

**Declaration**

Questions in this exercise are intentionally complex and could be convoluted or confusing. This is by design and to simulate real life situations where customers seldom give crystal clear requirements and ask unambiguous questions.

I have read the above statement and agree to these conditions

I AGREE

MOHAMED EL HASSNAOUI

<Enter your name above this line to indicate that you are in agreement>

**Instructions**

Every screenshot requested in this workbook is compulsory and carries 1 point

Your AWS account ID must be clearly visible in every screenshot using the AWS console; missing id or using someone else's id is not permitted. Such cases will be considered as plagiarism and severe penalty will be imposed.

All screenshots must be in the order mentioned under "Expected Screenshots" for every step

DO NOT WAIT UNTIL THE LAST MINUTE. The program office will not extend the project submission deadline under any circumstances.

The file should be renamed in the format PGPCCJUN24\_MOAHMED\_ELHASSNAOUI\_PROJECT1.  
For example: PGPCCMAY18\_VIJAY\_DWIVEDI\_PROJECT1.pdf

**Resource Clean Up**

Cloud is always pay per use model and all resources/services that we consume are chargeable. Cleaning up when you've completed your lab or project is always necessary. This is true whether you're doing a lab or implementing a project at your workplace.

After completing the lab, make sure to delete each resource created in reverse chronological order.

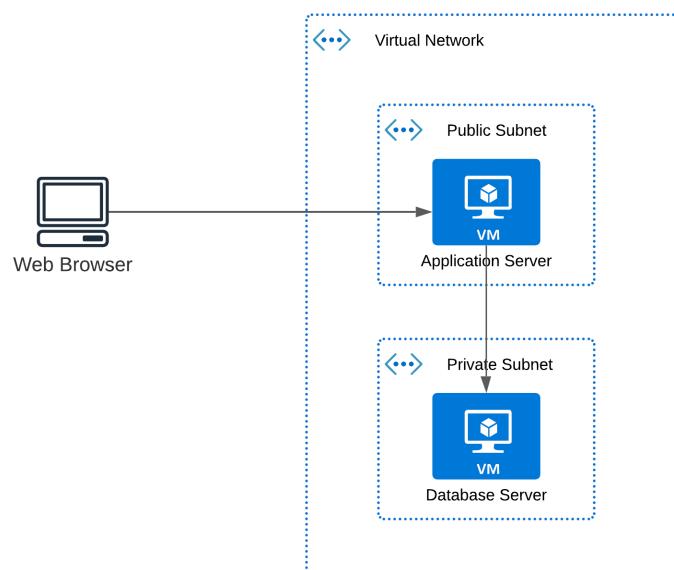


### Scenario

According to recent research, 40-75% of employees are using Dropbox to share files inside and outside of their businesses. Half of those Dropbox users do this even though they know it's against the rules. More than 40% of businesses have experienced the exposure of confidential information and the estimated average cost of a data breach equaled \$5.5 Million in 2011.

These files, containing sensitive company and customer data, are stored in a public cloud outside of the businesses' control - possibly even outside of the country. The potential for data leakage and security breaches is enormous and companies need to stay compliant with their own policies and procedures for security and governance

### Architecture diagram



Architecture Implementation	
1	Implement 2 different subnets (one public and the other private) in a virtual network
2	Install and configure MySQL on an Ubuntu virtual machine on the private subnet using the instructions provided. (Hint: Use a bastion host and a NAT gateway)
3	Install and configure OwnCloud on an Ubuntu virtual machine on the public subnet using the provided instructions.
4	Configure the network security groups to allow the required ports
5	Test the installation by accessing the IP of the application server in a browser

### Step 1: VPC and Subnet Creation

Step number	a
Step name	Creation of Virtual Network
Instructions	<p>1) Create a new resource group. You need to use this resource group to deploy all the resources in this exercise</p> <ol style="list-style-type: none"> <li>Search for resource groups using the search bar at the top of the screen</li> <li>Click on Create</li> <li>Enter a name and region of your choice. Remember to use the same region for all deployments in this exercise.</li> <li>Click on Review +Create and create the resource group</li> </ol> <p>2) Navigate to Virtual Networks and click on Create</p> <ol style="list-style-type: none"> <li>Name : P1VNET</li> <li>IPv4 CIDR Block : 10.0.0.0/16</li> <li>Delete the default created subnet and add the following subnets           <ol style="list-style-type: none"> <li>Public subnet with CIDR 10.0.1.0/24</li> <li>Private subnet with CIDR 10.0.2.0/24</li> </ol> </li> <li>The rest of the options can be set to the default values</li> <li>Click on Create to create the virtual network</li> </ol>
Expected screenshots	<ol style="list-style-type: none"> <li>Created virtual network with properties visible</li> <li>Properties of public subnet</li> <li>Properties of private subnet</li> </ol>

<Insert Screenshot a(1) here: Created virtual network with properties visible

&lt;Insert Screenshot a(2) here: Properties of public subnet

The screenshot shows the Microsoft Azure portal interface for editing a subnet. The URL in the address bar is `portal.azure.com`. The page title is "Edit subnet - Microsoft Azure". The left sidebar shows "Virtual networks" and "P1VNET". The main content area is titled "Edit subnet" and contains the following configuration:

- Subnet ID:** /subscriptions/b35899dd-1eaa-4f5f-9e4f-1a16a63b68d7/resourceGroups/OP1-Resource-Gro...
- Subnet purpose:** Default
- Name:** Public-subnet
- IPv4:**
  - Include an IPv4 address space:
  - Choose a starting address and size within your IPv4 address range: 10.0.0.0/16 (10.0.0.0 - 10.0.255.255)
  - Starting address: 10.0.1.0
  - Size: /24 (256 addresses)
  - Subnet address range: 10.0.1.0 - 10.0.1.255
- IPv6:** This virtual network has no IPv6 address ranges.
- Private subnet:**
  - 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. [Learn more](#)
  - Enable private subnet (no default outbound):

At the bottom are "Save" and "Cancel" buttons, and a "Give feedback" link.

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&lt;Insert Screenshot a(3) here: Properties of private subnet

The screenshot shows the Microsoft Azure portal interface for editing a subnet. The URL in the address bar is `portal.azure.com`. The page title is "Edit subnet - Microsoft Azure". The left sidebar shows "Virtual networks" and "P1VNET". The main content area is titled "Edit subnet" and contains the following configuration:

- Subnet ID:** /subscriptions/b35899dd-1eaa-4f5f-9e4f-1a16a63b68d7/resourceGroups/OP1-Resource-Gro...
- Subnet purpose:** Default
- Name:** Private-subnet
- IPv4:**
  - Include an IPv4 address space:
  - Choose a starting address and size within your IPv4 address range: 10.0.0.0/16 (10.0.0.0 - 10.0.255.255)
  - Starting address: 10.0.2.0
  - Size: /24 (256 addresses)
  - Subnet address range: 10.0.2.0 - 10.0.2.255
- IPv6:** This virtual network has no IPv6 address ranges.
- Private subnet:**
  - 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. [Learn more](#)
  - Enable private subnet (no default outbound):

At the bottom are "Save" and "Cancel" buttons, and a "Give feedback" link.

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Step number	b
Step name	Creation of NAT Gateway
Instructions	<p>1) Navigate to NAT Gateways</p> <p>2) Click on "Create"</p> <ul style="list-style-type: none"> <li>a) Use the resource group created above and the same region it is deployed in</li> <li>b) Use a new public IP and public IP prefix for the NAT gateway. Ensure that the public IP prefix has a CIDR size of /30</li> <li>c) When asked to select the subnet, select the private subnet created above</li> <li>d) Click on Create</li> </ul> <p>3) Navigate to virtual network and select the network created above</p> <p>4) Select the private subnet created under Subnets in the menu on the left of the screen.</p> <p>5) Under NAT Gateway, select the gateway created just now and select Save.</p>
Expected screenshots	1) Created NAT gateway

<Insert Screenshot b(1) here: Created NAT gateway

The screenshot shows the Microsoft Azure portal interface for managing a NAT gateway named 'NAT-GW-op2'. The page includes a navigation bar with links for Home, NAT gateways, and a search bar. The main content area displays the 'Overview' tab of the NAT gateway's configuration. Key details shown include:

- Resource group:** OP1-Resource-Group
- Location:** Central India
- Subscription:** AzureOP1-Subscription
- Subscription ID:** b35899dd-1eaa-4f5f-9e4f-1a16a63b68d7
- Tags:** Nat-GWay : Nat-gway-op1
- Virtual network:** P1VNET
- Subnets:** 1
- Public IP addresses:** 1
- Public IP prefixes:** 1

Below the main configuration, there are two callout boxes with links to 'Configure outbound IP addresses' and 'Configure subnets'.

Step number	c
Step name	Creation and configuration of Network security groups
Instructions	<p>1) Navigate to Network Security Groups</p> <p>2) Click on Create</p> <ul style="list-style-type: none"> <li>a) Resource Group: Use the one previously created</li> <li>b) Enter the name: AppNSG</li> <li>c) Region: Same as the resource group</li> </ul> <p>4) Click on Create</p> <p>5) Create another security group with the name DbNSG</p> <p>6) Navigate to the security group AppNSG</p> <p>7) Add inbound rules for ports 22 and 80 for any sources and destinations !</p> <p>8) Navigate to the security group DbNSG</p> <p>9) Add inbound rules for ports 3306 and 22 for any sources and destinations</p>
Expected screenshots	<p>1) AppNSG security rules</p> <p>2) DbNSG security rules</p>

<Insert Screenshot c(1) here: AppNSG security rules

The screenshot shows the Azure portal interface for managing Network Security Groups (NSGs). The URL in the address bar is [portal.azure.com](https://portal.azure.com). The page title is "AppNSG - Microsoft Azure". The left sidebar shows the navigation path: Home > Network security groups > AppNSG. The main content area is titled "AppNSG | Inbound security rules". The sidebar menu includes options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings (which is currently selected), Inbound security rules, Outbound security rules, Network interfaces, Subnets, Properties, Locks, Monitoring, Automation, and Help.

The "Inbound security rules" section displays the following table:

Priority ↑↓	Name ↑↓	Port ↑↓	Protocol ↑↓	Source ↑↓
100	AllowAnyCustom...	22,80	Any	Any
65000	AllowVnetInBound	Any	Any	VirtualNetwork
65001	AllowAzureLoadBalanc...	Any	Any	AzureLoadBalance...
65500	DenyAllInBound	Any	Any	Any

## &lt;Insert Screenshot c(2) here: DbNSG security rules

The screenshot shows the Azure portal interface for managing Network Security Groups (NSGs). The current view is for the 'DbNSG' NSG, specifically focusing on its inbound security rules. The left sidebar shows navigation options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings (which is expanded to show Inbound security rules), Outbound security rules, Network interfaces, Subnets, Properties, Locks, Monitoring, Automation, and Help. The main content area displays a table of five inbound security rules:

Priority	Name	Port	Protocol	Source
100	AllowAnyCustom...	3306,22	Any	Any
65000	AllowVnetInBound	Any	Any	VirtualNetwork
65001	AllowAzureLoadBalanc...	Any	Any	AzureLoadBalancer
65500	DenyAllInBound	Any	Any	Any

Below the table, there are buttons for 'Add', 'Hide default rules', 'Refresh', 'Delete', and 'Give feedback'. A note at the top right states: "Network security group security rules are evaluated by priority using the combination of source, source port, destination, destination port, and protocol to allow or deny the traffic. A security rule can't have the same priority and direction as an existing rule. You can't delete default security rules, but you can override them with rules that have a higher priority." There is also a link to 'Learn more'.

## Step 2 : Instance Creation

Step number	a
Step name	Creation of Application server
Instructions	<p>1) Navigate to <a href="#">Cloud Computing Services   Microsoft Azure</a></p> <p>2) Click on "Create"</p> <p>3) Create a virtual machine with the following properties</p> <ul style="list-style-type: none"> <li>a) Resource Group: As Created above</li> <li>b) Region: Same as used before</li> <li>c) Image: Ubuntu 22.04 LTS</li> <li>d) Size : Standard B1s</li> <li>e) Authentication type: SSH public key</li> <li>f) Username: ubuntu</li> <li>g) Create a new key pair</li> <li>h) Inbound rules: Allow 22 and 80</li> <li>i) Virtual Network : P1VNET</li> <li>j) Subnet : Public subnet create above</li> <li>k) Create a new public IP</li> <li>l) Network security group: Select Advanced and then pick AppNSG from the dropdown</li> <li>m) The rest of the options can be set to their default Values</li> </ul>
Expected screenshots	<p>1) Created Application server Overview page</p>

<Insert Screenshot a(1) here: Created Application server Overview page

The screenshot shows the Microsoft Azure portal interface for managing virtual machines. The main navigation bar at the top includes links for 'Cloud Computing Services | Microsoft Azure', 'CreateVm-canonical.0001-com-ubuntu-server-focal-2-2024112023095...', and 'Application-Server-OP1-VM - Microsoft Azure'. The user's email, 'melhassnaoui@alumni...', is also visible in the top right.

The left sidebar shows the 'Virtual machines' section, listing two instances: 'Application-Server-OP1-VM' and 'Database-server-op1-VM'. The 'Application-Server-OP1-VM' card is selected and expanded, showing its detailed overview.

The 'Overview' tab is active, displaying the following details:

- Essentials:**
  - Resource group: OP1-Resource-Group
  - Status: Running
  - Location: Central India (Zone 1)
  - Subscription: AzureOP1-Subscription
  - Operating system: Linux (Ubuntu 22.04)
  - Size: Standard B1s (1 vcpu, 1 GiB memory)
  - Public IP address: 4.186.58.105
  - Virtual network/subnet: P1VNET/Public-subnet
  - DNS name: Not configured
  - Health state: -
  - Time created: 11/21/2024, 3:53 AM UTC
- Tags:** Tags (edit) | Add tags

Below the main content area, there are tabs for 'Properties', 'Monitoring', 'Capabilities (7)', 'Recommendations (1)', and 'Tutorials'. The 'Virtual machines' tab is currently selected.

Step number	b
Step name	Creation of Database server
Instructions	<p>1) Create a virtual machine with the following properties</p> <ul style="list-style-type: none"> <li>a) Resource Group: As Created above</li> <li>b) Region: Same as used before</li> <li>c) Image : Ubuntu 20.04 LTS</li> <li>d) Size : Standard B1s</li> <li>e) Authentication type: SSH public key</li> <li>f) Username: ubuntu</li> <li>g) Create a new key pair (or reuse the one created for the application server)</li> <li>h) Inbound rules: Allow 22 and 80</li> <li>i) Virtual Network : P1VNET</li> <li>j) Subnet : Private subnet create above</li> <li>k) No public IP is required here</li> <li>l) Network security group: Select Advanced and then pick DbNSG from the dropdown</li> <li>m) The rest of the options can be set to their default Values</li> </ul>
Expected screenshots	<p>1) Created Database server overview page</p>

<Insert Screenshot 2(b) here: Created Database server overview page

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes 'Cloud Computing Services | Microsoft Azure', 'CreateVm-canonical.0001-com-ubuntu-server-focal-2-2024112023095...', 'Database-server-op1-VM - Microsoft Azure', and the user 'melhassnaoui@alumni... NEW ENGLAND INSTITUTE OF TE...'.

The main page displays the 'Virtual machines' section for 'New England Institute of Technology (newenglan...)'.

The 'Database-server-op1-VM' details are shown in the center:

- Name:** Database-server-op1-VM
- Type:** Virtual machine
- Region:** Central India (Zone 1)
- Subscription:** AzureOPT1-Subscription
- Resource group:** OPT-RESOURCE-GROUP
- Operating system:** Linux (ubuntu 20.04)
- Size:** Standard B1s (1 vcpu, 1 GiB memory)
- Public IP address:** (None)
- Virtual network/subnet:** P1VNET/Private-subnet
- DNS name:** (None)
- Health state:** (None)
- Time created:** 11/21/2024, 4:12 AM UTC

The 'Overview' tab is selected, showing other sections like 'Activity log', 'Access control (IAM)', 'Tags', and 'Diagnose and solve problems'. The 'Properties' tab is also visible at the bottom.

## Step 4: Application and Database Installation and Testing

Step number	a
Step name	Installation and configuration of MySQL
Instructions	<ol style="list-style-type: none"><li>1) Copy the database pem file into the application server using the below command <code>scp -i &lt;application server pem file&gt; &lt;database server pem file&gt; ubuntu@&lt;application server public IP&gt;:/home/ubuntu</code></li><li>2) Log into the application server using your SSH client of choice</li><li>3) From the application server, log into the database server using the pem file copied in step 1 and the private IP address of the database server with the following command <code>ssh -i &lt;database server pem file&gt; ubuntu@&lt;private IP of database server&gt;</code></li></ol> <p><b>Note: Use your existing knowledge of SSH and copying files to cloud VMs to perform the above SSH and SCP operations</b></p> <ol style="list-style-type: none"><li>4) Enter the following commands to install and configure MySQL on the database server <code>sudo apt update</code> <code>wget <a href="https://d6opu47qoi4ee.cloudfront.net/azure_install_mysql.sh">https://d6opu47qoi4ee.cloudfront.net/azure_install_mysql.sh</a></code> <code>sudo chmod 700 azure_install_mysql.sh</code> <code>sudo apt install dos2unix</code> <code>sudo dos2unix ./azure_install_mysql.sh</code> <code>sudo ./azure_install_mysql.sh</code></li><li>5) Type <code>exit</code> to exit the database server and go back to the application server</li></ol>
Expected screenshots	<ol style="list-style-type: none"><li>1) Downloading of the provided script</li><li>2) Executing the script</li></ol>

<Insert screenshot a(1) here: Downloading of the provided script

The screenshot shows a macOS desktop environment. In the foreground, a terminal window is open on the desktop, displaying a command-line session for an Ubuntu VM on Azure. The user is performing an apt update and then downloading a MySQL installation script from a cloudfront URL. The terminal output includes package details and download progress. In the background, a web browser window is open to portal.azure.com, showing documentation on exiting an SSH connection.

```

ubuntu@Database-server-op1-VM:~$ sudo apt update
Hit:1 http://azure.archive.ubuntu.com/ubuntu focal InRelease [128 kB]
Get:2 http://azure.archive.ubuntu.com/ubuntu focal-updates InRelease [128 kB]
Get:3 http://azure.archive.ubuntu.com/ubuntu focal-backports InRelease [128 kB]
Get:4 http://azure.archive.ubuntu.com/ubuntu focal-security InRelease [128 kB]
Get:5 http://azure.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3680 kB]
Get:6 http://azure.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [563 kB]
Get:7 http://azure.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [3379 kB]
Get:8 http://azure.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [473 kB]
Get:9 http://azure.archive.ubuntu.com/ubuntu focal-security/main amd64 Packages [3303 kB]
Fetched 11.8 MB in 3s (4328 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
24 packages can be upgraded. Run 'apt list --upgradable' to see them.
ubuntu@Database-server-op1-VM:~$ wget https://d0opu47qo14ee.cloudfront.net/azure_install_mysql.sh
--2024-11-22 03:06:00-- https://d0opu47qo14ee.cloudfront.net/azure_install_mysql.sh
Resolving d0opu47qo14ee.cloudfront.net (d0opu47qo14ee.cloudfront.net)... 108.159.79.102, 108.159.79.111, 108.159.79.15, ...
Connecting to d0opu47qo14ee.cloudfront.net (d0opu47qo14ee.cloudfront.net)|108.159.79.102|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 1359 (1.3K) [text/x-sh]
Saving to: 'azure_install_mysql.sh'

azure_install_mysql.sh          100%[=====] 1.31K --.-KB/s   in 0s

2024-11-22 03:06:00 (170 MB/s) - 'azure_install_mysql.sh' saved [1339/1339]

ubuntu@Database-server-op1-VM:~$ sudo chmod 700 azure_install_mysql.sh
ubuntu@Database-server-op1-VM:~$ sudo apt install dos2unix
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following NEW packages will be installed:
dos2unix
0 upgraded, 1 newly installed, 0 to remove and 24 not upgraded.
Need to get 374 kB of archives.
After this operation, 1342 kB of additional disk space will be used.
Get:1 http://azure.archive.ubuntu.com/ubuntu focal/universe amd64 dos2unix amd64 7.4.0-2 [374 kB]
Fetched 374 kB in 0s (8169 kB/s)
Selecting previously unselected package dos2unix.
(Reading database ... 59002 files and directories currently installed.)
Preparing to unpack .../dos2unix_7.4.0-2_amd64.deb ...
Unpacking dos2unix (7.4.0-2) ...
Setting up dos2unix (7.4.0-2) ...

```

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<Insert screenshot b(1) here: Executing the script

A screenshot of a macOS desktop environment. At the top, there's a dark menu bar with options like Terminal, Shell, Edit, View, Window, Help, and a date/time indicator. Below the menu bar is a toolbar with icons for search, file operations, and system status. The main window area contains two Terminal sessions. The left Terminal window shows the output of a MySQL installation script on an Azure VM, including package selection and dependency information. The right Terminal window shows the same script running on another VM. Between the terminals is a browser window displaying the Azure portal. A dock at the bottom contains various application icons, including Finder, Mail, Safari, and productivity tools like Microsoft Word and Excel.

Step number	b
Step name	Installation and configuration of Owncloud
Instructions	<p>1) Enter the following commands after logging into the application server via SSH to install and configure Owncloud  <b>Learning Tip:</b> The version of Owncloud has no bearing on this project. When migrating a legacy version of an application to the cloud, it might not be possible to update the application to current technological trends.</p> <pre> <i>sudo apt update</i> <i>sudo add-apt-repository ppa:ondrej/php -y</i> <i>sudo apt update</i> </pre> <p>Note : The following 4 lines are a single command</p> <pre> <i>sudo apt install -y apache2 libapache2-mod-php7.4 mariadb-server openssl redis-server</i> <i>wget php7.4 php7.4-imagick php7.4-common php7.4-curl php7.4-gd php7.4-imap</i> <i>php7.4-intl php7.4-json php7.4-mbstring php7.4-gmp php7.4-bcmath php7.4-mysql</i> <i>php7.4-ssh2 php7.4-xml php7.4-zip php7.4-apcu php7.4-redis php7.4-ldap</i> <i>php7.4-phar php7.4-pspell php7.4-readline php7.4-sysvmsg php7.4-sysvsem</i> </pre> <p>--- stopped here</p> <pre> <i>sudo a2enmod dir env headers mime rewrite setenvif</i> <i>sudo systemctl restart apache2</i> <i>cd /var/www/html</i> <i>sudo rm *</i> <i>sudo wget</i> <a href="https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2"><i>https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2</i></a> <i>sudo tar -xjf owncloud-complete-latest.tar.bz2</i> <i>sudo chown -R www-data. owncloud</i> <i>sudo systemctl restart apache2</i> </pre> <p>2) Check whether the server has been successfully deployed by visiting the public IP of the web server in the web browser in the below format</p> <p style="text-align: center;"><b>&lt;public IP of the application server VM&gt;/owncloud</b></p>
Expected screenshots	<ol style="list-style-type: none"> <li>1) Downloading the script</li> <li>2) Executing the script</li> <li>3) Accessing the application via web browser</li> </ol>

## &lt;Insert screenshot b(1) here: Downloading the script

```

Terminal Shell Edit View Window Help
portal.azure.com
Microsoft Azure
Azure — ubuntu@Application-Server-OP1-VM: /var/www/html — ssh -i Application-Server-OP1-VM_key.pem ubuntu@4.186.58.105 — 192x44
~/Desktop/Azure - zsh ...er-OP1-VM: /var/www/html — ssh -i Application-Server-OP1-VM_key.pem ubuntu@4.186.58.105 — 192x44
melhassnaoui@alumni... NEW ENGLAND INSTITUTE OF TE...
Thu Nov 21 10:50PM
Created symlink /etc/systemd/system/multi-user.target.wants/apache-htcacheclean.service → /lib/systemd/system/apache-htcacheclean.service.
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.8) ...
Scanning processes...
Scanning linux images...
Running kernel seems to be up-to-date.
No services need to be restarted.
No containers need to be restarted.
No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
[ubuntu@Application-Server-OP1-VM:~$ sudo azenmod dir env headers mime rewrite setenvif
Module dir already enabled
Module env already enabled
Enabling module headers
Module headers already enabled
Enabling module rewrite
Module setenvif already enabled
To activate the new configuration, you need to run:
| systemctl restart apache2
[ubuntu@Application-Server-OP1-VM:~$ sudo systemctl restart apache2
[ubuntu@Application-Server-OP1-VM:~$ cd /var/www/html
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo rm *
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo wget https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2
--2024-11-22 03:46:08-- https://download.owncloud.com/(download.owncloud.com)... 167.233.14.167:2a01:4f8:icid:3d1::1
Connecting to download.owncloud.com (download.owncloud.com)|167.233.14.167|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 75639976 (72M) [application/x-bzip2]
Saving to: 'owncloud-complete-latest.tar.bz2'

owncloud-complete-latest.tar.bz2          100%[=====] 72.14M 18.7MB/s   in 3.9s
2024-11-22 03:46:12 (18.7 MB/s) - 'owncloud-complete-latest.tar.bz2' saved [75639976/75639976]

[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo tar -xjf owncloud-complete-latest.tar.bz2
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo chown -R www-data. www-data
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo systemctl restart apache2
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo systemctl restart apache2

```

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## &lt;Insert screenshot b(2) here: Executing the script

```

Terminal Shell Edit View Window Help
portal.azure.com
Microsoft Azure
Azure — ubuntu@Application-Server-OP1-VM: /var/www/html — ssh -i Application-Server-OP1-VM_key.pem ubuntu@4.186.58.105 — 191x44
melhassnaoui@alumni... NEW ENGLAND INSTITUTE OF TE...
Thu Nov 21 11:02PM
Processing triggers for ufw (0.36.1-4ubuntu0.1) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.35-0ubuntu3.8) ...
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.
No services need to be restarted.
No containers need to be restarted.
No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
[ubuntu@Application-Server-OP1-VM:~$ sudo azenmod dir env headers mime rewrite setenvif
Module dir already enabled
Module env already enabled
Enabling module headers
Module headers already enabled
Enabling module rewrite
Module setenvif already enabled
To activate the new configuration, you need to run:
| systemctl restart apache2
[ubuntu@Application-Server-OP1-VM:~$ sudo systemctl restart apache2
[ubuntu@Application-Server-OP1-VM:~$ cd /var/www/html
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo rm *
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo wget https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2
--2024-11-22 03:46:08-- https://download.owncloud.com/(download.owncloud.com)... 167.233.14.167:2a01:4f8:icid:3d1::1
Connecting to download.owncloud.com (download.owncloud.com)|167.233.14.167|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 75639976 (72M) [application/x-bzip2]
Saving to: 'owncloud-complete-latest.tar.bz2'

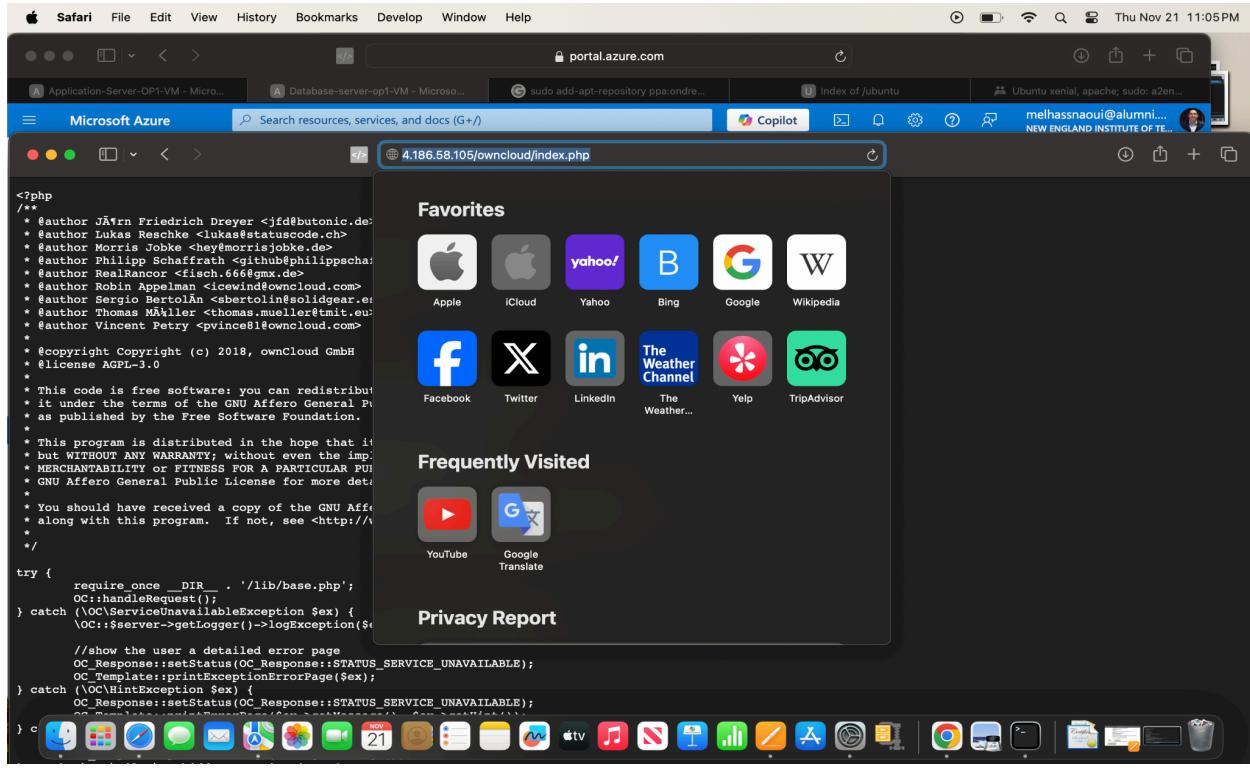
owncloud-complete-latest.tar.bz2          100%[=====] 72.14M 18.7MB/s   in 3.9s
2024-11-22 03:46:12 (18.7 MB/s) - 'owncloud-complete-latest.tar.bz2' saved [75639976/75639976]

[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo tar -xjf owncloud-complete-latest.tar.bz2
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo chown -R www-data. www-data
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo systemctl restart apache2
[ubuntu@Application-Server-OP1-VM:~/var/www/html$ sudo systemctl restart apache2

```

&gt;

<Insert screenshot b(3) here: Accessing the application via web browser



&gt;

### Step 5: Answer the following questions

- 1) Which of the following resources is optional at the time of VM creation?
  - a) Public IP address
  - b) Virtual Network
  - c) Network Interface
  - d) Resource Group

**Answer:** **Public IP address** (Use a public IP address if you want to communicate with the virtual machine from outside the virtual network).

- 2) Network Security group rules are evaluated in order of \_\_\_\_\_ Priority \_\_\_\_\_.
  - a) Priority
  - b) Name (Alphabetical)
  - c) Direction
  - d) Port number

**Answer:** **Priority**

- 3) Which of the following properties may change depending on the size of the VM?
- a) All of these
  - b) Max number of disks
  - c) Memory
  - d) vCPUs

Answer: **All of these**

- 4) Which of the following qualifies as a destination for inbound NSG rules?
- a) NIC
  - b) Virtual Network
  - c) Resource Group
  - d) Virtual machine

Answer: **NIC**

- 5) At which point in a VMs life cycle can it be assigned to an availability set?
- a) At the time of creation
  - b) Only when the VM is running
  - c) At any point of time
  - d) While it is stopped

Answer: **At the time of creation**

- 6) Which of the following would qualify as a point-to-site VPN connection?
- a) Local machine to VPN gateway
  - b) VM to VM within the same virtual network
  - c) VM to VM within the different virtual network
  - d) VM to MySQL deployment within the same virtual network

Answer: **Local machine to VPN gateway**

- 7) Which of the following is not a property of an incoming load balancer request?
- a) Source IP
  - b) Protocol
  - c) Destination port
  - d) Name of virtual network

Answer: **Name of virtual network**

**Grades distribution**

MCQs 7 (1 point each)

Implementation screenshots 13 points (1 point each)

Total 20 points