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

Instructions
Every screenshot requested in this workbook is compulsory and carries 0.5 points
Your Azure account ID must be clearly visible in every screenshot using the Azure portal; 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 BATCH_FIRSTNAME_LASTNAME_PROJECT1. For example: PGPCCMAY18_VIJAY_DWIVEDI_PROJECT1.pdf

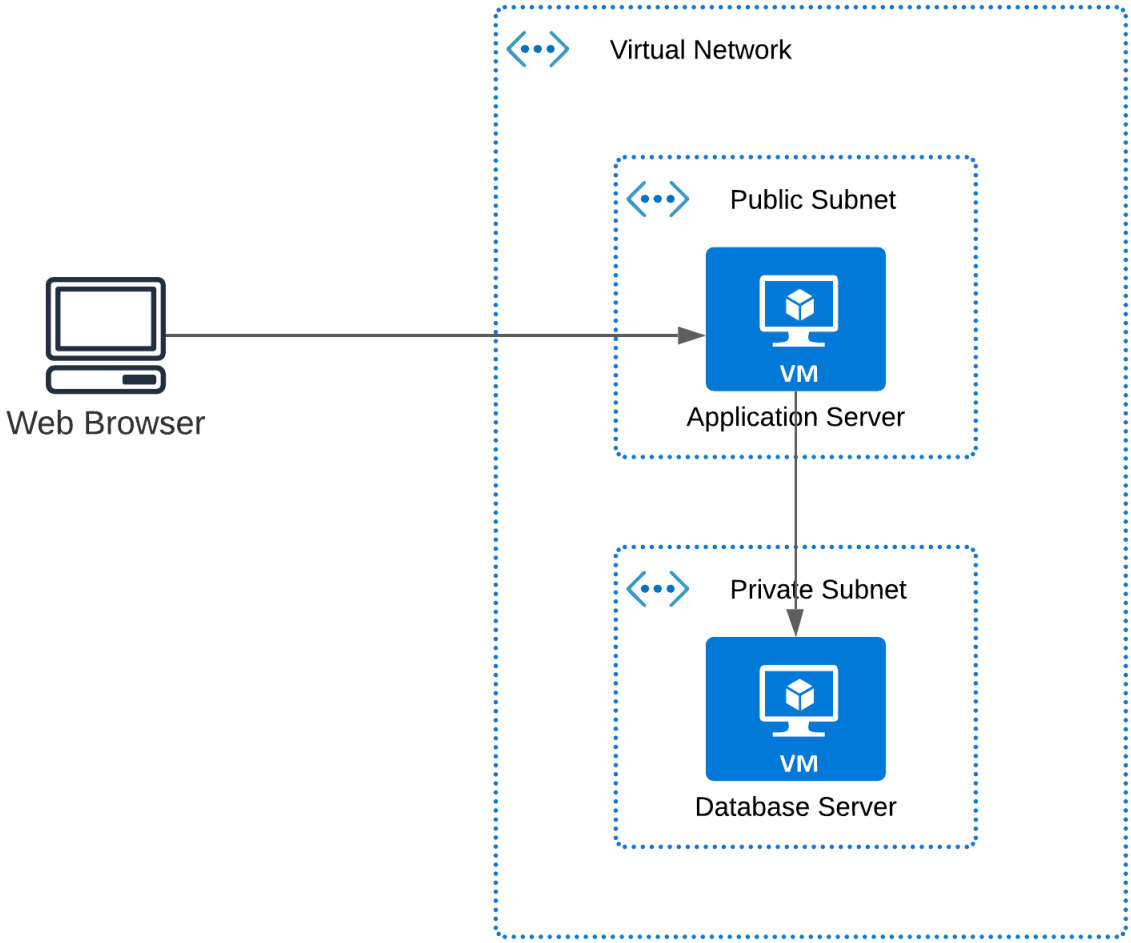
Resource Clean Up
Cloud is always pay per use model and all resources/services that we consume are chargeable. Cleaning up when you've completed your lab or project is always necessary. This is true whether you're doing a lab or implementing a project at your workplace.
After completing the lab, make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

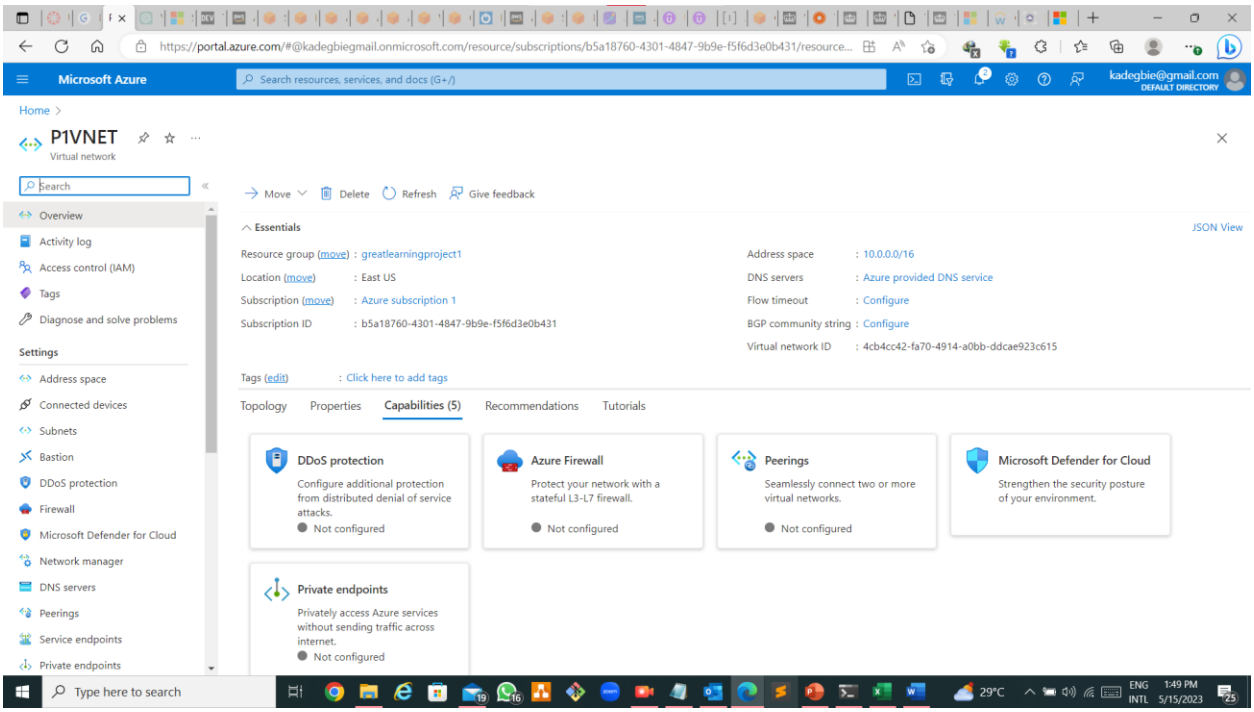


Architecture Implementation	
1	Implement 2 different subnets (one public and the other private) in a virtual network
2	Install and configure MySQL on an Ubuntu 18.04 virtual machine on the private subnet using the instructions provided. (Hint: Use a bastion host and a NAT gateway)
3	Install and configure OwnCloud on an Ubuntu 18.04 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

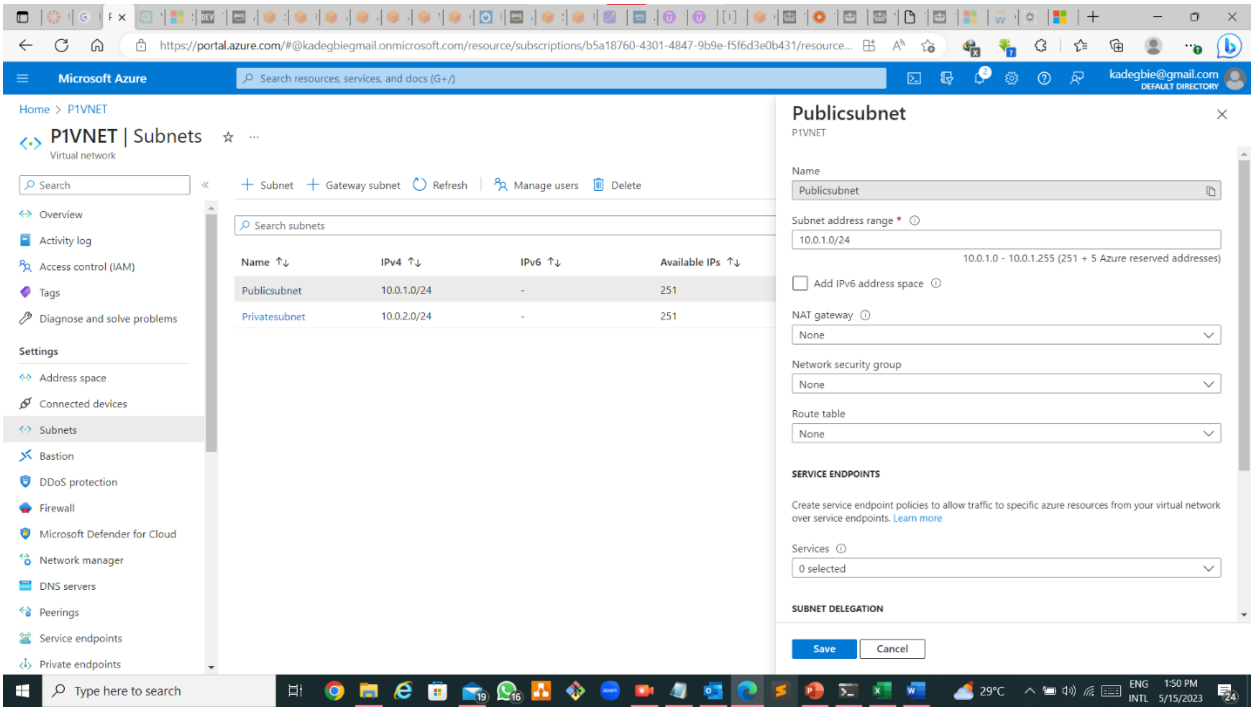
Step 1: VPC and Subnet Creation

Step number	a
Step name	Creation of Virtual Network
Instructions	1) Create a new resource group. You need to use this resource group to deploy all the resources in this exercise a) Search for resource groups using the search bar at the top of the screen b) Click on Create c) Enter a name and region of your choice. Remember to use the same region for all deployments in this exercise. d) Click on Review +Create and create the resource group 2) Navigate to Virtual Networks and click on Create a) Name : P1VNET b) IPv4 CIDR Block : 10.0.0.0/16 c) Delete the default created subnet and add the following subnets i) Public subnet with CIDR 10.0.1.0/24 ii) Private subnet with CIDR 10.0.2.0/24 d) The rest of the options can be set to the default values e) Click on Create to create the virtual network
Expected screenshots	1) Created virtual network with properties visible 2) Properties of public subnet 3) Properties of private subnet

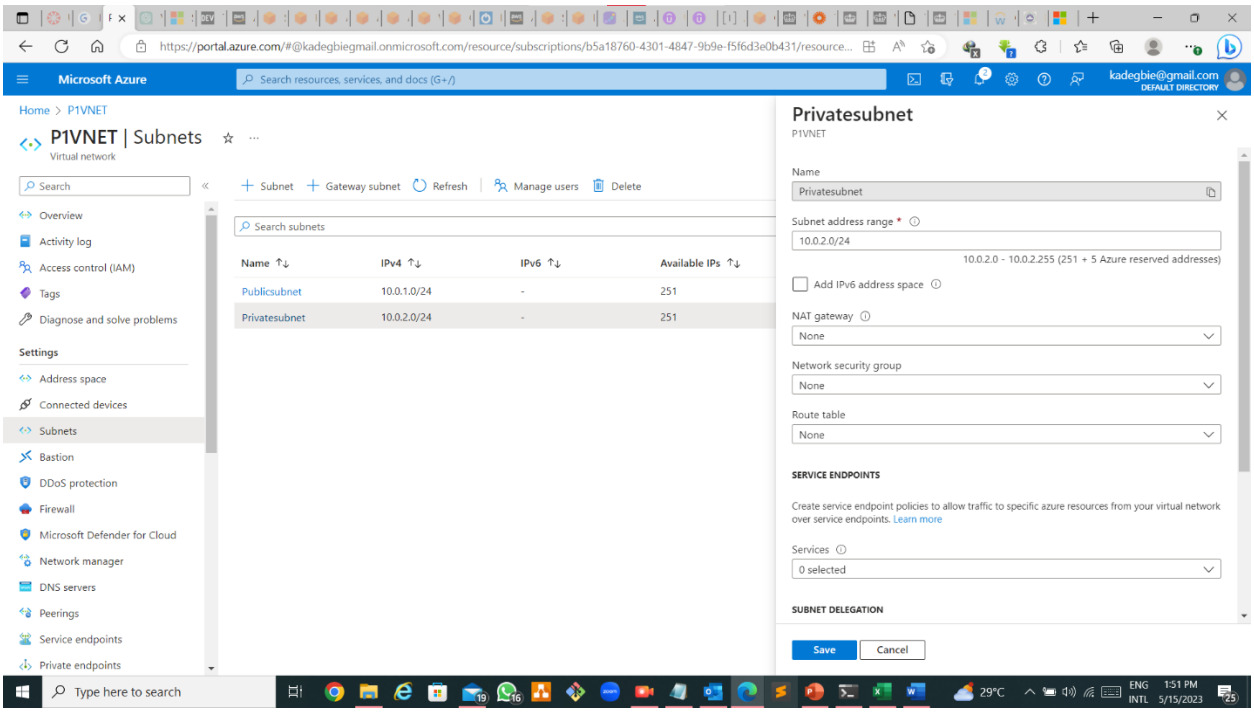
1. CREATED VIRTUAL NETWORK WITH ITS PROPERTIES



2. CREATED PUBLIC SUBNET WITH ITS PROPERTIES

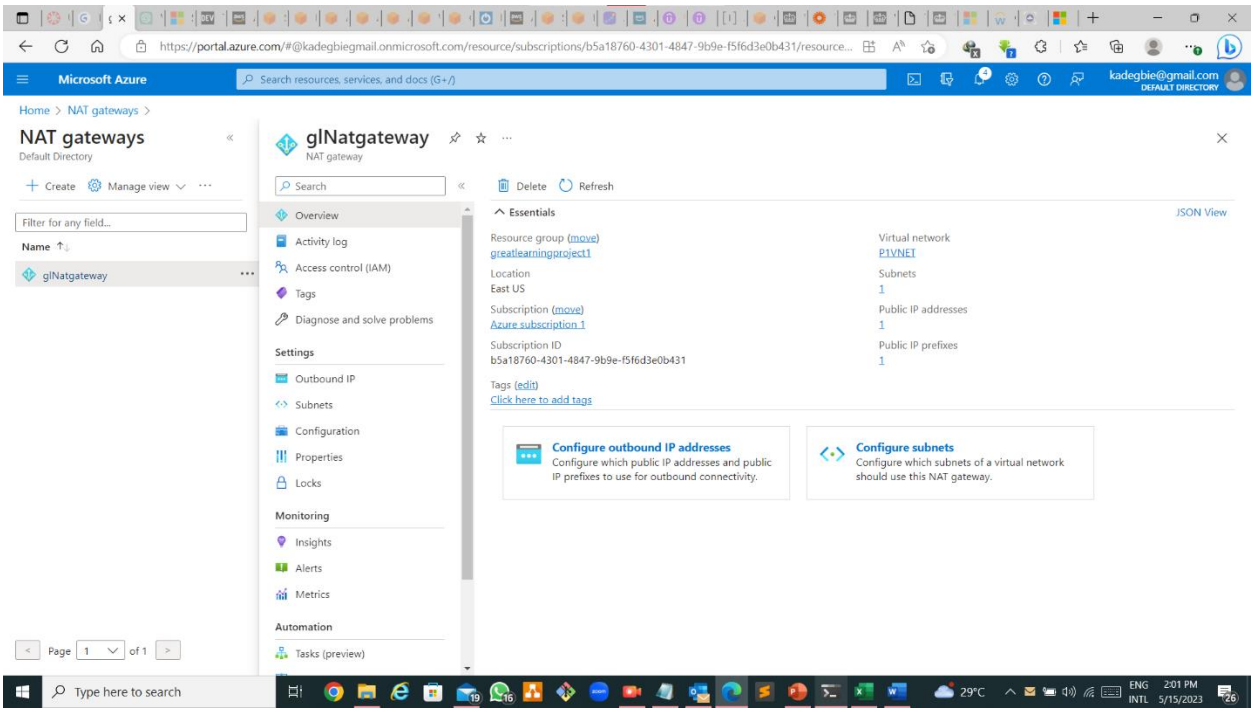


3. CREATED PRIVATE SUBNET WITH ITS PROPERTIES



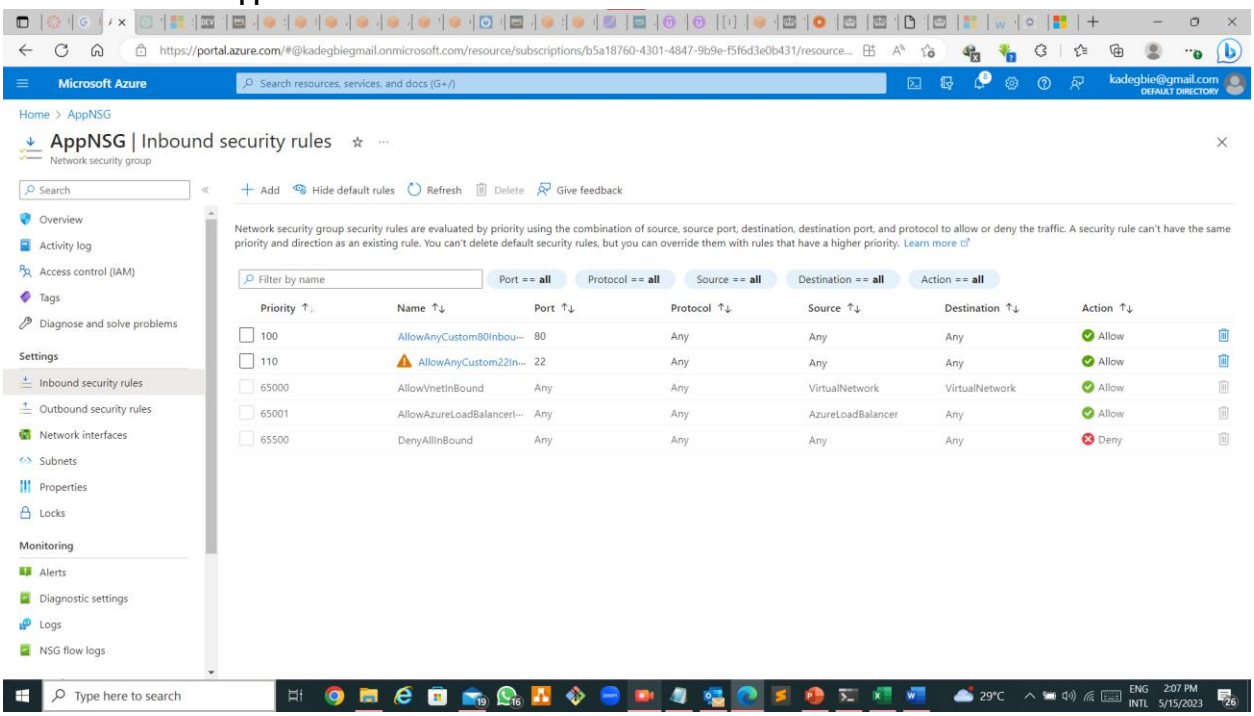
Step number	B
Step name	Creation of NAT Gateway
Instructions	1) Navigate to NAT Gateways 2) Click on "Create" a) Use the resource group created above and the same region it is deployed in b) Use a new public IP and public IP prefix for the NAT gateway. Ensure that the public IP prefix has a CIDR size 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

4. CREATED NAT GATEWAY

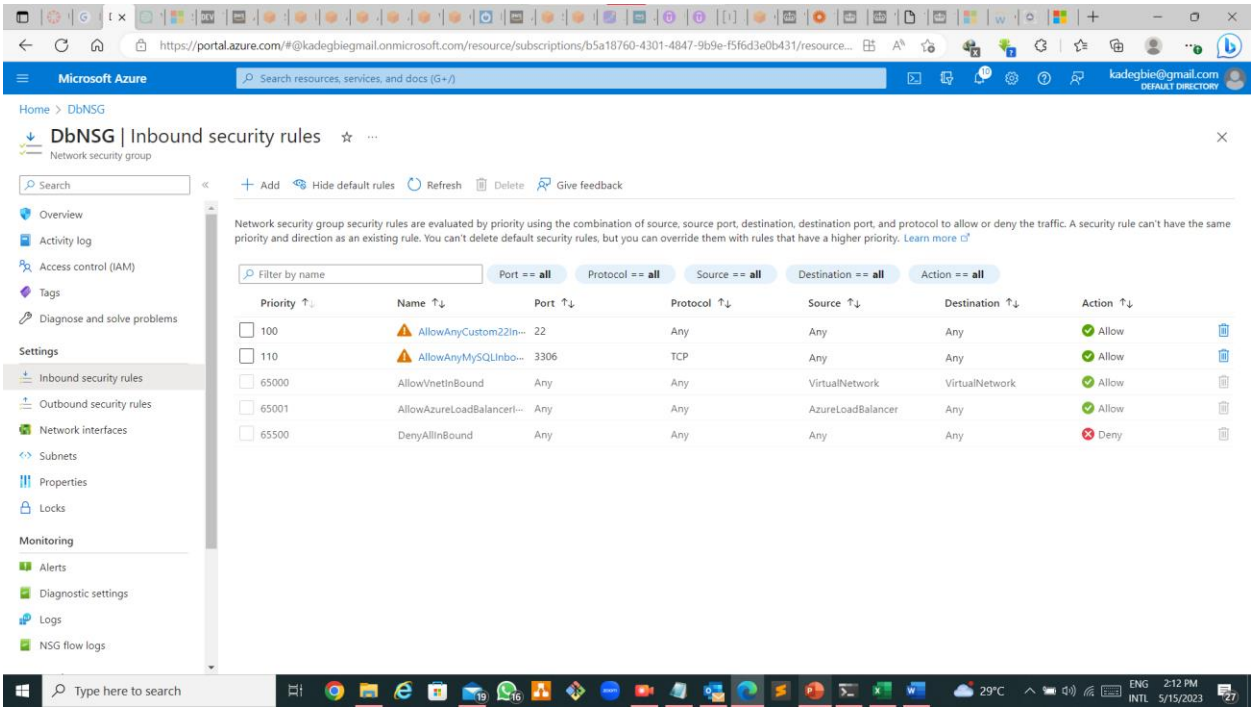


Step number	c
Step name	Creation and configuration of Network security groups
Instructions	1) Navigate to Network Security Groups 2) Click on Create a) Resource Group: Use the one previously created b) Enter the name: AppNSG c) Region: Same as the resource group 4) Click on Create 5) Create another security 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	1) AppNSG security rules 2) DbNSG security rules

5. CREATED AppNSG WITH ITS SECURITY RULES



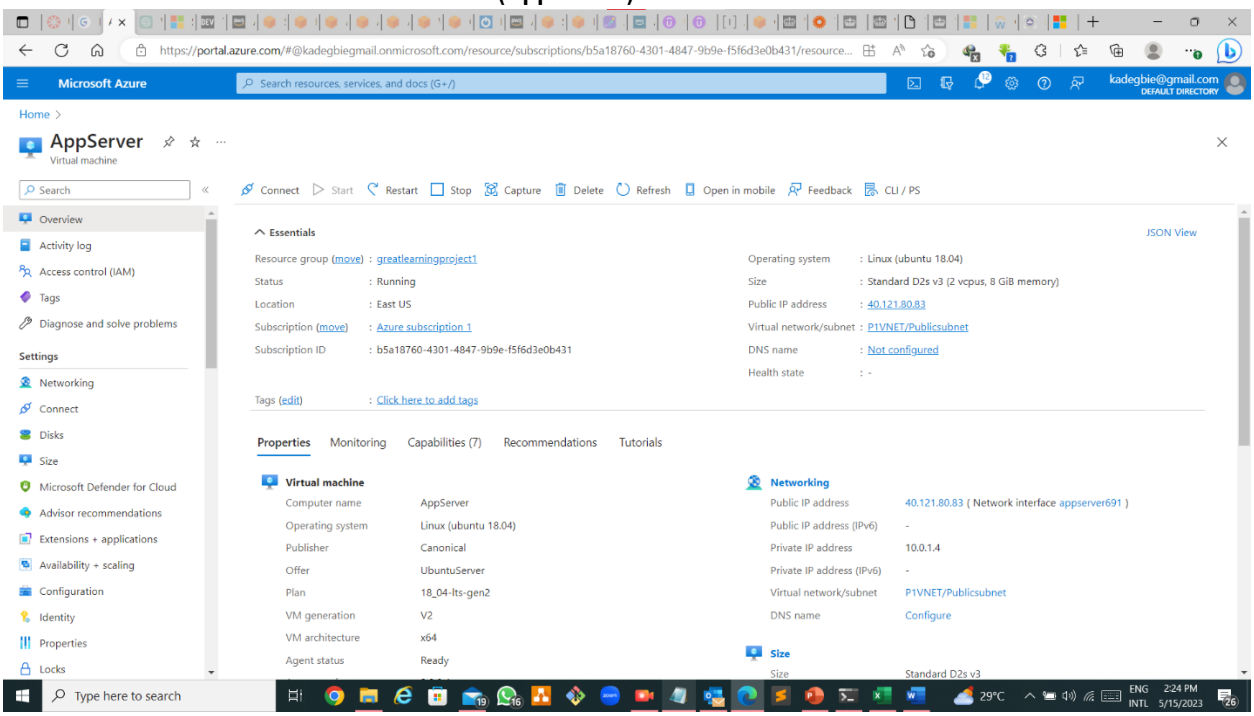
6. CREATED DbNSG WITH ITS SECURITY RULES



Step 2 : Instance Creation

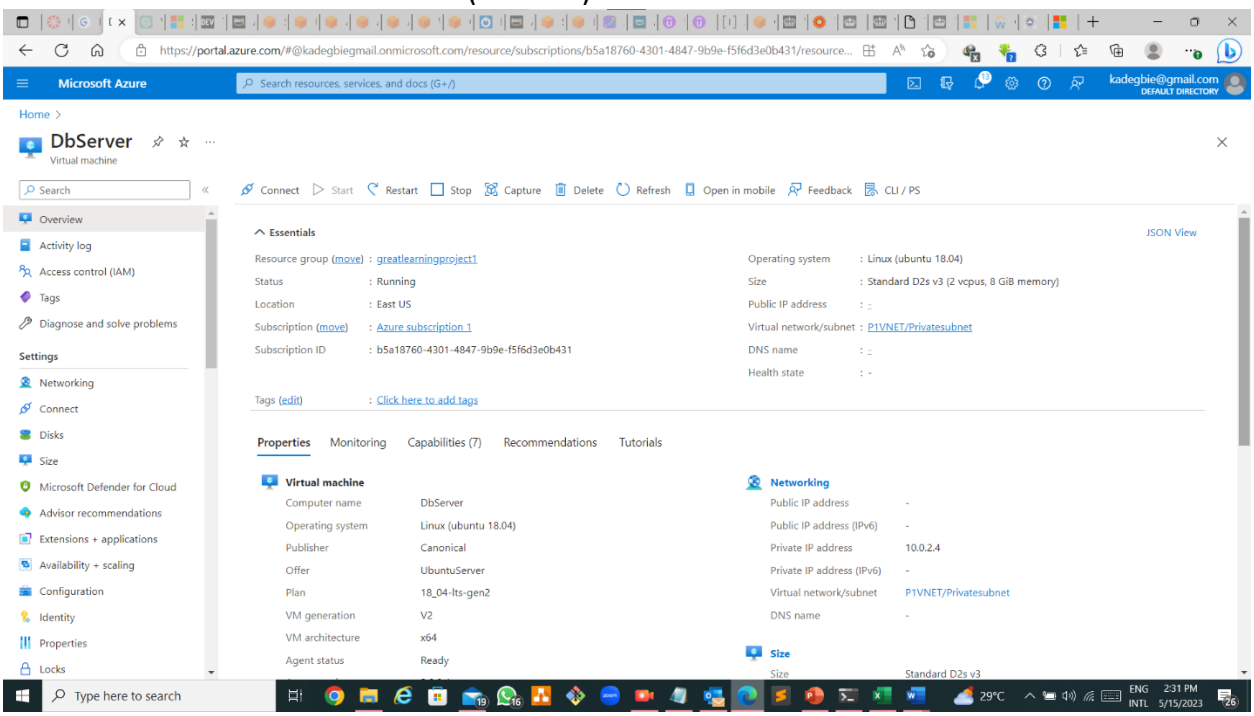
Step number	a
Step name	Creation of Application server
Instructions	1) Navigate to Virtual machines 2) Click on "Create" 3) Create a virtual machine with the following properties a) Resource Group: As Created above b) Region: Same as used before c) Image: Ubuntu 18.04 LTS d) Authentication type: SSH public key e) Username: ubuntu f) Create a new key pair g) Inbound rules: Allow 22 and 80 h) Virtual Network : P1VNET i) Subnet : Public subnet create above j) Create a new public IP k) Network security group: Select Advanced and then pick AppNSG from the dropdown l) The rest of the options can be set to their default Values
Expected screenshots	1) Created Application server Overview page

7. CREATED APPLICATION SERVER (AppServer) OVERVIEW PAGE



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 18.04 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

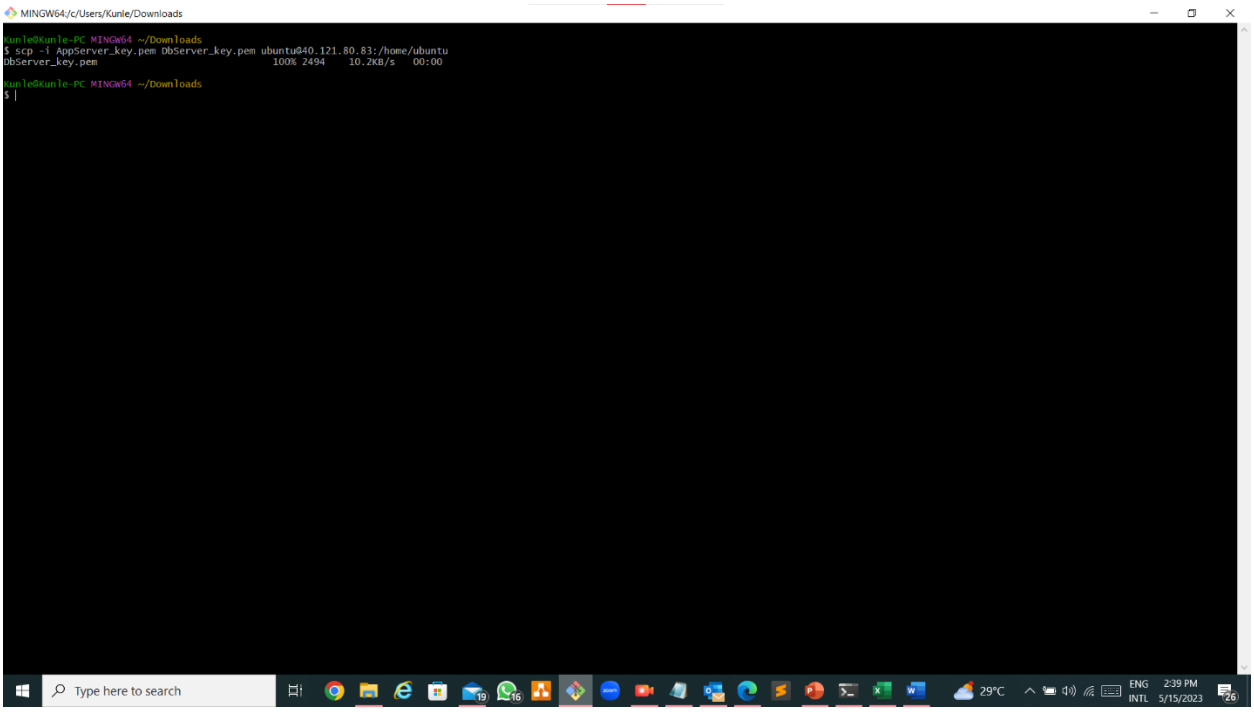
8. CREATED DATABASE SERVER (DbServer) OVERVIEW PAGE



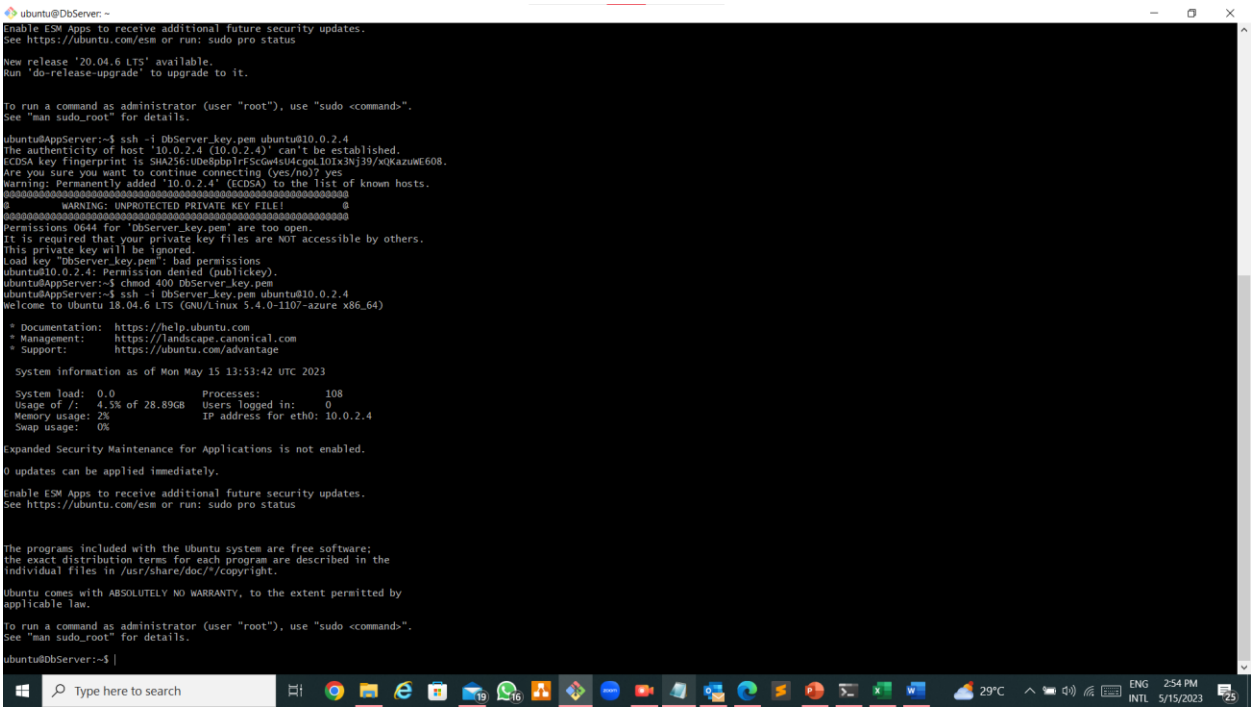
Step 4: Application and Database Installation and Testing

Step number	A
Step name	Installation and configuration of MySQL
Instructions	1) Copy the database pem file into the application server using the below command *scp -i <application server pem file> <database server pem file > ubuntu@<application server public IP>:/home/ubuntu* 2) Log into the application server using your SSH client of choice 3) From the application server, log into the database server using the pem file copied in step 1and the private IP address of the database server with the following command *ssh -i <database server pem file> ubuntu@<private IP of database server>* 4) Enter the following commands to install and configure MySQL on the database server *sudo apt update* *sudo apt install dos2unix -y* *wget https://d6opu47qoi4ee.cloudfront.net/azure_install_mysql.sh* *sudo chmod 700 azure_install_mysql.sh* *sudo dos2unix azure_install_mysql.sh* *sudo ./azure_install_mysql.sh* 5) Type *exit* to exit the database server and go back to the application server
Expected screenshots	1) Downloading of the provided script 2) Executing the script

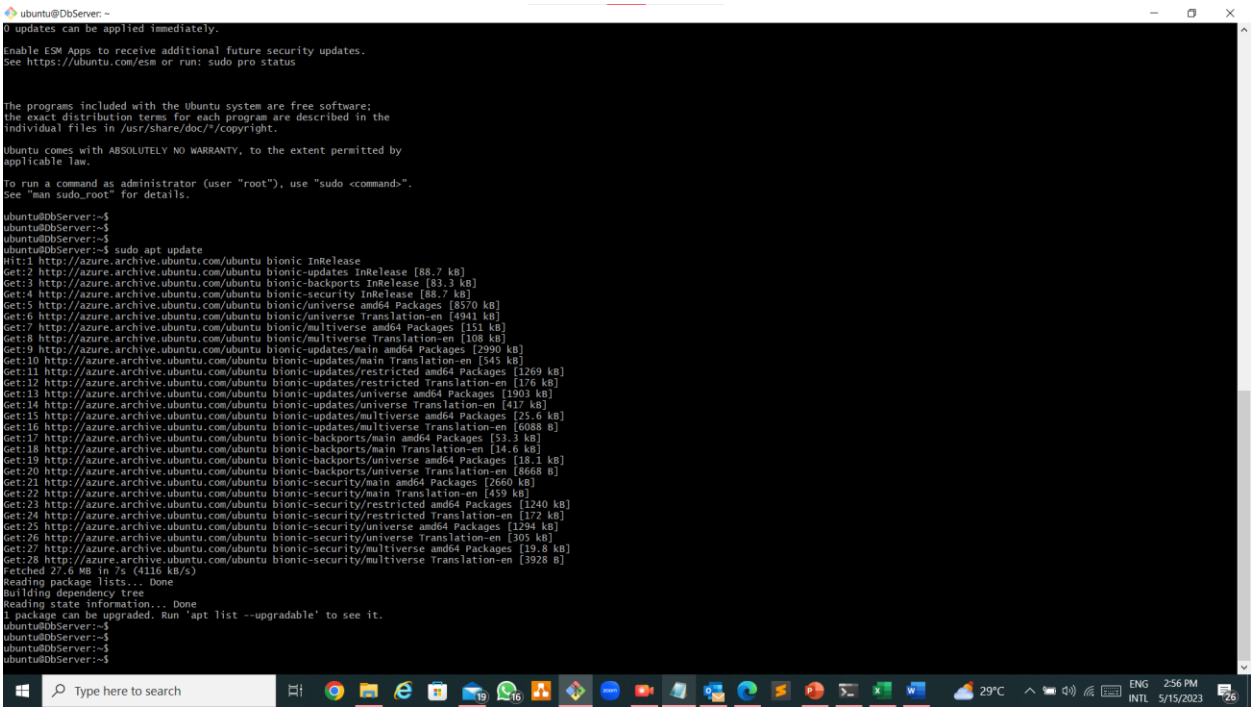
9. DOWNLOADING OF THE PROVIDED SCRIPT



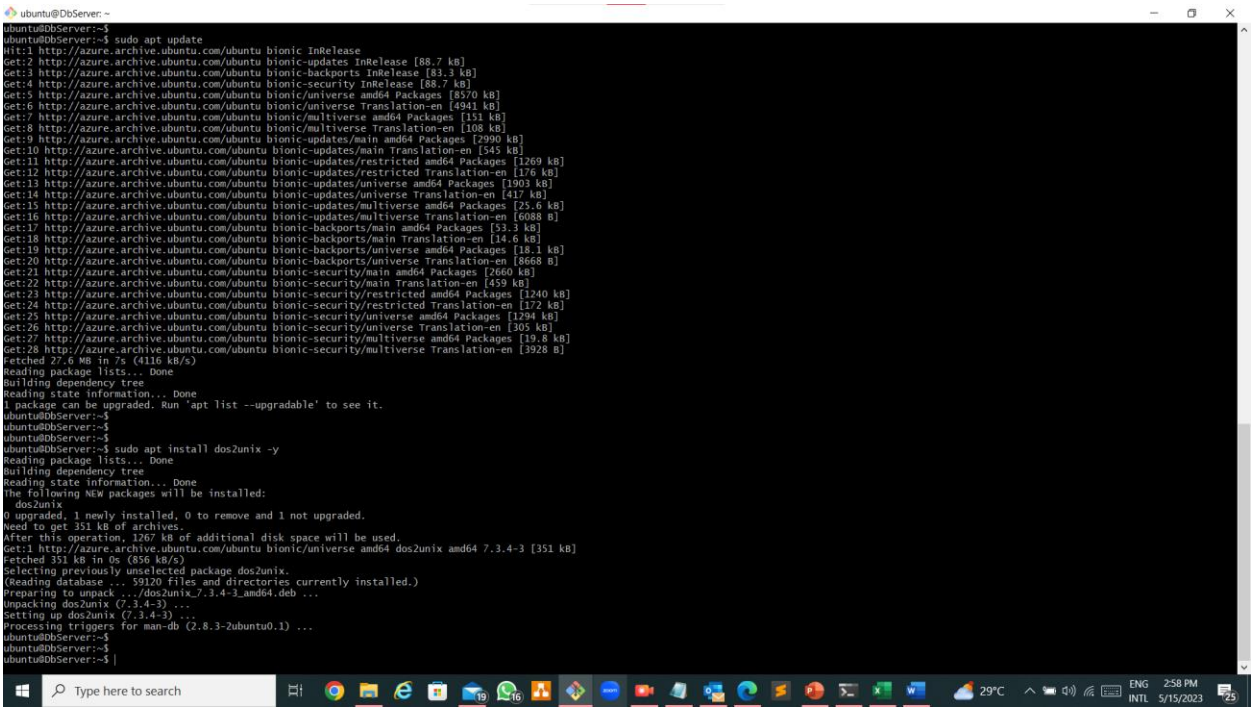
10. EXECUTING THE SCRIPTS



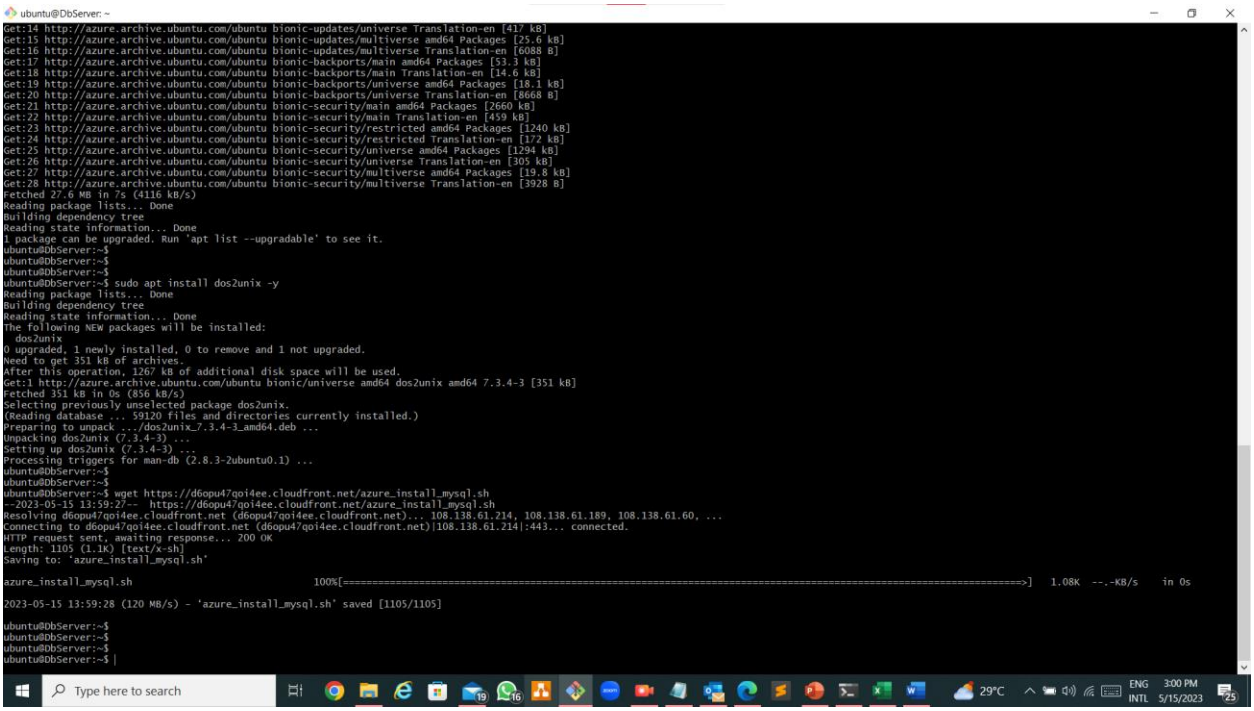
11. EXECUTING THE SCRIPTS



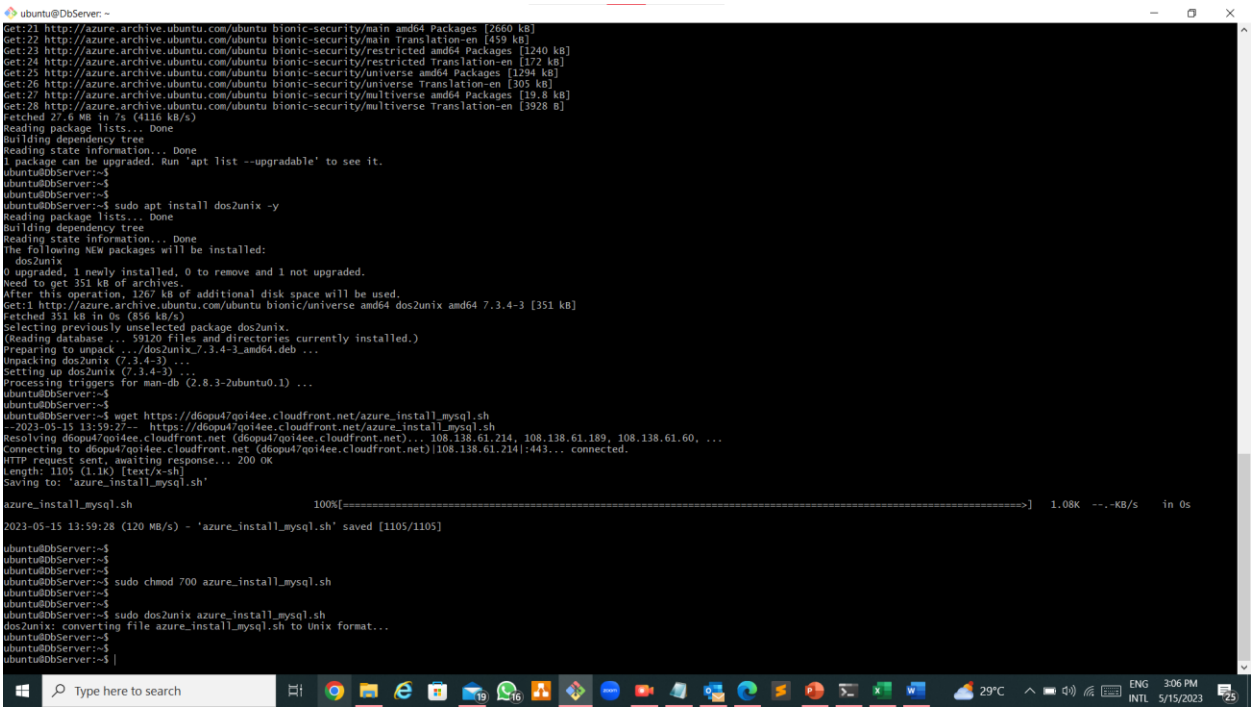
12. EXECUTING THE SCRIPTS



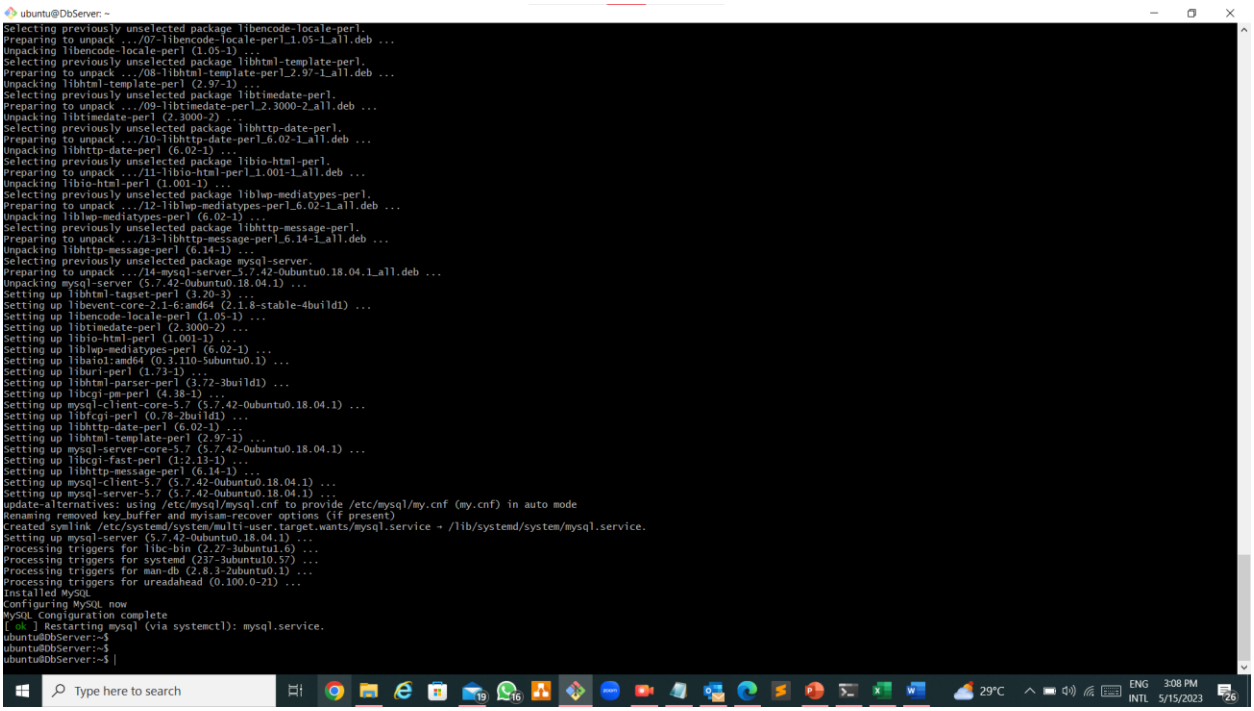
13. EXECUTING THE SCRIPTS



14. EXECUTING THE SCRIPTS



15. EXECUTING THE SCRIPTS

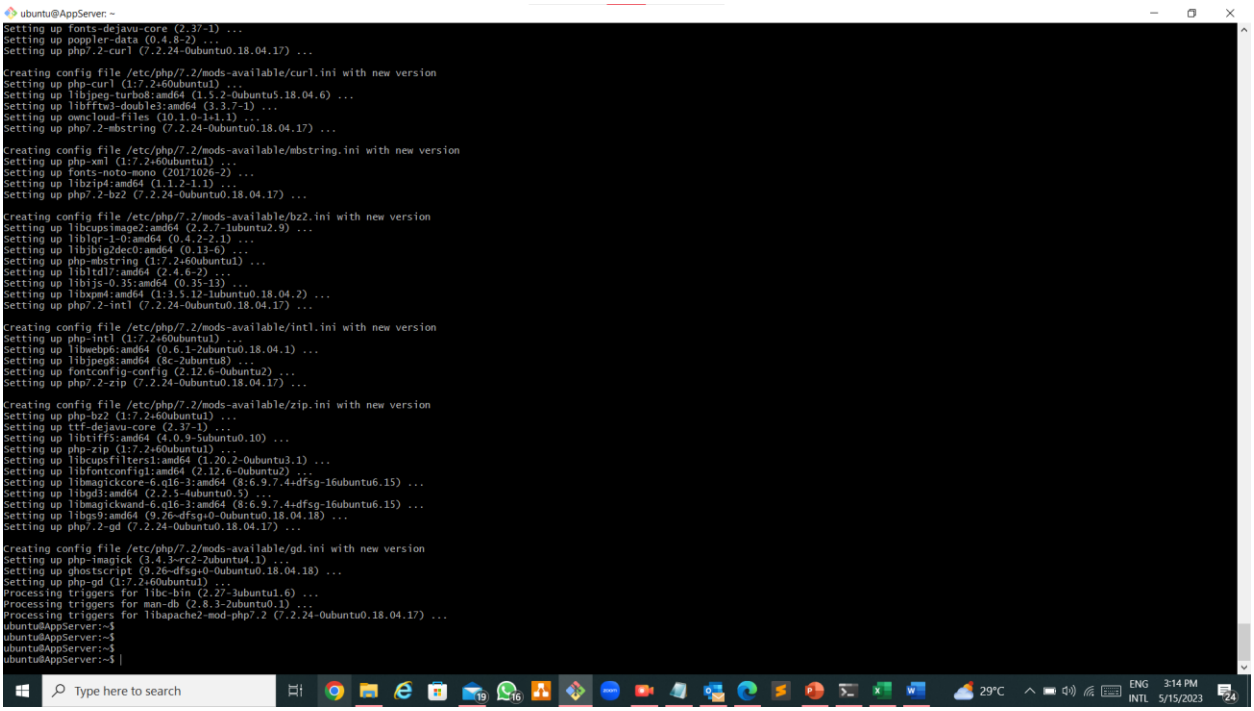


Step number	B
Step name	Installation and configuration of Mattermost
Instructions	1) Enter the following commands after logging into the application server via SSH to install and configure Mattermost Learning Tip: The version of Owncloud has no bearing on this project. When migrating a legacy version of an application to the cloud, it might not be possible to update the application to current technological trends. *sudo apt update* *sudo apt install dos2unix -y* *wget https://d6opu47qoi4ee.cloudfront.net/install_owncloud.sh* *sudo dos2unix install_owncloud.sh* *sudo chmod 700 install_owncloud.sh* *sudo ./install_owncloud.sh* *sudo systemctl restart apache2*

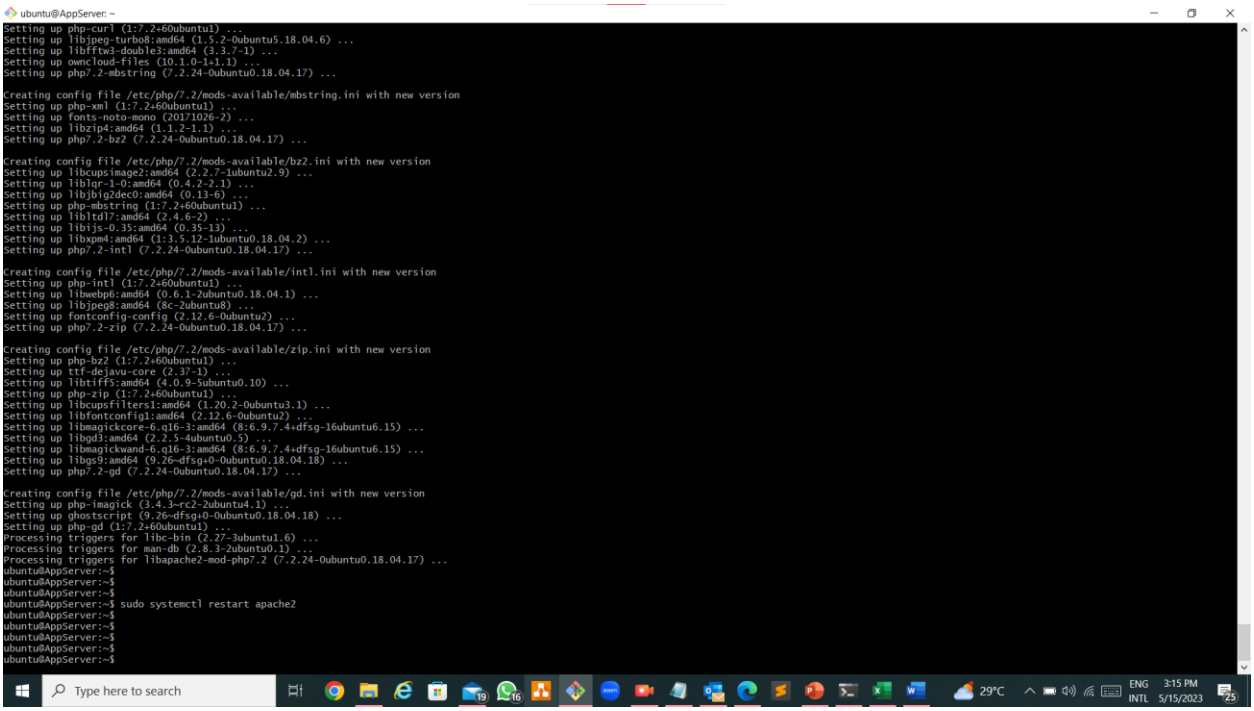
2) Check whether the server has been successfully deployed by visiting the public IP of the web server in the web browser.

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

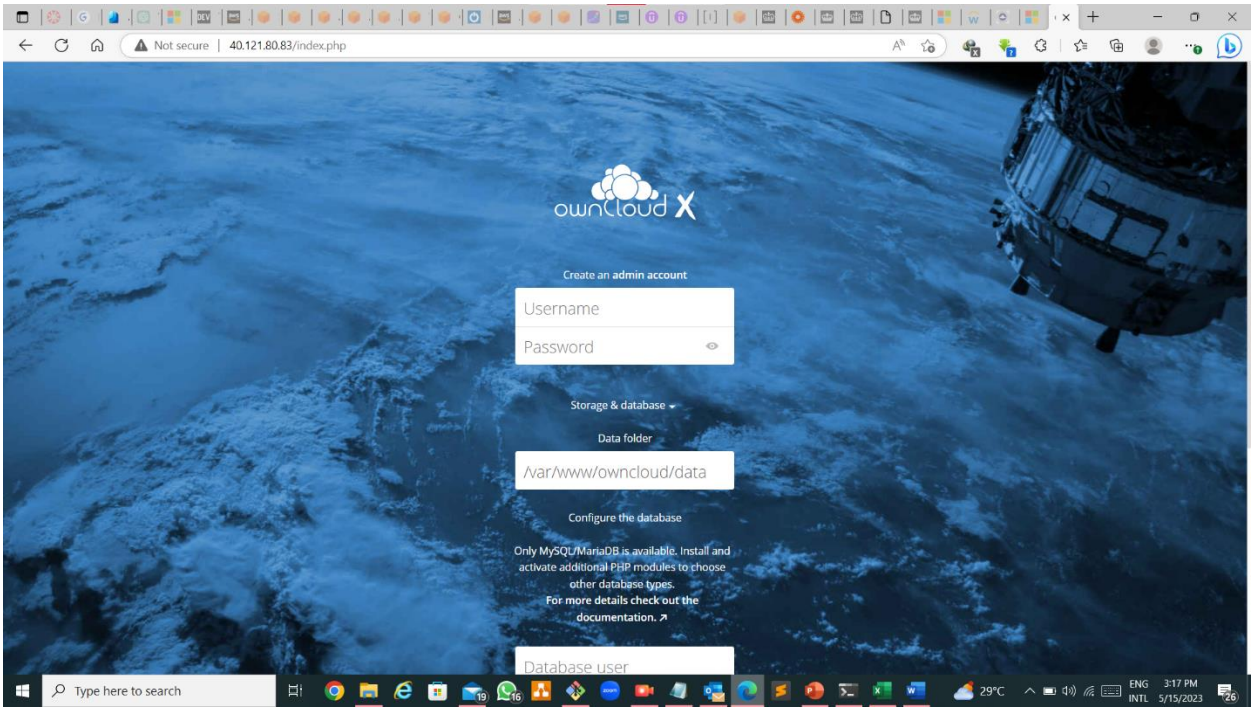
16. DOWNLOADING & EXECUTING THE SCRIPTS



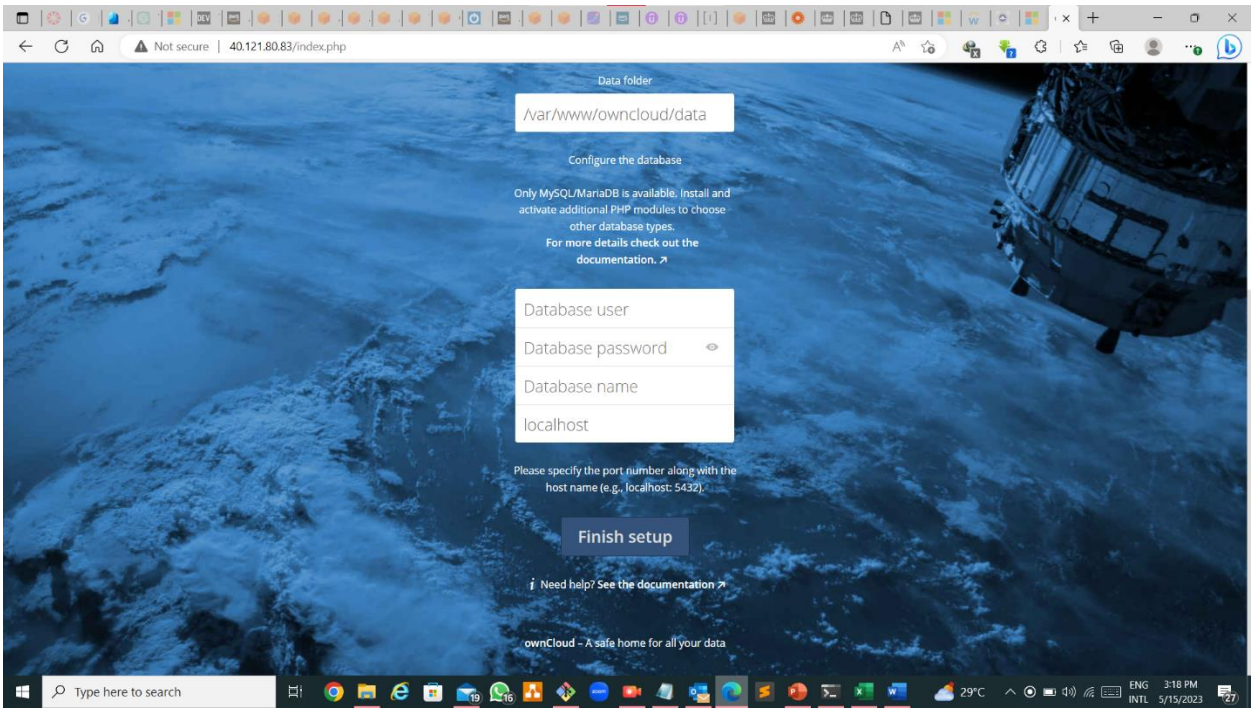
17. DOWNLOADING & EXECUTING THE SCRIPTS



18. ACCESSING THE APPLICATION VIA WEB BROWSER



19. ACCESSING THE APPLICATION VIA WEB BROWSER



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

2) Network Security group rules are evaluated in order of PORT NUMBER
    a) Priority
    b) Name (Alphabetical)
    c) Direction
    d) Port number ✓

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

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

5) Which of the following is not true about local VNET Peering?
    a) It is transitive
    b) It is commutative
    c) The 2 networks need to be in the same region
    d) All of these ✓

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

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 ✓

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