

Declaration	
<p>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.</p>	
<p>I have read the above statement and agree to these conditions</p>	
I AGREE	<p>Alka Sinha</p> <p><Enter your name above this line to indicate that you are in agreement></p>

Instructions	
<p>Every screenshot requested in this workbook is compulsory and carries 1 point</p>	
<p>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.</p>	
<p>All screenshots must be in the order mentioned under "Expected Screenshots" for every step</p>	
<p>DO NOT WAIT UNTIL THE LAST MINUTE. The program office will not extend the project submission deadline under any circumstances.</p>	
<p>The file should be renamed in the format BATCH_FIRSTNAME_LASTNAME_PROJECT1. For example: PGPCCMAY18_VIJAY_DWIVEDI_PROJECT1.pdf</p>	

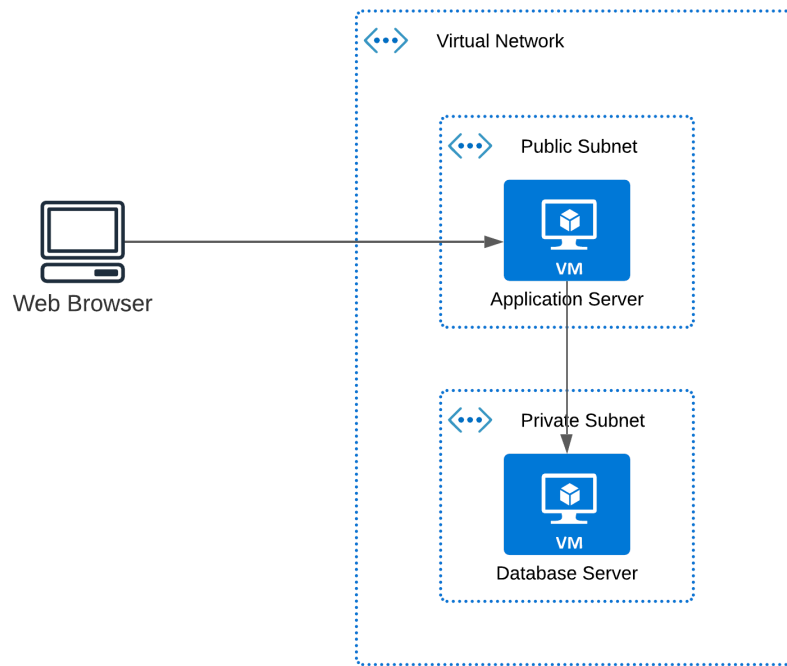
Resource Clean Up	
<p>Cloud is always pay per use model and all resources/services that we consume are chargeable. Cleaning up when you've completed your lab or project is always necessary. This is true whether you're doing a lab or implementing a project at your workplace.</p>	
<p>After completing the lab, make sure to delete each resource created in reverse chronological order.</p>	

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">Search for resource groups using the search bar at the top of the screenClick on CreateEnter a name and region of your choice. Remember to use the same region for all deployments in this exercise.Click on Review +Create and create the resource group <p>2) Navigate to Virtual Networks and click on Create</p> <ol style="list-style-type: none">Name : P1VNETIPv4 CIDR Block : 10.0.0.0/16Delete the default created subnet and add the following subnets<ol style="list-style-type: none">Public subnet with CIDR 10.0.1.0/24Private subnet with CIDR 10.0.2.0/24The rest of the options can be set to the default valuesClick on Create to create the virtual network
Expected screenshots	<ol style="list-style-type: none">Created virtual network with properties visibleProperties of public subnetProperties of private subnet

Virtual Network

Home > rgforproj1 | Deployments >

P1VNET-1708720155029 | Overview

Deployment

Search

Delete Cancel Redeploy Download Refresh

✓ Your deployment is complete

Deployment name : P1VNET-1708720155029 Start time : 2/23/2024, 12:29:18 PM
Subscription : Azure subscription 1 Correlation ID : 0eb12faa-2a58-44ed-b331-32262722...
Resource group : rgforproj1

Deployment details

Resource	Type	Status	Operation details
P1VNET	Virtual network	OK	Operation details

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 >](#)

Properties of public subnet

Microsoft Azure Upgrade Search resources, services, and docs (G+/)

Home > Virtual networks > P1VNET

Virtual networks

Default Directory (alkasinha2011@gmail.onmicrosof...

+ Create Manage view ...

Filter for any field...

Name ↑↓

P1VNET

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

Settings
Address space
Connected devices
Subnets
Bastion
DDoS protection
Firewall
Microsoft Defender for Cloud
Network manager

P1VNET | Subnets

Virtual network

Search

+ Subnet + Gateway sub

Search subnets

Name ↑↓	IPv4
publicsub	10.0
privatesub	10.0

publicsub

P1VNET

Name publicsub Copy to clipboard

Subnet address range * 10.0.1.0/24 10.0.1.0 - 10.0.1.255 (251 + 5 Azure reserved addresses)

☐ Add IPv6 address space

NAT gateway None

Network security group None

Route table None

SERVICE ENDPOINTS

Create service endpoint policies to allow traffic to specific azure resources from your virtual network over service endpoints. [Learn more](#)

Save Cancel Give feedback

Properties of private subnet

Microsoft Azure Upgrade Search resources, services, and docs (G+/)

Home > Virtual networks > P1VNET

Virtual networks

Default Directory (alkasinha2011@gmail.onmicrosof...

+ Create Manage view ...

Filter for any field...

Name ↑↓

P1VNET

Overview
Activity log
Access control (IAM)
Tags
Diagnose and solve problems

Settings
Address space
Connected devices
Subnets
Bastion
DDoS protection
Firewall
Microsoft Defender for Cloud
Network manager

P1VNET | Subnets

Virtual network

Search

+ Subnet + Gateway sub

Search subnets

Name ↑↓	IPv4
publicsub	10.0
privatesub	10.0

privatesub

P1VNET

Name privatesub Copy to clipboard

Subnet address range * 10.0.2.0/24 10.0.2.0 - 10.0.2.255 (251 + 5 Azure reserved addresses)

☐ Add IPv6 address space

NAT gateway None

Network security group None

Route table None

SERVICE ENDPOINTS

Create service endpoint policies to allow traffic to specific azure resources from your virtual network over service endpoints. [Learn more](#)

Save Cancel Give feedback

Step number

b

Step name

Creation of NAT Gateway

Instructions

- 1) Navigate to NAT Gateways
- 2) Click on "Create"
 - a) Use the resource group created above and the same region it is deployed in
 - 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
 - c) When asked to select the subnet, select the private subnet created above
 - d) Click on Create
- 3) Navigate to virtual network and select the network created above
- 4) Select the private subnet created under Subnets in the menu on the left of the screen.
- 5) Under NAT Gateway, select the gateway created just now and select Save.

Expected screenshots

- 1) Created NAT gateway

NAT Gateway

Microsoft Azure | Upgrade | Search resources, services, and docs (G+)

Home > Microsoft.NatGateway-20240226135432 | Overview

Deployment

Search << Delete Cancel Redeploy Download Refresh

Overview

Inputs

Outputs

Template

✓ Your deployment is complete

Deployment name : Microsoft.NatGateway-2024022613... Start time : 2/26/2024, 1:57:24 PM

Subscription : Azure subscription 1 Correlation ID : 48c326cc-1c36-4a6f-9aa0-f1631e61...

Resource group : rgforproj1

Deployment details

Resource	Type	Status	Operation details
VirtualNetworkAss	Deployment	OK	Operation details
natgproj1	NAT gateway	OK	Operation details
proj1ip	Public IP Prefix	OK	Operation details
proj1pip	Public IP address	OK	Operation details

Next steps

Cost management

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Set up cost alerts >

Microsoft Defender for Cloud

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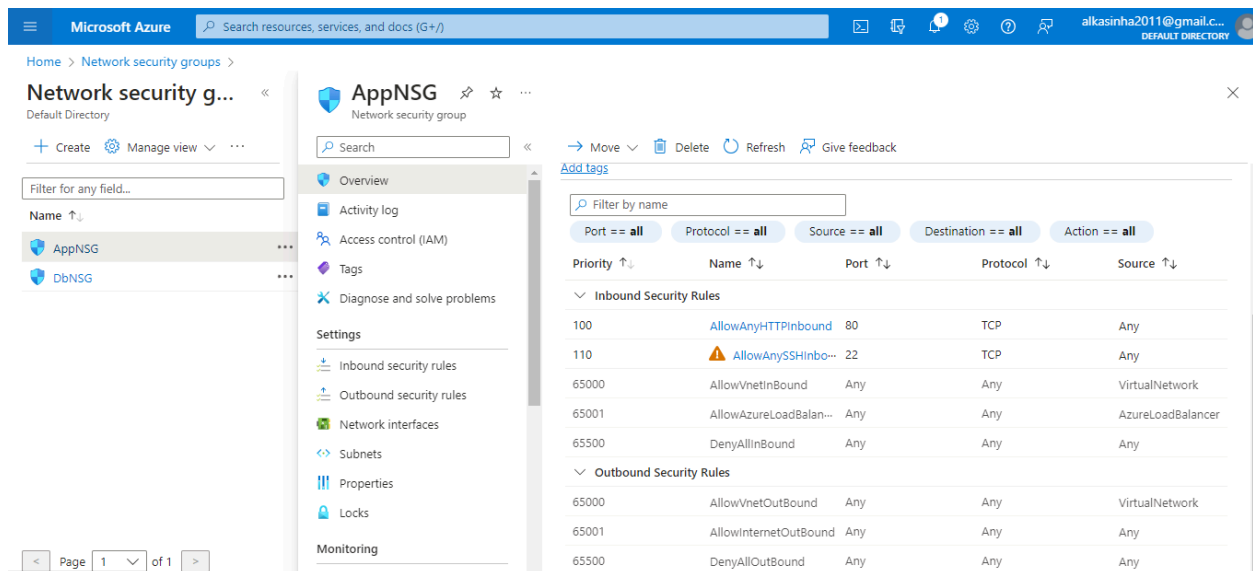
Azure experts are service provider partners

Step number

c

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

AppNSG security rules



Microsoft Azure

Home > Network security groups > Network security g...

Default Directory

AppNSG

Network security group

Filter for any field...

Name ↑

AppNSG

DbNSG

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Inbound security rules

Outbound security rules

Network interfaces

Subnets

Properties

Locks

Monitoring

Page 1 of 1

Priority	Name	Port	Protocol	Source
100	AllowAnyHTTPInbound	80	TCP	Any
110	AllowAnySSHInbound	22	TCP	Any
65000	AllowVnetInBound	Any	Any	VirtualNetwork
65001	AllowAzureLoadBalancerInBound	Any	Any	AzureLoadBalancer
65500	DenyAllInBound	Any	Any	Any
65000	AllowVnetOutBound	Any	Any	VirtualNetwork
65001	AllowInternetOutBound	Any	Any	Any
65500	DenyAllOutBound	Any	Any	Any

DbNSG security rules

Microsoft Azure

Search resources, services, and docs (G+)

alkasinha2011@gmail.c...

DEFAULT DIRECTORY

Home > Network security groups >

Network security g...
Default Directory

+ Create

Manage view

...

Filter for any field...

Name ↑↓

AppNSG

DbNSG

DbNSG

Network security group

Search

Move

Delete

Refresh

Give feedback

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Inbound security rules

Outbound security rules

Network interfaces

Subnets

Properties

Locks

Monitoring

Subscription ID
3e05ef44-4622-4b4e-ab15-a690f32398a0

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

Filter by name

Port == all Protocol == all Source == all Destination == all Action == all

Priority ↑↓	Name ↑↓	Port ↑↓	Protocol ↑↓	Source ↑↓
Inbound Security Rules				
100	AllowAnyHTTPI inbound	80	TCP	Any
110	AllowAnyMySQL...	3306	TCP	Any
65000	AllowVnetInBound	Any	Any	VirtualNetwork
65001	AllowAzureLoadBalan...	Any	Any	AzureLoadBalancer
65500	DenyAllInBound	Any	Any	Any
Outbound Security Rules				

< Page 1 of 1 >

Step 2 : Instance Creation

Step number	a
Step name	Creation of Application server
Instructions	<ol style="list-style-type: none">1) Navigate to Virtual machines2) Click on "Create"3) Create a virtual machine with the following properties<ol style="list-style-type: none">a) Resource Group: As Created aboveb) Region: Same as used beforec) Image: Ubuntu 22.04 LTSd) Authentication type: SSH public keye) Username: ubuntuf) Create a new key pairg) Inbound rules: Allow 22 and 80h) Virtual Network : P1VNETi) Subnet : Public subnet create abovej) Create a new public IPk) Network security group: Select Advanced and then pick AppNSG from the dropdownl) The rest of the options can be set to their default Values
Expected screenshots	<ol style="list-style-type: none">1) Created Application server Overview page

Application server

Microsoft Azure

Search resources, services, and docs (G+)

Home >

CreateVm-canonical.0001-com-ubuntu-server-jammy-2-20240227203232 | Overview

Deployment

Search

Delete Cancel Redeploy Download Refresh

Overview

Inputs

Outputs

Template

✓ Your deployment is complete

Deployment name: CreateVm-canonical.0001-com-ubuntu-server-... Start time: 2/27/2024, 8:35:56 PM
Subscription: Azure subscription 1 Correlation ID: 47e3360e-f343-4232-abb6-e5
Resource group: rgforproj1

Deployment details

Resource	Type	Status	Operation details
✓ appvm	Microsoft.Compute/virtu...	OK	Operation details
✓ appvm485_z1	Microsoft.Network/netw...	Created	Operation details
✓ appvm-ip	Microsoft.Network/publi...	OK	Operation details

Next steps

[Setup auto-shutdown](#) Recommended

[Monitor VM health, performance and network dependencies](#) Recommended

[Run a script inside the virtual machine](#) Recommended

Cost Management

Get notified to stay within your budget and prevent unexpected charges on your bill.

[Set up cost alerts >](#)

Microsoft Defender for Cloud

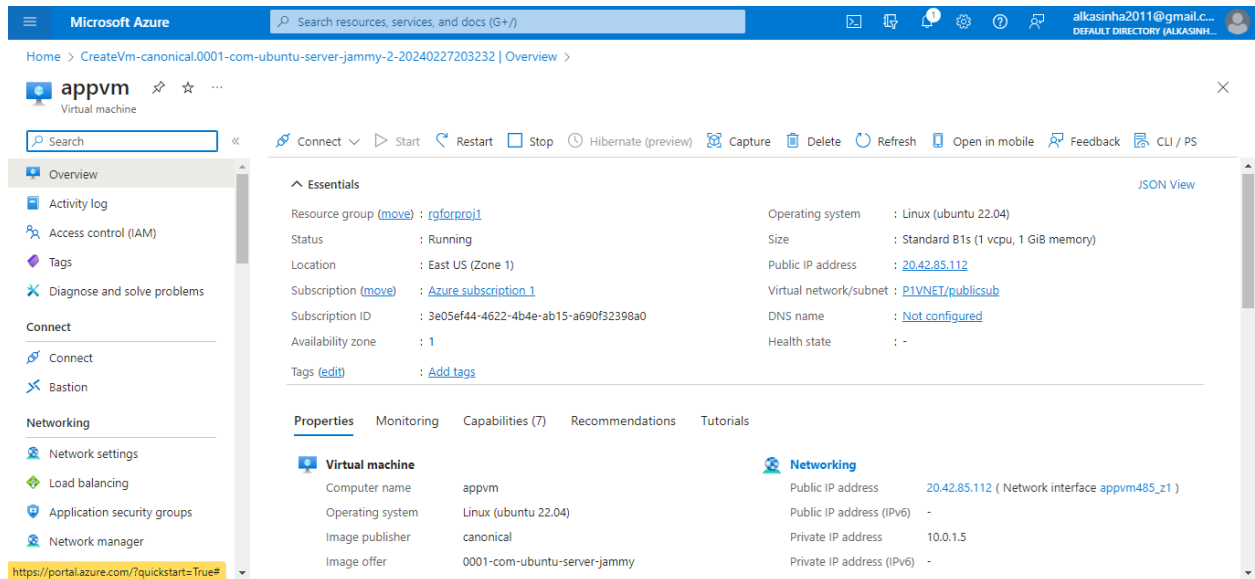
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Step number b

Step name Creation of Database server

- Instructions 1) Create a virtual machine with the following properties
- a) Resource Group: As Created above
 - b) Region: Same as used before
 - c) Image : Ubuntu 20.04 LTS
 - d) Authentication type: SSH public key
 - e) Username: ubuntu
 - f) Create a new key pair (or reuse the one created for the application server)
 - g) Inbound rules: Allow 22 and 80
 - h) Virtual Network : P1VNET
 - i) Subnet : Private subnet create above
 - j) No public IP is required here
 - k) Network security group: Select Advanced and then pick DbNSG from the dropdown
 - l) The rest of the options can be set to their default Values

Expected screenshots 1) Created Database server overview page

Database server VM

Microsoft Azure

Search resources, services, and docs (G+J)

alkasinha2011@gmail.c...
DEFAULT DIRECTORY (ALKASINH...

Home >

dbvm

Virtual machine

Search

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

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Connect

Connect

Bastion

Networking

Network settings

Load balancing

Application security groups

Network manager

Settings

Essentials

Resource group (move) : [rgforproj1](#)

Status : Running

Location : East US (Zone 1)

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

Subscription ID : 3e05ef44-4622-4b4e-ab15-a690f32398a0

Availability zone : 1

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

Operating system : Linux (ubuntu 20.04)

Size : Standard B1s (1 vcpu, 1 GiB memory)

Public IP address : -

Virtual network/subnet : -

DNS name : -

Health state : -

JSON View

Properties Monitoring Capabilities (7) Recommendations Tutorials

Virtual machine

Computer name : dbvm

Operating system : Linux (ubuntu 20.04)

Image publisher : canonical

Image offer : 0001-com-ubuntu-server-focal

Networking

Public IP address : -

Public IP address (IPv6) : -

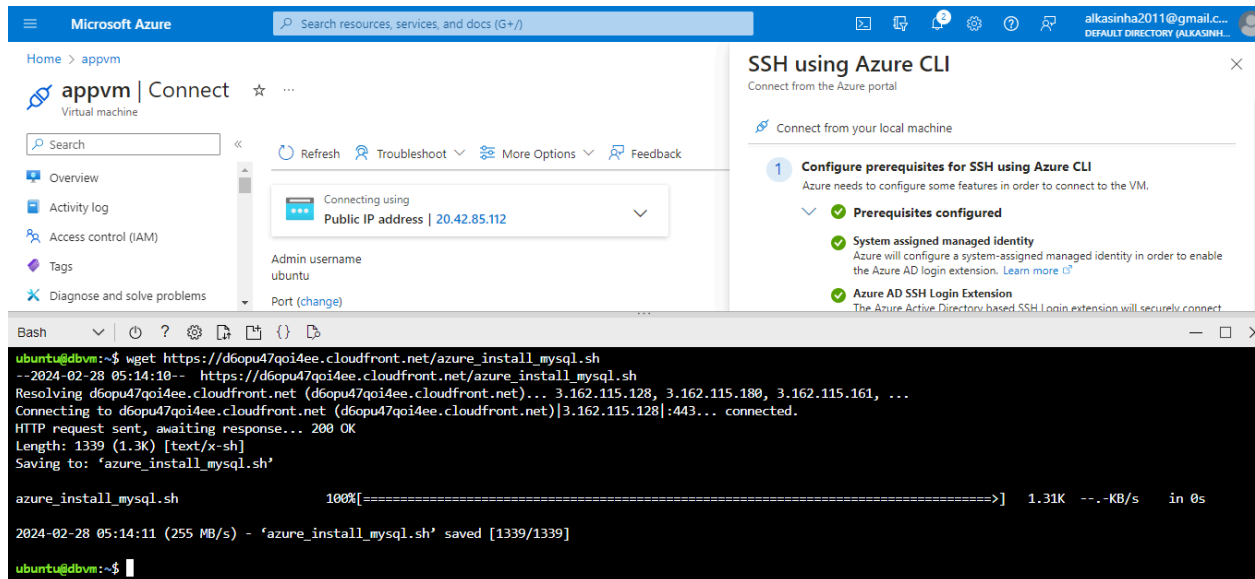
Private IP address : -

Private IP address (IPv6) : -

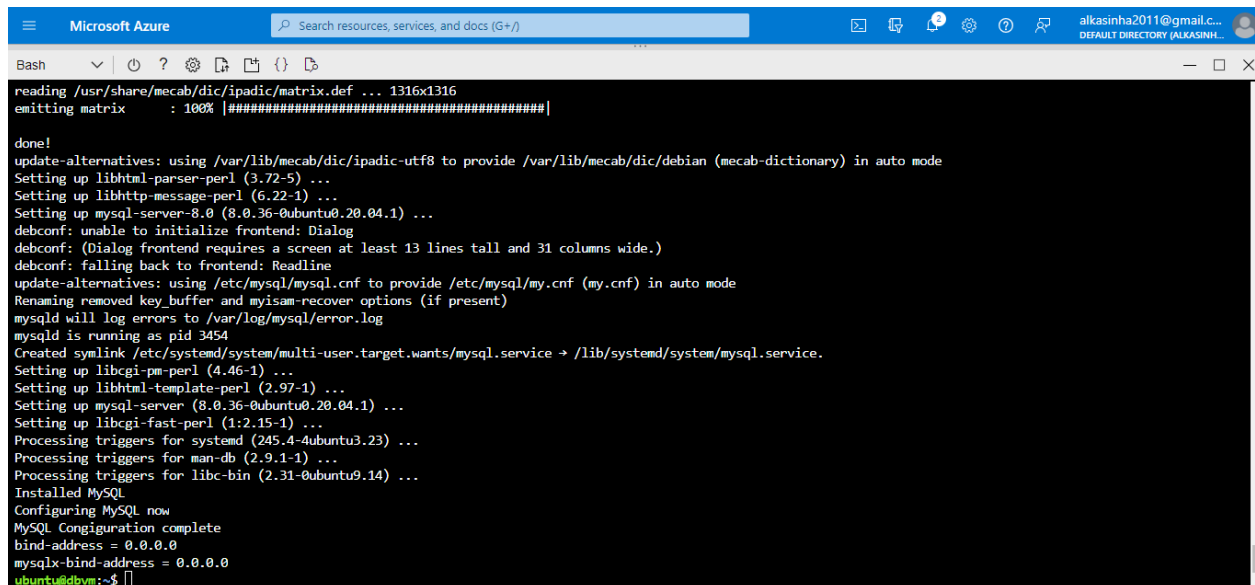
Step 4: Application and Database Installation and Testing

Step number	a
Step name	Installation and configuration of MySQL
Instructions	<p>1) Copy the database pem file into the application server using the below command <code>scp -i <application server pem file> <database server pem file> ubuntu@<application server public IP>:/home/ubuntu</code></p> <p>2) Log into the application server using your SSH client of choice</p> <p>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 <database server pem file> ubuntu@<private IP of database server></code></p> <p>Note : Use your existing knowledge of SSH and copying files to cloud VMs to perform the above SSH and SCP operations</p> <p>4) Enter the following commands to install and configure MySQL on the database server <code>sudo apt update</code> <code>wget https://d6opu47qoi4ee.cloudfront.net/azure_install_mysql.sh</code> <code>sudo chmod 700 azure_install_mysql-v2.sh</code> <code>sudo apt install dos2unix</code> <code>sudo dos2unix ./azure_install_mysql-v2.sh</code> <code>sudo ./azure_install_mysql-v2.sh</code></p> <p>5) Type <code>exit</code> to exit the database server and go back to the application server</p>
Expected screenshot	<p>1) Downloading of the provided script</p> <p>2) Executing the script</p>
s	

Downloading the script



Executing Script



Step number

b

Step name

Installation and configuration of Owncloud

Instructions

1) Enter the following commands after logging into the application server via SSH to install and configure Owncloud
Learning Tip: 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.

```
sudo apt update
sudo add-apt-repository ppa:ondrej/php -y
sudo apt update
```

Note : The following 4 lines are a single command

```
sudo apt install -y apache2 libapache2-mod-php7.4 mariadb-server openssl redis-server
wget php7.4 php7.4-imagick php7.4-common php7.4-curl php7.4-gd php7.4-imap
php7.4-intl php7.4-json php7.4-mbstring php7.4-gmp php7.4-bcmath php7.4-mysql
php7.4-ssh2 php7.4-xml php7.4-zip php7.4-apcu php7.4-redis php7.4-ldap
php-phpseclib
```

```
sudo a2enmod dir env headers mime rewrite setenvif
sudo systemctl restart apache2
cd /var/www/html
sudo rm *
sudo wget
https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2
sudo tar -xjf owncloud-complete-latest.tar.bz2
sudo chown -R www-data. owncloud
sudo systemctl restart apache2
```

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

<public IP of the application server VM>/owncloud

Expected	1) Downloading the script
screenshots	2) Executing the script
	3) Accessing the application via web browser

Downloading the script

```
Microsoft Azure Search resources, services, and docs (G+/) alkasinha2011@gmail.c...  
DEFAULT DIRECTORY (ALKASINH...  
Recent Favorite  
Bash ? ? ? ? ? ? ? ? ? ?  
Module setenvif already enabled  
To activate the new configuration, you need to run:  
systemctl restart apache2  
ubuntu@appvm:~$ sudo systemctl restart apache2  
ubuntu@appvm:~$ cd /var/www/html  
ubuntu@appvm:/var/www/html$ sudo rm *  
ubuntu@appvm:/var/www/html$ sudo wget  
wget: missing URL  
Usage: wget [OPTION]... [URL]...  
  
Try 'wget --help' for more options.  
ubuntu@appvm:/var/www/html$ https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
bash: https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2: No such file or directory  
ubuntu@appvm:/var/www/html$ https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
bash: https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2: No such file or directory  
ubuntu@appvm:/var/www/html$ sudo wget https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
--2024-02-28 05:35:39-- https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
Resolving download.owncloud.com (download.owncloud.com)... 167.233.14.167, 2a01:4f8:1c1d:3d1::1  
Connecting to download.owncloud.com (download.owncloud.com)[167.233.14.167]:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 76010860 (72M) [application/x-bzip2]  
Saving to: 'owncloud-complete-latest.tar.bz2'  
  
owncloud-complete-latest.tar.bz2 100%[=====>] 72.49M 23.4MB/s in 3.1s  
  
2024-02-28 05:35:43 (23.4 MB/s) - 'owncloud-complete-latest.tar.bz2' saved [76010860/76010860]  
ubuntu@appvm:/var/www/html$
```

Executing the script

```
Microsoft Azure Search resources, services, and docs (G+/) alkasinha2011@gmail.c...  
DEFAULT DIRECTORY (ALKASINH...  
Recent Favorite  
Bash ? ? ? ? ? ? ? ? ? ?  
ubuntu@appvm:~$ sudo systemctl restart apache2  
ubuntu@appvm:~$ cd /var/www/html  
ubuntu@appvm:/var/www/html$ sudo rm *  
ubuntu@appvm:/var/www/html$ sudo wget  
wget: missing URL  
Usage: wget [OPTION]... [URL]...  
  
Try 'wget --help' for more options.  
ubuntu@appvm:/var/www/html$ https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
bash: https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2: No such file or directory  
ubuntu@appvm:/var/www/html$ https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
bash: https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2: No such file or directory  
ubuntu@appvm:/var/www/html$ sudo wget https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
--2024-02-28 05:35:39-- https://download.owncloud.com/server/stable/owncloud-complete-latest.tar.bz2  
Resolving download.owncloud.com (download.owncloud.com)... 167.233.14.167, 2a01:4f8:1c1d:3d1::1  
Connecting to download.owncloud.com (download.owncloud.com)[167.233.14.167]:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 76010860 (72M) [application/x-bzip2]  
Saving to: 'owncloud-complete-latest.tar.bz2'  
  
owncloud-complete-latest.tar.bz2 100%[=====>] 72.49M 23.4MB/s in 3.1s  
  
2024-02-28 05:35:43 (23.4 MB/s) - 'owncloud-complete-latest.tar.bz2' saved [76010860/76010860]  
  
ubuntu@appvm:/var/www/html$ sudo tar -xjf owncloud-complete-latest.tar.bz2  
ubuntu@appvm:/var/www/html$ sudo chown -R www-data:owncloud  
ubuntu@appvm:/var/www/html$ sudo systemctl restart apache2  
ubuntu@appvm:/var/www/html$
```

Accessing browser



Create an admin account

Username

Password



Storage & database ▾

Data folder

Configure the database

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- a) Public IP address

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

Answer: a) 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: a) 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: b) Virtual network

- 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: a) 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- a) 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- d) Name of virtual network

Grades distribution	
MCQs	7 (1 point each)
Implementation screenshots	13 points (1 point each)
Total	20 points