enable outbound connectivity for virtual machines to access the internet, it is necessary to explicitly grant outbound access. A NAT gateway is the recommended way to provide outbound connectivity for virtual machines in the subnet. <a href="#">Learn more ↗</a>	
<input type="checkbox"/> Enable private subnet (no default outbound access)	
<small>This setting can't be changed after the subnet is created</small>	

**Security**

**Save** **Cancel**

**Create virtual network**

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

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

Add IPv4 address space	<input type="button" value="10.0.0.0/16"/> 10.0.0.0 - 10.0.255.255 65,536 addresses		
<small>This address prefix overlaps with virtual network 'myVM-vnet'. If you intend to peer these virtual networks, change the address space. <a href="#">Learn more ↗</a></small>			
<input type="checkbox"/> Add a subnet			
Subnets	IP address range	Size	NAT gateway
subnet-1	10.0.0 - 10.0.255	/24 (256 addresses)	-
AzurebastionSubnet	10.0.1.0 - 10.0.1.63	/26 (64 addresses)	-

**Previous** **Next** **Review + create**

84°F Mostly sunny 8/24/2024

The screenshot shows the Microsoft Azure portal interface for creating a virtual network. The current step is 'Review + create'. The configuration includes:

- Subscription:** Azure for Students
- Resource Group:** test-rg
- Name:** vnet-1
- Region:** East US 2
- Security:**
  - Azure Bastion: Enabled (New bastion)
  - Public IP Address: (New public ip bastion)
  - Azure Firewall: Disabled
  - Azure DDoS Network Protection: Disabled
- IP addresses:**
  - Address space: 10.0.0.0/16 (65,536 addresses)
  - Subnet: subnet-1 (10.0.0.0/24) (256 addresses)
  - Subnet: AzurebastionSubnet (10.0.1.0/26) (64 addresses)
- Tags:** None

At the bottom, there are 'Previous' and 'Next' buttons, and a prominent 'Create' button which is highlighted with a red box.

The screenshot shows the Microsoft Azure portal for the deployment of the virtual network 'vnet-1-1724498544835'. The 'Overview' tab is selected. Key information displayed includes:

- Deployment name:** vnet-1-1724498544835
- Subscription:** Azure for Students
- Resource group:** test-rg
- Status:** Your deployment is complete (with a green checkmark icon)
- Start time:** 8/24/2024, 4:52:35 PM
- Correlation ID:** a5b8e972-3cc4-47e6-872e-6f1537fd5f1

On the right side, there are several promotional cards:

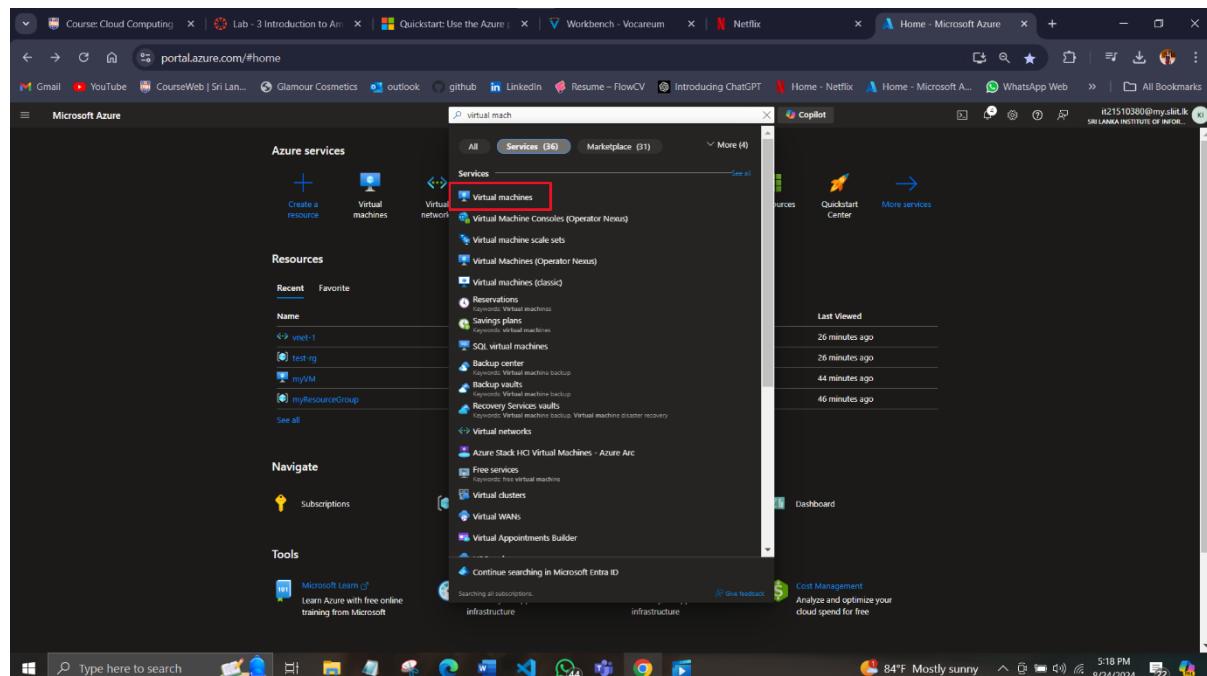
- Cost management:** Get notified to stay within your budget and prevent unexpected charges on your bill. [Set up cost alerts >](#)
- Microsoft Defender for Cloud:** Secure your apps and infrastructure. [Go to Microsoft Defender for Cloud >](#)
- Free Microsoft tutorials:** Start learning today! [Start 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 >](#)

At the bottom, there is a 'Give feedback' section and a link to 'Tell us about your experience with deployment'.

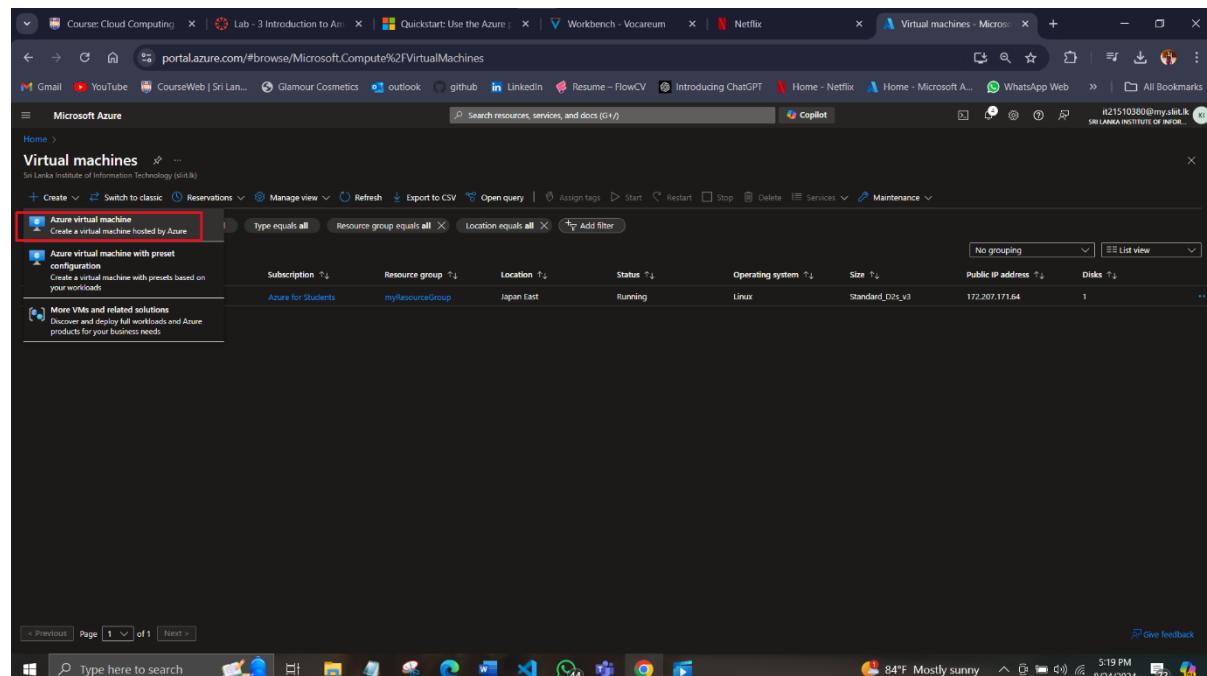
# Create virtual machines

The following procedure creates two VMs named **vm-1** and **vm-2** in the virtual network:

1. In the portal, search for and select **Virtual machines**.
2. In **Virtual machines**, select **+ Create**, and then select **Azure virtual machine**.
3. On the **Basics** tab of **Create a virtual machine**, enter or select the following information:



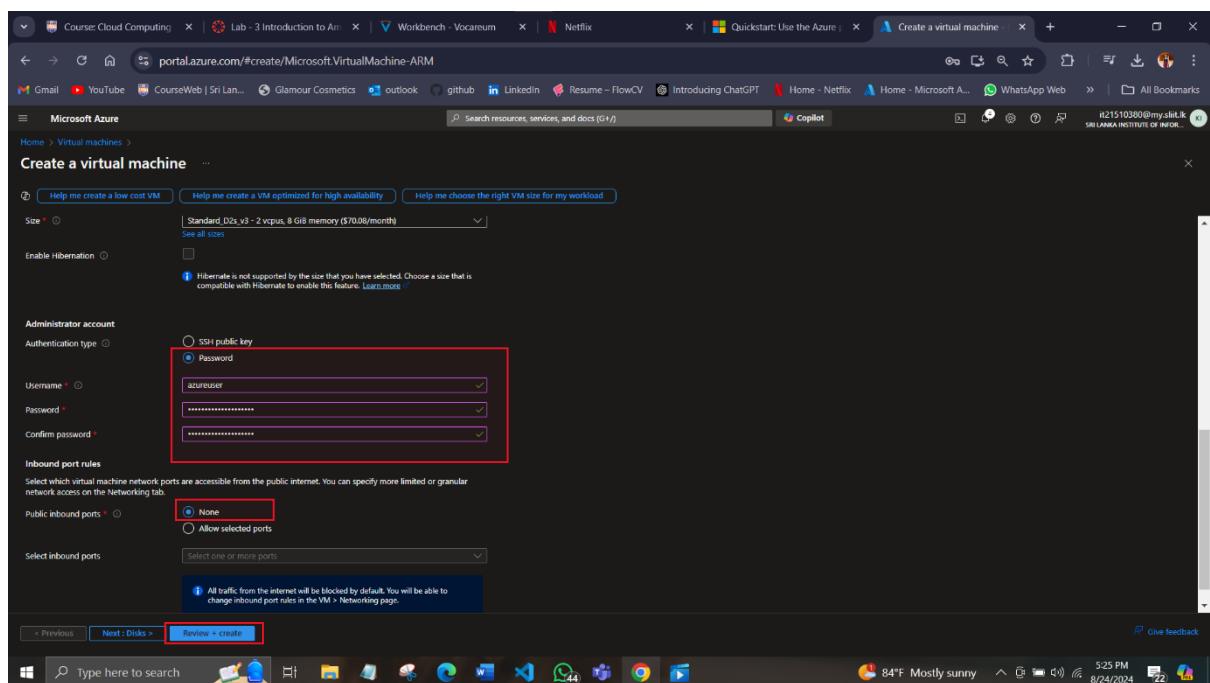
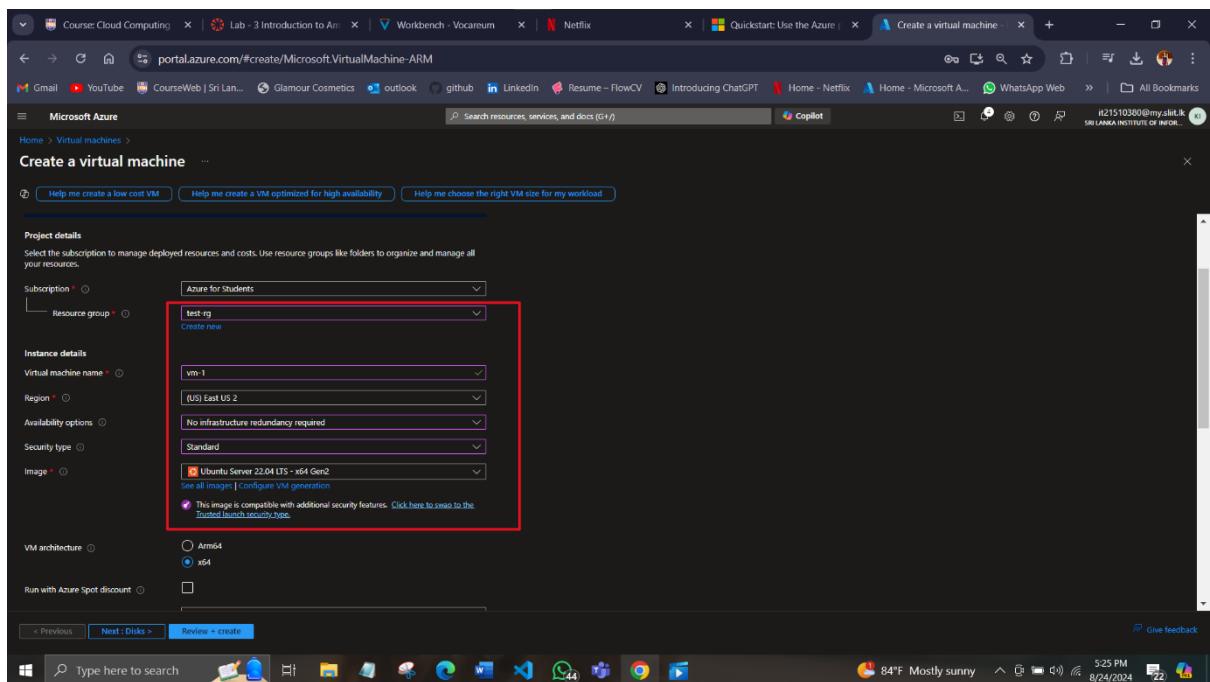
This screenshot shows the Microsoft Azure portal homepage. The left sidebar includes 'Create a resource', 'Virtual machines', 'Recent' (with items like 'vnet-1', 'test-rg', 'myVM', and 'myResourceGroup'), 'Navigate' (with 'Subscriptions'), and 'Tools' (with 'Microsoft Learn'). The main content area has a search bar 'Search resources, services, and docs (G+)' and a 'Copilot' button. A red box highlights the 'Virtual machines' link under 'Services'. Below it, a list of services includes 'Virtual machines (classic)', 'Virtual machines (Operator Nexus)', 'Virtual machine scale sets', 'Virtual Machines (Operator Nexus)', and 'Virtual networks'. To the right, there's a 'Last Viewed' section with items like '26 minutes ago' and '44 minutes ago'. At the bottom, there's a 'Dashboard' button.



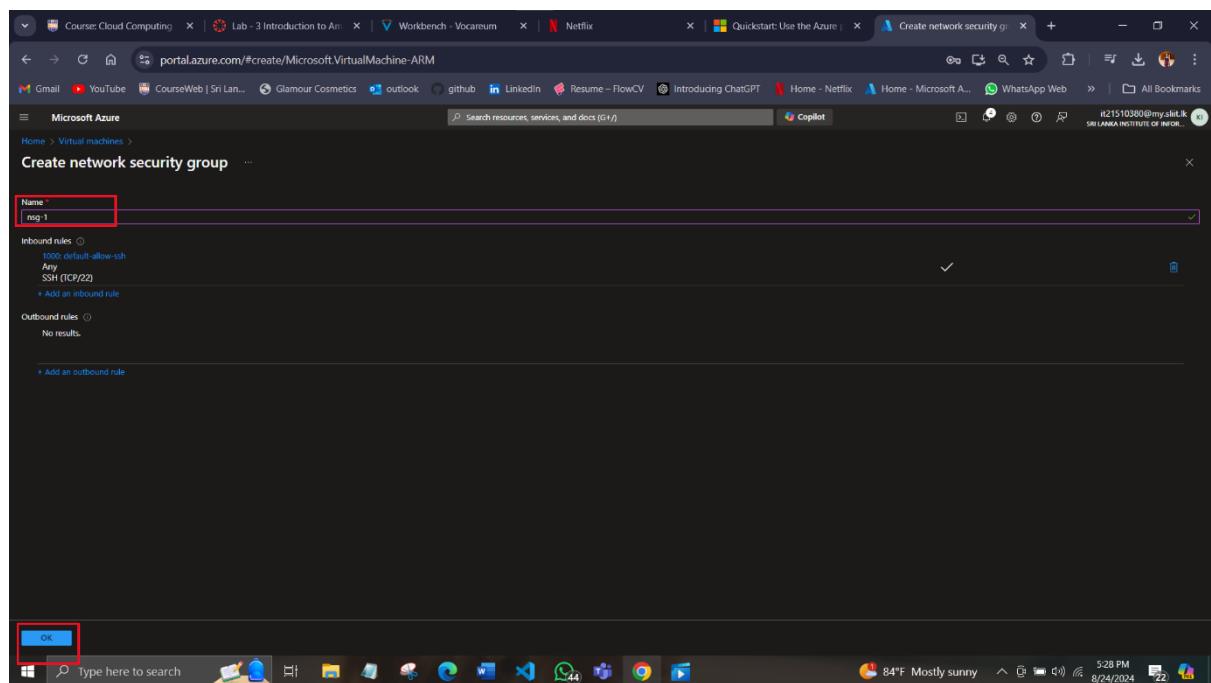
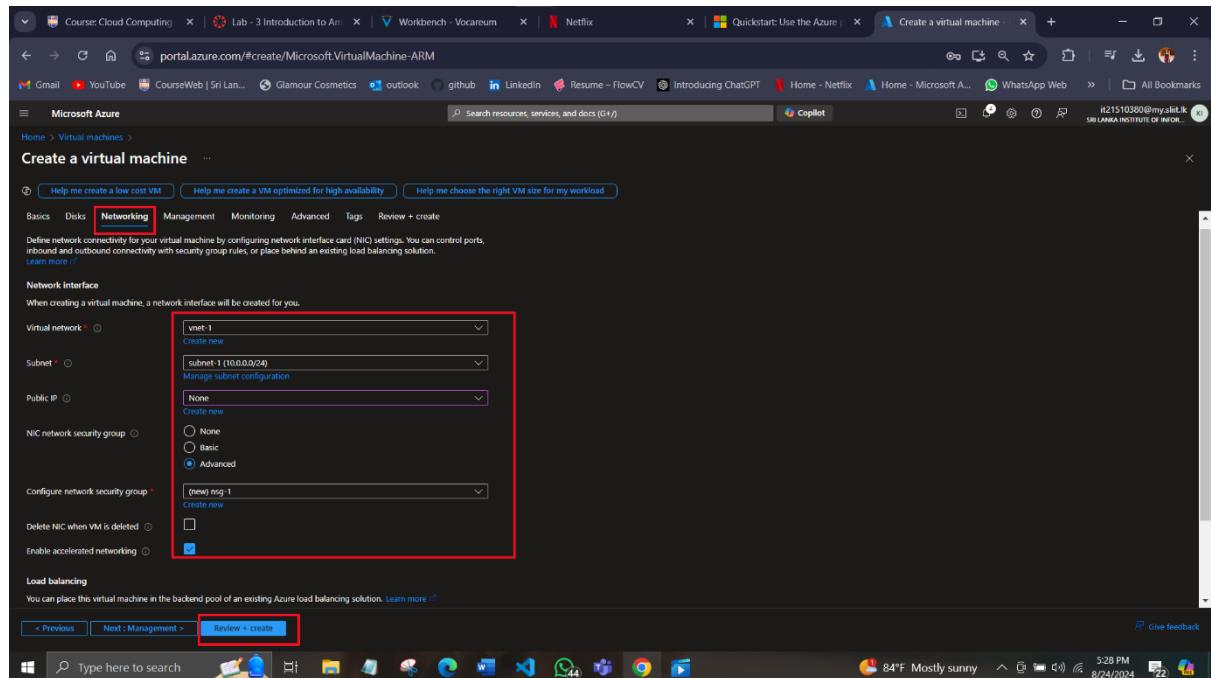
This screenshot shows the 'Virtual machines' list page in the Microsoft Azure portal. The top navigation bar includes 'Course: Cloud Computing', 'Lab - 3 Introduction to Am...', 'Quickstart: Use the Azure...', 'Workbench - Vocareum', 'Netflix', 'Home - Microsoft Azure', and a 'Copilot' button. The main content area has a search bar 'Search resources, services, and docs (G+)' and a 'Copilot' button. A red box highlights the 'Azure virtual machine' link under 'Create'. Below it, a table lists one existing VM:

Subscription	Resource group	Location	Status	Operating system	Size	Public IP address	Disk
Azure for Students	myResourceGroup	Japan East	Running	Linux	Standard_D2s_v3	172.207.171.64	1

At the bottom, there are navigation links for 'Previous', 'Page 1 of 1', and 'Next >'. The status bar at the bottom shows '84°F Mostly sunny' and the date '8/24/2024'.

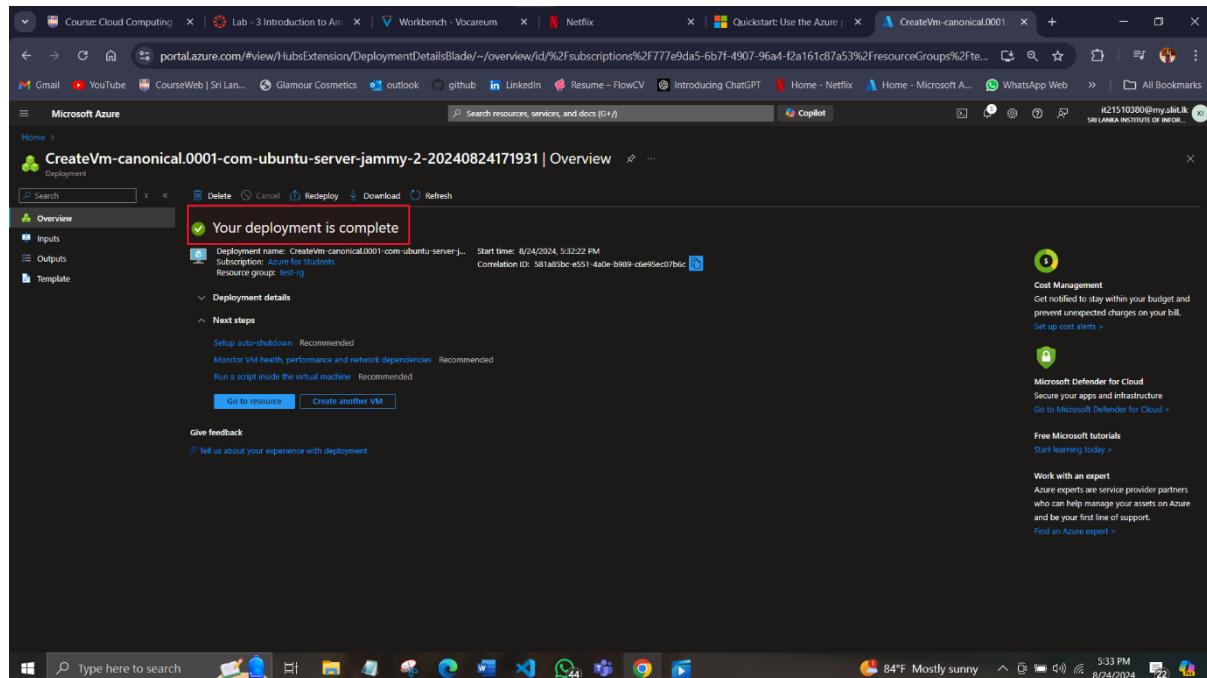
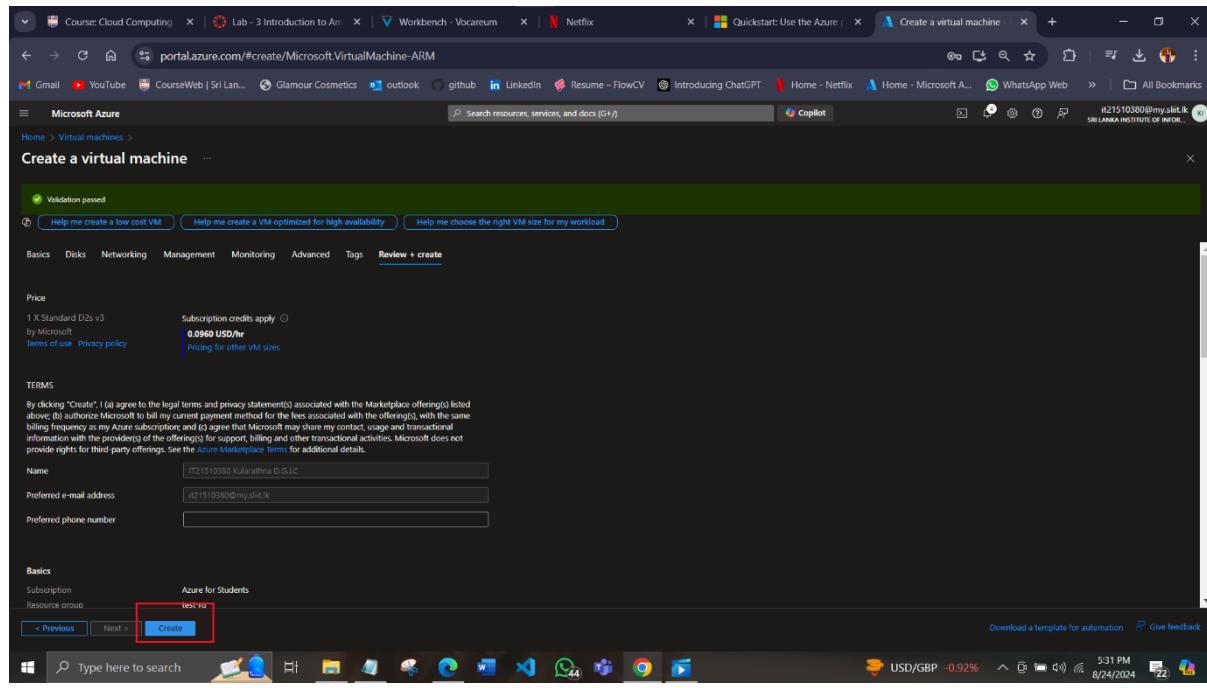


4. Select the **Networking** tab. Enter or select the following information:



5. Leave the rest of the settings at the defaults and select Review + create.

6. Review the settings and select Create.



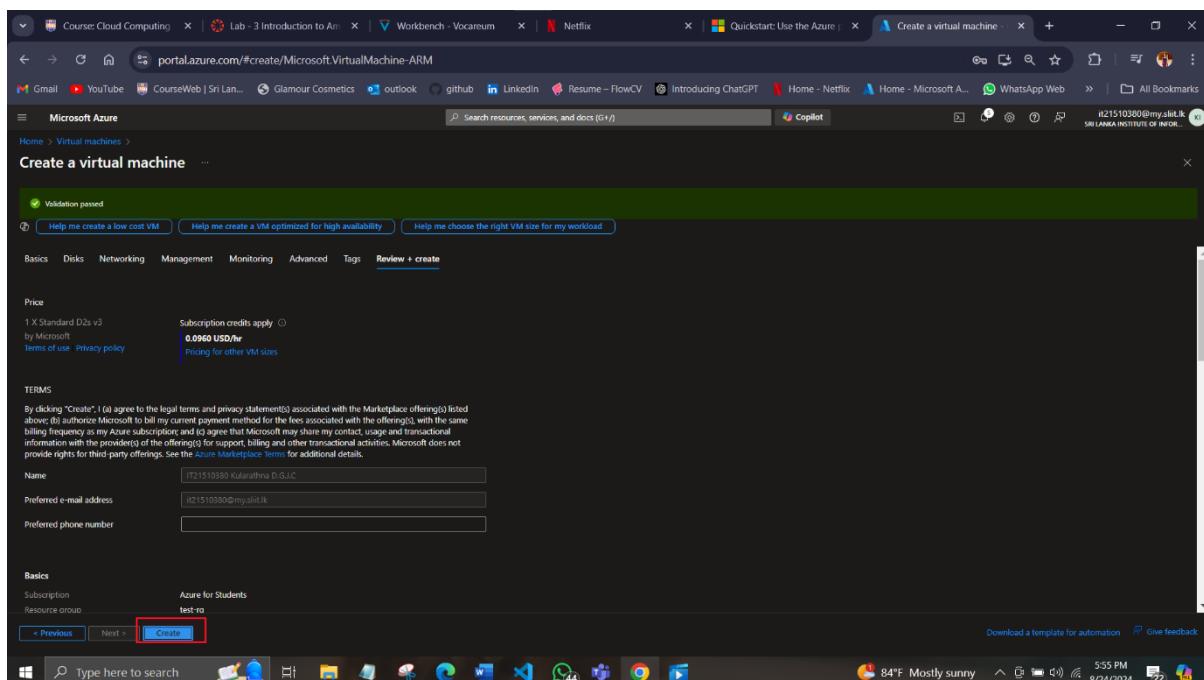
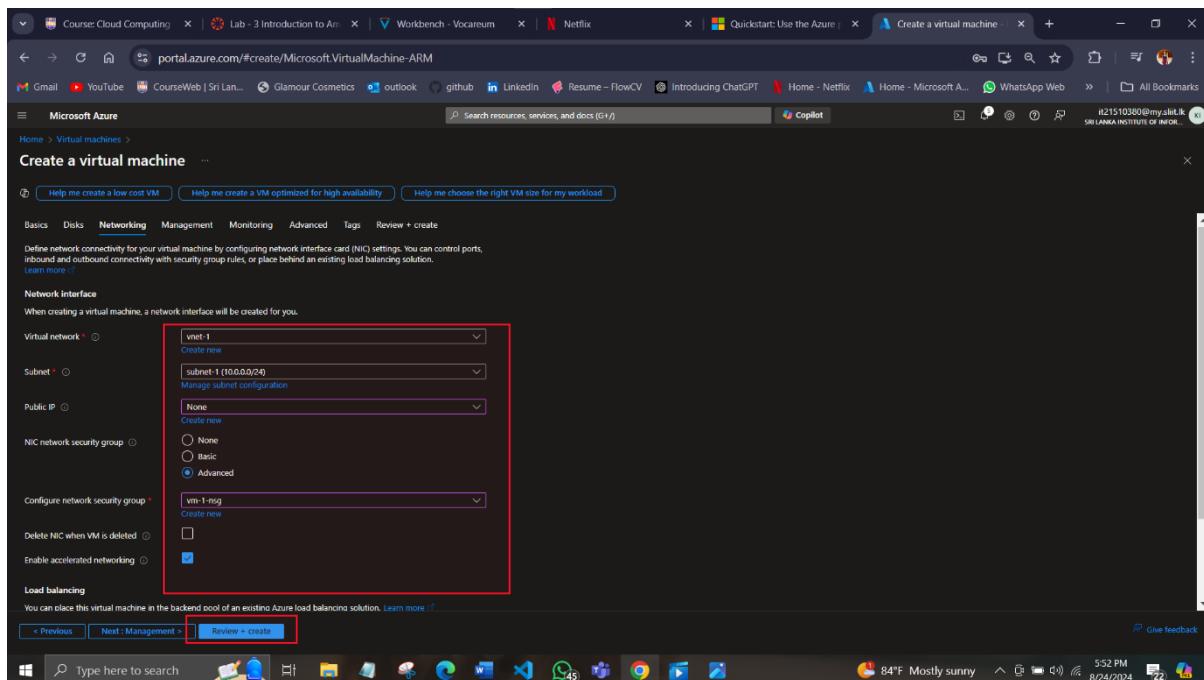
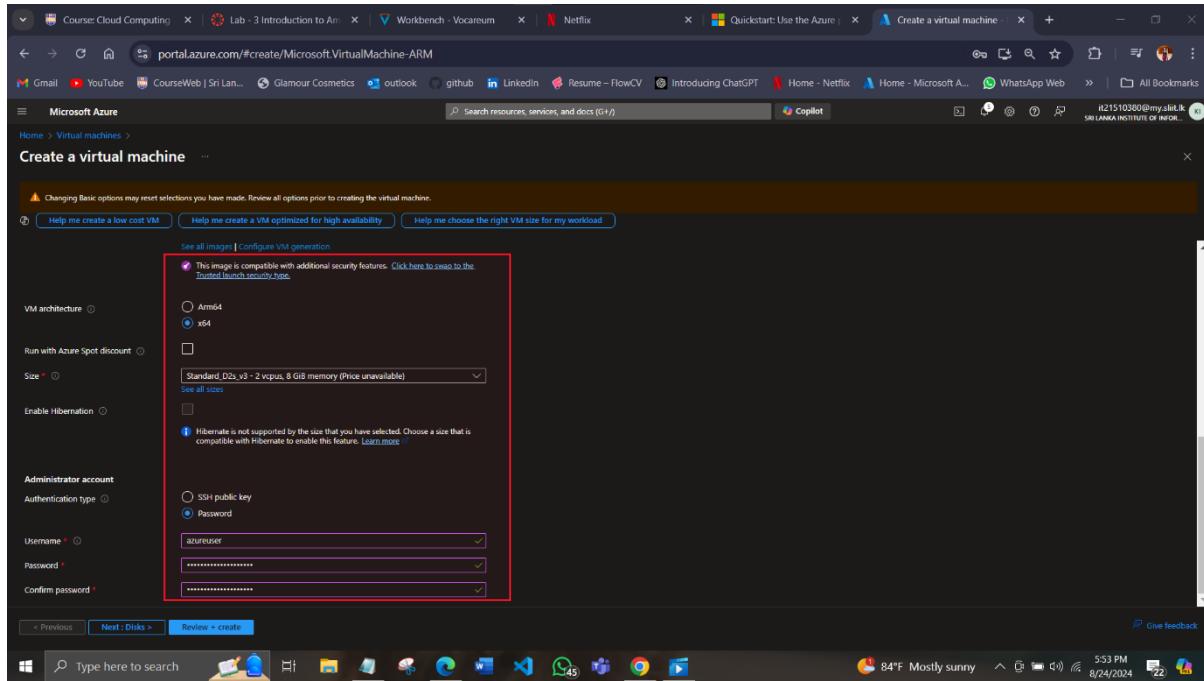
Screenshot of the Microsoft Azure portal showing the Virtual machines page. The page lists two virtual machines:

Name	Subscription	Resource group	Location	Status	Operating system	Size	Public IP address	Disk
myVM	Azure for Students	myResourceGroup	Japan East	Running	Linux	Standard_D2s_v3	172.20.1.11.64	1
vm-1	Azure for Students	test-rg	East US 2	Running	Linux	Standard_D2s_v3	52.254.85.247	1

7. repeat the previous steps to create a second virtual machine with the following settings:

Screenshot of the Microsoft Azure portal showing the 'Create a virtual machine' wizard. The configuration options shown are:

- Virtual machine name: vm-2
- Region: (US) East US 2
- Image: Ubuntu Server 22.04 LTS - x64 Gen2
- Size: Standard (D2s\_v3 - 2 vcpus, 8 GiB memory)



Name	Subscription	Resource group	Location	Status	Operating system	Size	Public IP address	Disks
myVM	Azure for Students	myResourceGroup	Japan East	Running	Linux	Standard_D2s_v3	172.207.171.64	1
vm-1	Azure for Students	test-rg	East US 2	Running	Linux	Standard_D2s_v3	52.254.85.247	1
vm-2	Azure for Students	test-rg	East US 2	Running	Linux	Standard_D2s_v3	20.161.0.213	1

Your deployment is complete

Deployment name: CreateVm-canonical.0001-com-ubuntu-server-jammy-2-20240824174353 | Overview

Subscription: Azure for Students

Resource group: test-rg

Start time: 8/24/2024, 5:56:39 PM

Correlation ID: 9c197043-6859-4f5b-88cd-a01bbcb0d1c

Deployment details

Next steps

Setup auto-shutdown Recommended

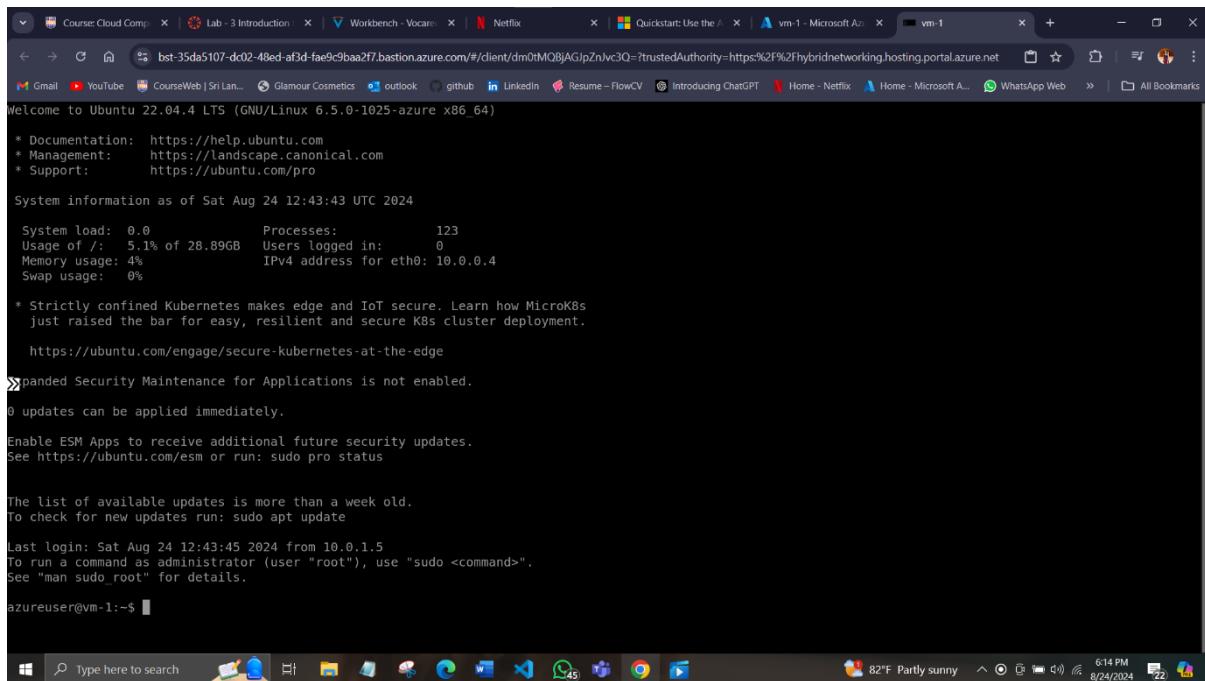
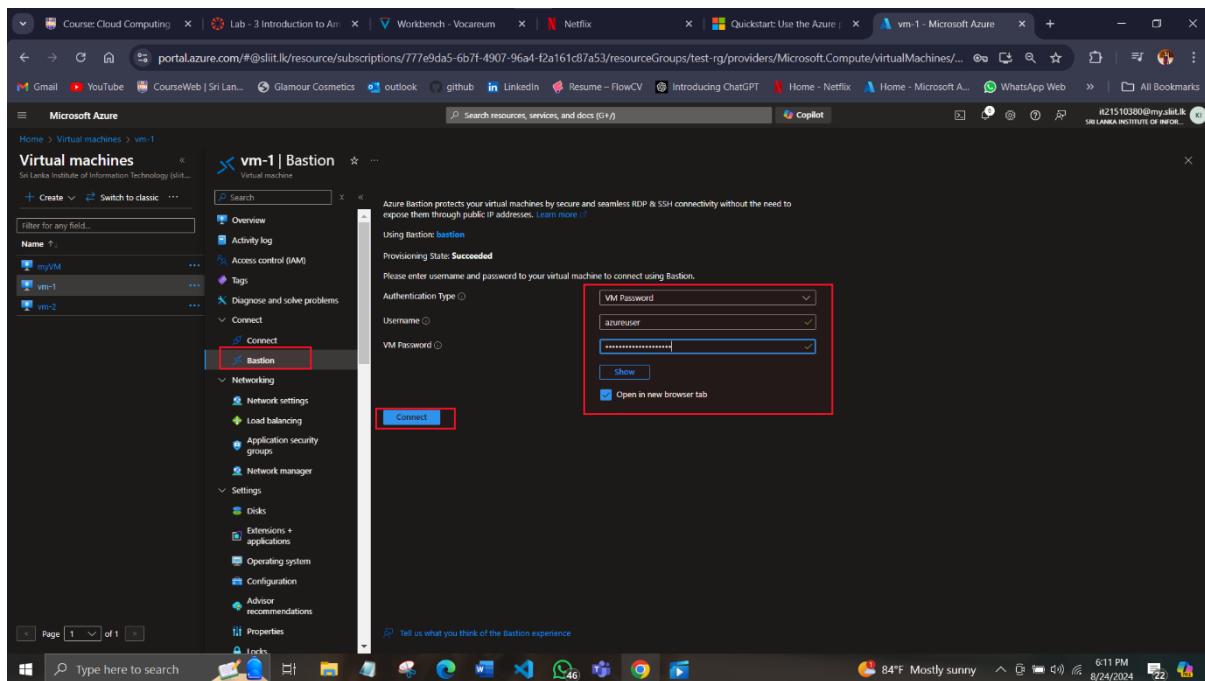
Monitor VM health, performance and network dependencies Recommended

Run a script inside the virtual machine Recommended

## Connect to a virtual machine

1. In the portal, search for and select **Virtual machines**.
2. On the **Virtual machines** page, select **vm-1**.

3. In the **Overview** information for **vm-1**, select **Connect**.
  4. On the **Connect to virtual machine** page, select the **Bastion** tab.
  5. Select **Use Bastion**.
  6. Enter the username and password that you created when you created the VM, and then select **Connect**.



```

System load: 0.0          Processes: 126
Usage of /: 5.2% of 28.89GB   Users logged in: 0
Memory usage: 4%           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.

0 updates can be applied immediately.

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

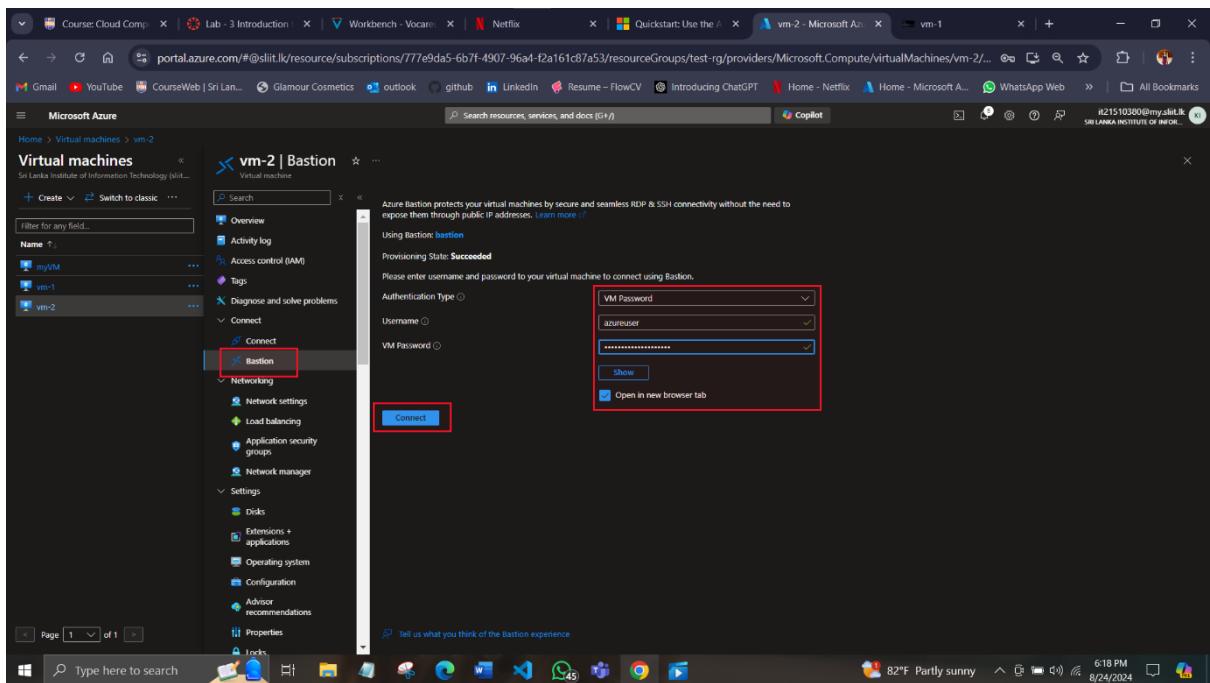
The list of available updates is more than a week old.
To check for new updates run: sudo apt update

Last login: Sat Aug 24 12:44:43 2024 from 10.0.1.5
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

azureuser@vm-1:~$ ping -c 4 vm-2
PING vm-2.aphsmxfveouethlmoxrgohu2fb.cx.internal.cloudapp.net (10.0.0.5) 56(84) bytes of data.
64 bytes from vm-2.internal.cloudapp.net (10.0.0.5): icmp_seq=1 ttl=64 time=1.03 ms
64 bytes from vm-2.internal.cloudapp.net (10.0.0.5): icmp_seq=2 ttl=64 time=3.72 ms
64 bytes from vm-2.internal.cloudapp.net (10.0.0.5): icmp_seq=3 ttl=64 time=1.01 ms
64 bytes from vm-2.internal.cloudapp.net (10.0.0.5): icmp_seq=4 ttl=64 time=0.889 ms
--- vm-2.aphsmxfveouethlmoxrgohu2fb.cx.internal.cloudapp.net ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3005ms
rtt min/avg/max/mdev = 0.989/1.689/3.722/1.173 ms
azureuser@vm-1:~$ 

```

2. Close the Bastion connection to vm-1.
3. Repeat the steps in Connect to a virtual machine to connect to vm-2.
4. At the bash prompt for **vm-1**, enter **ping -c 4 vm-1**.



```
System information as of Sat Aug 24 12:48:55 UTC 2024

System load: 0.0 Processes: 123
Usage of /: 5.1% of 28.89GB Users logged in: 0
Memory usage: 4% 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.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
> 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

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

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

azureuser@vm-2:~$
```

The taskbar at the bottom shows various icons for Microsoft Office applications like Word, Excel, and PowerPoint, along with a search bar and system status indicators.

```
System information as of Sat Aug 24 13:00:32 2024 from 10.0.1.5

System load: 0.0 Processes: 124
Usage of /: 5.2% of 28.89GB Users logged in: 0
Memory usage: 4% 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.

0 updates can be applied immediately.

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: Sat Aug 24 13:00:32 2024 from 10.0.1.5
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

azureuser@vm-2:~$ ping -c 4 vm-1
PING vm-1.aphsmxfveouethlmoxrghohu2fb.cx.internal.cloudapp.net (10.0.0.4) 56(84) bytes of data.
64 bytes from vm-1.internal.cloudapp.net (10.0.0.4): icmp seq=1 ttl=64 time=1.20 ms
64 bytes from vm-1.internal.cloudapp.net (10.0.0.4): icmp seq=2 ttl=64 time=1.14 ms
64 bytes from vm-1.internal.cloudapp.net (10.0.0.4): icmp seq=3 ttl=64 time=1.02 ms
64 bytes from vm-1.internal.cloudapp.net (10.0.0.4): icmp seq=4 ttl=64 time=1.03 ms
--- vm-1.aphsmxfveouethlmoxrghohu2fb.cx.internal.cloudapp.net ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 1.015/1.094/1.197/0.077 ms
azureuser@vm-2:~$
```

The taskbar at the bottom shows various icons for Microsoft Office applications like Word, Excel, and PowerPoint, along with a search bar and system status indicators.

## Clean up resources

When you finish using the resources that you created, you can delete the resource group and all its resources:

1. In the Azure portal, search for and select **Resource groups**.

2. On the **Resource groups** page, select the **test-rg** resource group.
3. On the **test-rg** page, select **Delete resource group**.
4. Enter **test-rg** in **Enter resource group name to confirm deletion**, and then select **Delete**.

The screenshot shows the Microsoft Azure portal's 'Resource groups' page. The URL is <https://portal.azure.com/#browse/resourcegroups>. The 'test-rg' resource group is listed and selected, highlighted with a red box. Other groups like 'myResourceGroup' and 'NetworkWatcherRG' are also visible. The page includes standard Azure navigation and search bars at the top.

The screenshot shows the 'Delete a resource group' dialog box. The 'Resource group to be deleted' field contains 'test-rg'. The 'Dependent resources to be deleted (13)' section lists various resources including 'bastion', 'public-ip-bastion', 'vm-1', 'vm-1-ip', 'vm-1-msg', 'vm-1610', 'vm-1-disk1\_05209e28e0546e59a8661efac47422', 'vm-2', 'vm-2-ip', 'vm-2-msg', and 'vm-2220'. A red box highlights the 'Delete' button at the bottom of the dialog. The background shows the Azure Resource groups page with the 'test-rg' group selected.

The screenshot shows the Microsoft Azure Resource Groups Overview page. On the left, there's a sidebar with navigation links like Home, Resource groups, Create, Manage view, Delete resource group, Refresh, Export to CSV, Open query, and Copilot. The main area displays a resource group named 'test-rg'. It includes sections for Overview, Essentials, and Resources. Under Overview, it shows a subscription moved to 'Azure for Students' with ID 777e9da5-6b7f-4907-96a4-f2a161c87a53, and a location of East US 2. The Resources section lists 13 items, including a Bastion, several VMs (vm-1, vm-1-ip, vm-1-msg, vm-1610, vm-1-disk1), and network components (public-ip-bastion, vm-1-ip, vm-1-msg, vm-1610, vm-2-ip, vm-2-msg, vm-2220). A modal window titled 'Delete a resource group' is open, asking for confirmation to delete the resource group and its dependent resources. The 'Delete' button is highlighted with a red border.

This screenshot shows the same Azure Resource Groups Overview page after the deletion of the 'test-rg' resource group. The main area now displays a message: 'No resources match your filters' with options to 'Create resources' or 'Clear filters'. In the Notifications panel on the right, there is a log entry: 'Deleted resource group test-rg' with a timestamp of '6 minutes ago'.

The screenshot shows the Microsoft Azure Virtual Machines page. The top navigation bar includes links for Course: Cloud Computing, Lab - 3 Introduction to AI, Workbench - Vocareum, Netflix, Quickstart: Use the Azure, and Virtual machines - Microsoft. The main content area is titled 'Virtual machines' and shows a message: 'No virtual machines to display. Create a virtual machine that runs Linux or Windows. Select an image from the marketplace or use your own customized image.' Below this, there are two buttons: '+ Create' and 'Give feedback'. The status bar at the bottom indicates '81°F Mostly clear' and the date '8/24/2024'.