

Cloud Computing Journal

Name	Tauseem Chaudhary
Seat No.	31010921006
Course	BSc-IT
Year/Sem	TY VI
College	S K Somaiya College, SVU
Faculty	Hemalata Mam

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Practical 1:Setting up of Azure account and Creating a virtual machine in Azure with Linux OS.

A. Setting up of Azure account

1. Search for “Microsoft Azure for Students” on Google and click on the link.

The screenshot shows the Microsoft Azure for Students landing page. At the top, there is a navigation bar with the Microsoft logo, the text "Microsoft Azure", the URL "https://azure.microsoft.com/en-in/free/students", and a three-dot menu icon. Below the navigation bar, the title "Azure for Students – Free Account Credit" is displayed in purple. A sub-headline states, "With Microsoft Azure for Students, get a USD 100 credit when you create your free account. There is no credit card needed and 12 months of free Azure ...".

2. Click on “Start Free”

The screenshot shows the "Build in the cloud free with Azure for Students" landing page. At the top, there is a navigation bar with the Microsoft logo, "Azure", "Explore", "Products", "Solutions", "Pricing", "Partners", and "Resources". To the right of the navigation bar are "Search", "Learn", "Support", "Contact Sales", and "Sign In" buttons. The main heading is "Build in the cloud free with Azure for Students". Below it, a sub-headline says, "Use your university or school email to sign up and renew each year you're a student". There are two buttons: a green "Start free" button and a white "Learn about eligibility" button. Below these buttons, there are two boxes: one containing "Start with USD 100 Azure credit" and another containing "No credit card required". A plus sign (+) is located at the bottom center of the page.

3. Sign in to Microsoft using the email address and password.



Sign in

carol.d@somaiya.edu

No account? [Create one!](#)

[Can't access your account?](#)

Back

Next



4. Fill in the details mentioned and verify the academic status.

Student Verification



Start by entering your name as per the school records. Select your school's country and enter your school's name. Enter your date of birth as per the school records. The email address may be used to reach you if we have trouble verifying your application, so please enter your school provided email address.

First name

Carol

Last name

Dsouza

Country

India



If your country is not listed, the offer is not available in your region. [Learn More](#)

School name

S K सोमैया कॉलेज (Mumbai, Maharashtra)

School name will help provide Microsoft with additional information for verification. If available, please enter it here.

Date of birth

09/28/2003



5. The student version of Azure has \$100 credits free for students

Microsoft Azure

Home > Education | Overview

Get started Overview

Student offer details

- Available credits: US\$100 out of US\$100
- Days until credit expires: 355 (Expires on 08/12/2024)

Popular solutions

- Deploy a Docker container: Create simple containers to host apps.
- Create your first Node.js app: Build and deploy web, mobile and API-based
- Create and train a Machine Learning model: Train, deploy, automate, manage, and track
- Build and deploy your first website: Automatically publish to web as your code

Free Services

- Azure Virtual Machines – Windows: Use 750 hours of access to B1s virtual
- Azure Blob Storage: Get 5 GB of locally redundant storage (LRS)
- Computer Vision: Receive 5000 AI transactions to process visual
- Azure App Service: Quickly create up to 10 powerful apps with 1

Learning resources

- Roles
- Software
- Learning
- Templates
- GitHub
- Need help?
- Support

Free software

- SQL Server 2019 Developer
- Machine Learning Server 9.4.7 for Windows
- Microsoft R Client 9.4.7

Free learning paths

- Data Scientist: Nineteen learning paths with 75+ hours of content.
- AI Engineer

Resources

- Get started guide for Azure developers
- Learn the languages and tools needed to develop
- Pricing calculator
- Estimate costs for Azure services.

B. Creation of Virtual Machine

1. Go to Home on Azure and click on “Virtual machines”

Microsoft Azure

All services

Filter services: Service providers: All Release Status: All

AI + machine learning (22)

- Azure AI Studio (PREVIEW)
- Azure Machine Learning
- AI Search
- Azure AI services
- Azure AI services multi-service account
- Azure AI Video Indexer
- Anomaly detectors
- Bot Services
- Computer vision
- Content moderators
- Custom vision
- Document intelligences
- Face APIs
- Immersive readers
- Language
- Metrics advisors
- Azure OpenAI
- Personalizers
- Speech services
- Translators
- Azure Synapse Analytics
- Intelligent Recommendations Accounts

Analytics (21)

- Analytics Services
- Data Lake Analytics
- Data Factories

2. Click on “Create” and select “Azure virtual machine - Create a virtual machine hosted by Azure”

The screenshot shows the Microsoft Azure Virtual Machines dashboard. At the top, there's a search bar and a user profile for carol.d@somaiya.edu. Below the header, a navigation bar includes 'All services >', 'Virtual machines', and other options like 'Create', 'Switch to classic', and 'Reservations'. A toolbar with icons for Refresh, Export to CSV, Open query, Assign tags, Start, Restart, Stop, Delete, Services, and Maintenance follows. The main area displays a list of virtual machine types: 'Azure virtual machine' (selected), 'Azure virtual machine with preset configuration', 'Azure Arc virtual machine', and 'Azure VMware Solution virtual machine'. A large central icon is a computer monitor with a cube on it. Below the icon, the text 'No virtual machines to display' is centered. A note below says 'Create a virtual machine that runs Linux or Windows. Select an image from the marketplace or use your own customized image.' A prominent blue 'Create' button is at the bottom left. At the very bottom right, there's a 'Give feedback' link.

3. Enter the name of the virtual machine as well as change the region to India.

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

All services > Create a virtual machine ...

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

ⓘ This subscription may not be eligible to deploy VMs of certain sizes in certain regions.

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) VirtualMachine1_group Create new

Instance details
Virtual machine name * VirtualMachine1 Region * (Asia Pacific) Central India Availability options Availability zone Availability zone * Zones 1

Review + create < Previous Next : Disks >

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

All services > Create a virtual machine ...

Security type (Trusted launch virtual machines) Configure security features

Image * Ubuntu Server 20.04 LTS - x64 Gen2 See all images Configure VM generation

VM architecture Arm64 x64

Run with Azure Spot discount

Size * Standard_D2s_v3 - 2 vcpus, 8 GiB memory (₹6,019.67/month) See all sizes

Enable Hibernation (preview) ⓘ To enable Hibernation, you must register your subscription. [Learn more](#)

Administrator account

Authentication type SSH public key Password

ⓘ Azure now automatically generates an SSH key pair for you and allows you to store it for future use. It is a fast, simple, and secure way to connect to your virtual machine.

Review + create < Previous Next : Disks >

Create a virtual machine

Password

Azure now automatically generates an SSH key pair for you and allows you to store it for future use. It is a fast, simple, and secure way to connect to your virtual machine.

Username *

SSH public key source

Key pair name *

Inbound port rules
Select which virtual machine network ports are accessible from the public internet. You can specify more limited or granular network access on the Networking tab.

Public inbound ports * Allow selected ports

Select inbound ports *

All traffic from the internet will be blocked by default. You will be able to change inbound port rules in the VM > Networking page.

Review + create < Previous Next : Disks >

4. Then click on “Review + create”. Once the validation is complete, click on “Create”

Create a virtual machine

Validation passed

Basics Disks Networking Management Monitoring Advanced Tags **Review + create**

Cost given below is an estimate and not the final price. Please use [Pricing calculator](#) for all your pricing needs.

Price

1 X Standard B1s by Microsoft
[Terms of use](#) | [Privacy policy](#)

Subscription credits apply

[Pricing for other VM sizes](#)

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the Azure Marketplace Terms for additional details.

Name

Preferred e-mail address

Create < Previous Next > Download a template for automation

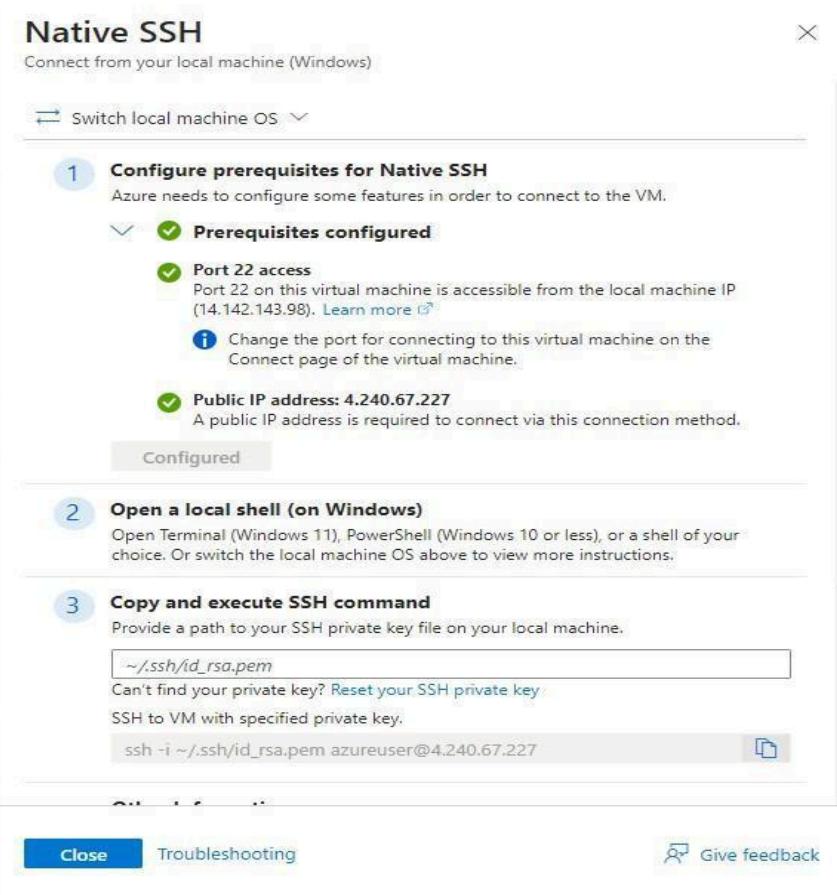
5. The machine will be created along with the SSH keys. Download the private key pair present as a “PEM file” and save it. Click on “Go to resource”

The screenshot shows the Microsoft Azure Deployment Overview page for a deployment named 'CreateVm-canonical.0001-com-ubuntu-server-focal-2-20231220071742'. The status is 'Your deployment is complete'. Deployment details include a name, start time (12/20/2023, 7:27:23 AM), subscription (Azure for Students), resource group (VirtualMachine1_group), and a correlation ID. Below this, there are sections for 'Deployment details' (Setup auto-shutdown, Monitor VM health, Run a script inside the virtual machine) and 'Next steps' (Give feedback, Tell us about your experience with deployment). Buttons for 'Go to resource' and 'Create another VM' are at the bottom.

6. Under “Connect” in Settings, select the “Native SSH”.

The screenshot shows the 'VirtualMachine1 | Connect' page in Microsoft Azure. The 'Connect' section is selected in the sidebar. It displays connection settings: Admin username (azureuser), Port (22), and Just-in-time policy (Unsupported by plan). Below this, two options are shown: 'SSH using Azure CLI' and 'Native SSH'. The 'Native SSH' option is highlighted with a green background and has a 'Select' button. A note states: 'No additional software needed. Private key required for connection. Best for those with existing SSH tools.' A link to 'More ways to connect (3)' is also present.

7. Follow the instructions given to connect the local machine i.e. copy the path of the private key (PEM File) and paste it. Then, open the local shell (Command Prompt) on the PC and execute the command.



8. The command is executed as shown below in the Command Prompt or terminal and the local machine is now connected to the virtual machine.

```
azureuser@VirtualMachine1: ~ + 
Microsoft Windows [Version 10.0.22631.2861]
(c) Microsoft Corporation. All rights reserved.

C:\Users\admin>ssh -i C:\Users\admin\Downloads\VirtualMachine1_key.pem azureuser@4.240.67.227
The authenticity of host '4.240.67.227 (4.240.67.227)' can't be established.
ED25519 key fingerprint is SHA256:3G4oObacZHtPwELtiA9plXh826oPTZcmjaE+USyQ1z4.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '4.240.67.227' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1053-azure x86_64)

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

System information as of Wed Dec 20 02:14:46 UTC 2023

System load: 0.0          Processes:           101
Usage of /:  5.2% of 28.89GB   Users logged in:   0
Memory usage: 31%
Swap usage:  0%

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
```

Practical 2: Creating Excel Blob using Storage Account in Azure

1. Go to Home on Azure and click on “Virtual machines”

The screenshot shows the Microsoft Azure portal homepage. At the top, there's a search bar and a user profile. Below the header, the 'All services' blade is visible. On the left, a sidebar lists various service categories like AI + machine learning, Compute, Databases, DevOps, General, Hybrid + multicloud, Identity, Integration, Internet of Things, Management and governance, Migration, Mixed reality, and Monitor. The main area displays a grid of service icons and names. Under 'AI + machine learning', it lists Azure AI Studio (PREVIEW), Azure Machine Learning, Azure Search, and others. Under 'Analytics', it lists Data factories and Data lake Analytics.

2. Click on “Create” and select “Azure virtual machine - Create a virtual machine hosted by Azure”

The screenshot shows the 'Virtual machines' blade in the Microsoft Azure portal. At the top, there's a toolbar with various actions like Create, Refresh, Export to CSV, Open query, Assign tags, Start, Restart, Stop, Delete, Services, and Maintenance. Below the toolbar, there's a filter bar with dropdowns for Type (set to all), Resource group (set to all), and Location (set to all). The main area shows a list of creation options:

- Azure virtual machine: Create a virtual machine hosted by Azure.
- Azure virtual machine with preset configuration: Create a virtual machine with presets based on your workloads.
- Azure Arc virtual machine: Create a new Azure Arc virtual machine in one of your non-Azure environments.
- Azure VMware Solution virtual machine: Create a VMware virtual machine hosted by Azure.

Below the list, a message says "No virtual machines to display". It provides instructions to "Create a virtual machine that runs Linux or Windows. Select an image from the marketplace or use your own customized image." There are "Create" and "Give feedback" buttons at the bottom.

3. Enter the name of the virtual machine as well as change the region to India.

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

All services > Create a virtual machine ...

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Create a virtual machine that runs Linux or Windows. Select an image from Azure marketplace or use your own customized image. Complete the Basics tab then Review + create to provision a virtual machine with default parameters or review each tab for full customization. [Learn more](#)

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 (New) VirtualMachine1_group Create new

Resource group * (New) VirtualMachine1_group Create new

Instance details

Virtual machine name * VirtualMachine1

Region * (Asia Pacific) Central India

Availability options Availability zone

Availability zone * Zones 1

Review + create < Previous Next : Disks >

4. Then click on “Review + create”. Once the validation is complete, click on “Create”

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

All services > Create a virtual machine ...

Validation passed

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Price

1 X Standard B1s by Microsoft Subscription credits apply 0.8796 INR/hr Pricing for other VM sizes

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the [Azure Marketplace Terms](#) for additional details.

Name Carol Dsouza

Preferred e-mail address carol.d@somaiya.edu

Create < Previous Next > Download a template for automation

5. The machine will be created along with the SSH keys. Download the private key pair present as a “PEM file” and save it.



6. Click on “Go to resource”

A screenshot of the Microsoft Azure Deployment Overview page. The title bar shows "CreateVm-canonical.0001-com-ubuntu-server-focal-2-20231220071742 | Overview". The main content area displays a green checkmark icon and the message "Your deployment is complete". It provides deployment details: Deployment name: CreateVm-canonical.0001-com-ubuntu-server-f..., Subscription: Azure for Students, Resource group: virtualMachine1_group, Start time: 12/20/2023, 7:27:23 AM, Correlation ID: 85542b42-40fa-43a5-9ae3-d616495a5449. Below this, there are sections for "Deployment details" (Setup auto-shutdown, Monitor VM health, Run a script inside the virtual machine) and "Next steps". At the bottom are "Go to resource" and "Create another VM" buttons, along with "Give feedback" and "Tell us about your experience with deployment" links.

7. Under “Connect” in Settings, select the “Native SSH”.

The screenshot shows the Microsoft Azure portal interface for a virtual machine named 'VirtualMachine1'. The top navigation bar includes a search bar and links to 'All services', 'CreateVm-canonical.0001-com-ubuntu-server-focal-2-20231220071742 | Overview', and 'VirtualMachine1'. The main content area is titled 'VirtualMachine1 | Connect' and shows a summary of the VM's status. It includes a 'Search' bar, a toolbar with 'Refresh', 'Troubleshoot', 'More Options', and 'Feedback' buttons, and a summary card for connecting using a Public IP address (4.240.67.227). Below this, it lists the Admin username (azureuser), Port (changeable to 22), and Just-in-time policy (Unsupported by plan). A sidebar on the left contains sections for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Settings (Networking, Connect, Disks, Size, Microsoft Defender for Cloud, Advisor recommendations, Extensions + applications, Availability + scaling, Configuration, Identity, Properties, Locks), and a 'More ways to connect' section.

8. Follow the instructions given to connect the local machine i.e copy the path of the private key (PEM File) and paste it. Then, open the Command Prompt and execute the command.

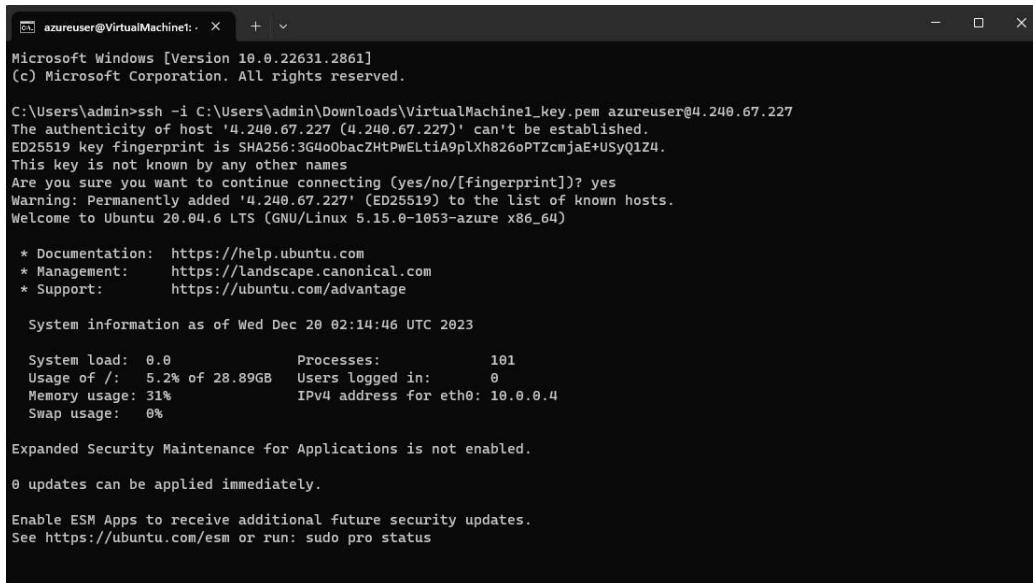
The screenshot shows the 'Native SSH' configuration wizard in the Azure portal. It starts with a header 'Native SSH' and a note 'Connect from your local machine (Windows)'. A 'Switch local machine OS' dropdown is present. The process is divided into three steps:

- Configure prerequisites for Native SSH**:
 - Azure needs to configure some features in order to connect to the VM.
 - Prerequisites configured**:
 - Port 22 access**: Port 22 on this virtual machine is accessible from the local machine IP (14.142.143.98). Learn more.
 - Change the port for connecting to this virtual machine on the Connect page of the virtual machine.
 - Public IP address: 4.240.67.227**: A public IP address is required to connect via this connection method.
 - Configured**

- Open a local shell (on Windows)**: Open Terminal (Windows 11), PowerShell (Windows 10 or less), or a shell of your choice. Or switch the local machine OS above to view more instructions.
- Copy and execute SSH command**: Provide a path to your SSH private key file on your local machine.
Input field: ~/ssh/id_rsa.pem
Note: Can't find your private key? Reset your SSH private key
Text: SSH to VM with specified private key.
Command: ssh -i ~/ssh/id_rsa.pem azureuser@4.240.67.227

At the bottom are 'Close', 'Troubleshooting', and 'Give feedback' buttons.

8. The command is executed as shown below in the Command Prompt and the local machine is now connected to the virtual machine.



```
azureuser@VirtualMachine: ~ + 
Microsoft Windows [Version 10.0.22631.2861]
(c) Microsoft Corporation. All rights reserved.

C:\Users\admin>ssh -i C:\Users\admin\Downloads\VirtualMachine1_key.pem azureuser@4.240.67.227
The authenticity of host '4.240.67.227 (4.240.67.227)' can't be established.
ED25519 key fingerprint is SHA256:3G4o0bacZHtpwELtia9plXh826oPTZcmjaE+USyQ1z4.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '4.240.67.227' (ED25519) to the list of known hosts.

Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1053-azure x86_64)

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

 System information as of Wed Dec 20 02:14:46 UTC 2023

 System load: 0.0          Processes:      101
 Usage of /: 5.2% of 28.89GB   Users logged in: 0
 Memory usage: 31%           IPv4 address for eth0: 10.0.0.4
 Swap usage: 0%             

Expanded Security Maintenance for Applications is not enabled.

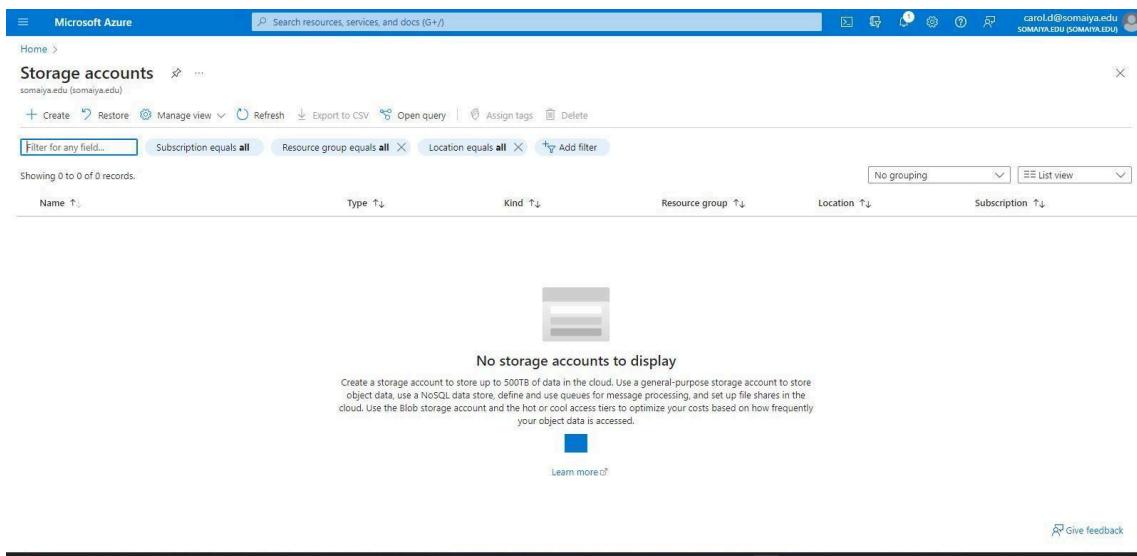
0 updates can be applied immediately.

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

9. Go to Home and click on “Storage Accounts”.



10. Click on “Create”



Microsoft Azure Search resources, services, and docs (G+) carol.d@somaiya.edu SOMAIYA.EDU (SOMAIYA.EDU)

Storage accounts Home > somaiya.edu (somaiya.edu)

+ Create Restore Manage view Refresh Export to CSV Open query Assign tags Delete

Filter for any field... Subscription equals all Resource group equals all Location equals all Add filter

No grouping List view

Showing 0 of 0 records.

Name ↑ Type ↑ Kind ↑ Resource group ↑ Location ↑ Subscription ↑

No storage accounts to display

Create a storage account to store up to 500TB of data in the cloud. Use a general-purpose storage account to store object data, use a NoSQL data store, define and use queues for message processing, and set up file shares in the cloud. Use the Blob storage account and the hot or cool access tiers to optimize your costs based on how frequently your object data is accessed.

Learn more ↗ Give feedback ↗

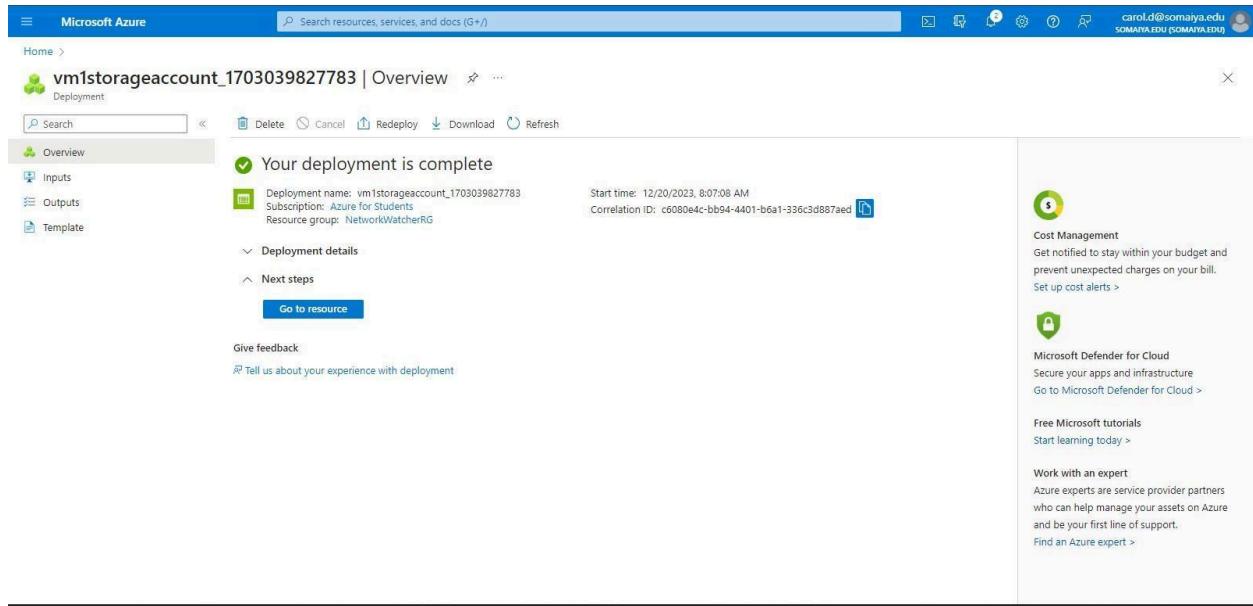
11. Enter the name of the storage account and fill in the required information. Click on “Review”

The screenshot shows the 'Create a storage account' review step in the Azure portal. At the top, there's a navigation bar with 'Microsoft Azure' and a search bar. Below it, the breadcrumb path is 'Home > Storage accounts > Create a storage account'. The main content area has tabs for 'Basics', 'Advanced', 'Networking', 'Data protection', 'Encryption', 'Tags', and 'Review', with 'Review' being the active tab. A summary section states: 'Azure Storage is a Microsoft-managed service providing cloud storage that is highly available, secure, durable, scalable, and redundant. Azure Storage includes Azure Blobs (objects), Azure Data Lake Storage Gen2, Azure Files, Azure Queues, and Azure Tables. The cost of your storage account depends on the usage and the options you choose below.' Below this, the 'Project details' section shows the selected subscription ('Azure for Students') and resource group ('NetworkWatcherRG'). The 'Instance details' section shows the storage account name ('vm1storageaccount') and location ('(Asia Pacific) Central India'). At the bottom, there are buttons for 'Review', '< Previous', and 'Next : Advanced >'.

12. Then, click on “Create”.

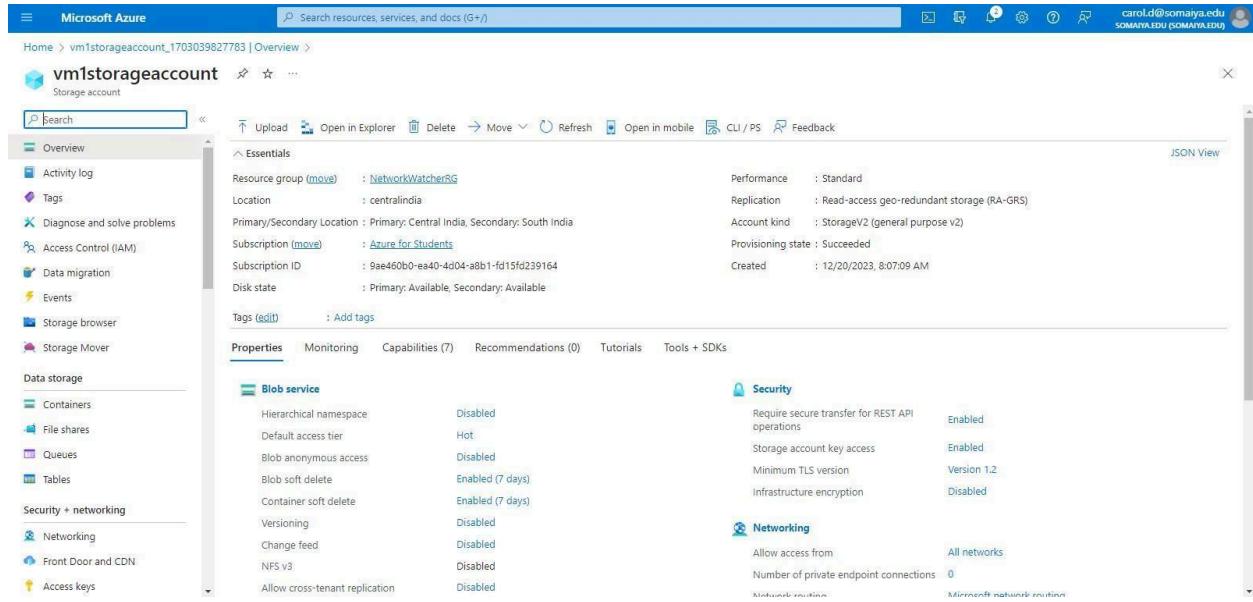
The screenshot shows the 'Create a storage account' creation step in the Azure portal. The interface is similar to the previous review step, with a navigation bar, breadcrumb path, and tabs for 'Basics', 'Advanced', 'Networking', 'Data protection', 'Encryption', 'Tags', and 'Review'. The 'Review' tab is active. The 'Basics' section displays the configuration details: Subscription ('Azure for Students'), Resource Group ('NetworkWatcherRG'), Location ('centralindia'), Storage account name ('vm1storageaccount'), Deployment model ('Resource manager'), Performance ('Standard'), and Replication ('Read-access geo-redundant storage (RA-GRS)'). The 'Advanced' section shows settings like 'Enable hierarchical namespace' (Disabled), 'Enable network file system v3' (Disabled), 'Allow cross-tenant replication' (Disabled), 'Access tier' (Hot), 'Enable SFTP' (Disabled), and 'Large file shares' (Disabled). At the bottom, there are buttons for 'Create', '< Previous', 'Next >', and 'Download a template for automation'.

13. Here, the storage account has been created and deployment is completed. Click on “Go to resource”



The screenshot shows the Microsoft Azure Deployment Overview page for a deployment named "vm1storageaccount_1703039827783". The status is "Your deployment is complete". Deployment details include a start time of 12/20/2023, 8:07:08 AM, and a correlation ID of c6080e4c-bb94-4401-b6a1-336c3d887aed. The resource group is NetworkWatcherRG. A "Go to resource" button is visible. The right sidebar features links for Cost Management, Microsoft Defender for Cloud, Free Microsoft tutorials, and Work with an expert.

14. Click on “Upload”.



The screenshot shows the Microsoft Azure Storage account overview page for "vm1storageaccount". The "Properties" tab is selected, displaying blob service settings like Hierarchical namespace (Disabled), Default access tier (Hot), and Blob anonymous access (Disabled). The "Security" section shows options for secure transfer, storage account key access, minimum TLS version (Version 1.2), and infrastructure encryption (Disabled). The "Networking" section indicates allow access from all networks and 0 private endpoint connections.

15. Create an Excel file as below and save it.

	A	B
1	Name	Country
2	ABC	India
3	DEF	Thailand
4	GHI	Korea

16. Upload the file by clicking on “Browse for files”. Create a new container and name it.

Upload blob ×



 1 file(s) selected: VM1Excel.xlsx

 Drag and drop files here or [Browse for files](#)

Select an existing container

[Create new](#)

Overwrite if files already exist

^ Advanced

Blob type ①

Block blob

Upload .vhdx files as page blobs (recommended)

Block size ①

4 MiB

Access tier ①

Hot (Inferred)

Upload to folder

17. Navigate to “Storage Browser” and enter the blob container to see if the Excel file has been uploaded.

Microsoft Azure

Search resources, services, and docs (G+)

Home > vm1storageaccount_1703039827783 | Overview > vm1storageaccount

vm1storageaccount | Storage browser

Storage account

Search

Overview

Activity log

Tags

Diagnose and solve problems

Access Control (IAM)

Data migration

Events

Storage browser

Storage Mover

Data storage

- Containers
- File shares
- Queues
- Tables

Security + networking

- Networking
- Front Door and CDN
- Access keys

vm1storageaccount

Add Directory Upload Change access level Refresh Delete Copy Paste Rename Acquire lease Break lease ...

Blob containers > vm1container

Authentication method: Access key (Switch to Microsoft Entra user account)

Add filter

Search blobs by prefix (case-sensitive)

Only show active blobs

Sorting all 1 items

Name	Last modified	Access tier	Blob type	Size	Lease state
VM1Excel.xlsx	12/20/2023, 8:12:46 AM	Hot (Inferred)	Block blob	15.08 KiB	Available

Practical 3: Creating Image Blob using Storage Account in Azure

1. Go to Home on Azure and click on “Virtual machines”



2. Click on “Create” and select “Azure virtual machine - Create a virtual machine hosted by Azure”

The screenshot shows the 'Virtual machines' blade in the Azure portal. It lists three creation options: 'Azure virtual machine with preset configuration', 'Azure Arc virtual machine', and 'Azure VMware Solution virtual machine'. Below these, a message says 'No virtual machines to display' with a link to learn more about Windows and Linux virtual machines.

3. Enter the name of the virtual machine as well as change the region to India.

The screenshot shows the 'Create a virtual machine' wizard in the Azure portal, on the 'Basics' tab. It includes fields for 'Subscription' (set to 'Azure for Students'), 'Resource group' (set to '(New) VirtualMachine1_group'), 'Virtual machine name' ('VirtualMachine1'), 'Region' ('(Asia Pacific) Central India'), and 'Availability zone' ('Availability zone'). At the bottom are 'Review + create' and 'Next : Disks >' buttons.

4. Then click on “Review + create”. Once the validation is complete, click on “Create”

Microsoft Azure

All services >

Create a virtual machine

Validation passed

Basics Disks Networking Management Monitoring Advanced Tags Review + create

Cost given below is an estimate and not the final price. Please use [Pricing calculator](#) for all your pricing needs.

Price

1 X Standard B1s by Microsoft

Subscription credits apply ⓘ

0.8796 INR/hr

[Terms of use](#) | [Privacy policy](#)

Pricing for other VM sizes

TERMS

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. See the [Azure Marketplace Terms](#) for additional details.

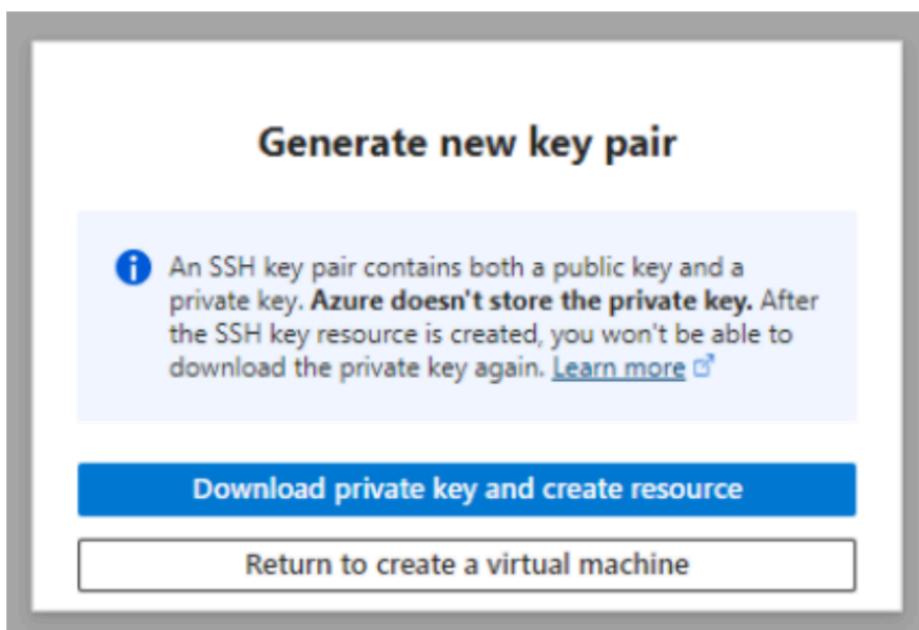
Name: Carol Dsouza

Preferred e-mail address: carol.d@somaiya.edu

< Previous Next > Download a template for automation

Create

5. The machine will be created along with the SSH keys. Download the private key pair present as a “PEM file” and save it.



6. Click on “Go to resource”

The screenshot shows the Microsoft Azure Deployment Overview page for a deployment named "CreateVm-canonical.0001-com-ubuntu-server-focal-2-20231220071742". The status is "Your deployment is complete". The deployment name, subscription, and resource group are listed. Below the main summary, there are sections for "Deployment details" and "Next steps". Under "Next steps", three options are listed: "Setup auto-shutdown" (Recommended), "Monitor VM health, performance and network dependencies" (Recommended), and "Run a script inside the virtual machine" (Recommended). At the bottom, there are "Go to resource" and "Create another VM" buttons, along with "Give feedback" and "Tell us about your experience with deployment" links.

7. Under “Connect” in Settings, select the “Native SSH”.

The screenshot shows the "VirtualMachine1 | Connect" settings page. The "Connect" section is selected in the sidebar. It displays connection information: "Connecting using Public IP address | 4.240.67.227". Below this, connection details are shown: Admin username (azureuser), Port (22), and Just-in-time policy (Unsupported by plan). Two connection methods are listed: "SSH using Azure CLI" and "Native SSH". The "Native SSH" method is highlighted with a green border and has a "Select" button. A link "More ways to connect (3)" is also visible.

8. Follow the instructions given to connect the local machine i.e copy the path of the private key (PEM File) and paste it. Then, open the Command Prompt and execute the command.

Native SSH

Connect from your local machine (Windows)

Switch local machine OS ▾

1 Configure prerequisites for Native SSH
Azure needs to configure some features in order to connect to the VM.

Prerequisites configured

Port 22 access
Port 22 on this virtual machine is accessible from the local machine IP (14.142.143.98). [Learn more](#) ⓘ
Change the port for connecting to this virtual machine on the Connect page of the virtual machine.

Public IP address: 4.240.67.227
A public IP address is required to connect via this connection method.
Configured

2 Open a local shell (on Windows)
Open Terminal (Windows 11), PowerShell (Windows 10 or less), or a shell of your choice. Or switch the local machine OS above to view more instructions.

3 Copy and execute SSH command
Provide a path to your SSH private key file on your local machine.
~/ssh/id_rsa.pem
Can't find your private key? [Reset your SSH private key](#)
SSH to VM with specified private key.
ssh -i ~/ssh/id_rsa.pem azureuser@4.240.67.227

[Close](#) [Troubleshooting](#) [Give feedback](#)

8. The command is executed as shown below in the Command Prompt and the local machine is now connected to the virtual machine.

```
azureuser@VirtualMachine1:~ % + ^

Microsoft Windows [Version 10.0.22631.2861]
(c) Microsoft Corporation. All rights reserved.

C:\Users\admin>ssh -i C:\Users\admin\Downloads\VirtualMachine1_key.pem azureuser@4.240.67.227
The authenticity of host '4.240.67.227 (4.240.67.227)' can't be established.
ED25519 key fingerprint is SHA256:3G4oObacZHtPwELtiA9plXh826oPTZcmjaE+USyQ1Z4.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added '4.240.67.227' (ED25519) to the list of known hosts.
Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-1053-azure x86_64)

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

System information as of Wed Dec 20 02:14:46 UTC 2023

System load: 0.0          Processes:           101
Usage of /:   5.2% of 28.89GB  Users logged in:     0
Memory usage: 31%
Swap usage:  0%

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
```

9. Go to Home and click on “Storage Accounts”.



10. Click on “Create”

A screenshot of the Microsoft Azure Storage accounts list page. The top navigation bar shows "Home > Storage accounts". Below it, there are filter options: "Subscription equals all", "Resource group equals all", and "Location equals all". A message says "Showing 0 to 0 of 0 records." In the center, there's a placeholder image of a storage account and the text "No storage accounts to display". Below this, a descriptive paragraph explains how to create a storage account. At the bottom right, there's a "Learn more" link.

11. Enter the name of the storage account and fill in the required information. Click on “Review”

A screenshot of the "Create a storage account" wizard in the Microsoft Azure portal. The title is "Create a storage account" and the sub-step is "Basics". The "Subscription" dropdown is set to "Azure for Students" and the "Resource group" dropdown is set to "NetworkWatcherRG". The "Storage account name" field contains "vm1storageaccount" and the "Region" dropdown is set to "(Asia Pacific) Central India". At the bottom, there are "Review" and "Next : Advanced >" buttons.

12. Then, click on “Create”.

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

Home > Storage accounts >

Create a storage account

Basics Advanced Networking Data protection Encryption Tags **Review**

Basics

Subscription	Azure for Students
Resource Group	NetworkWatcherRG
Location	centralindia
Storage account name	vm1storageaccount
Deployment model	Resource manager
Performance	Standard
Replication	Read-access geo-redundant storage (RA-GRS)

Advanced

Enable hierarchical namespace	Disabled
Enable network file system v3	Disabled
Allow cross-tenant replication	Disabled
Access tier	Hot
Enable SFTP	Disabled
Large file shares	Disabled

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13. Here, the storage account has been created and deployment is completed. Click on “Go to resource”

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

Home > vm1storageaccount_1703039827783 | Overview

Overview Deployment

Your deployment is complete

Deployment name: vm1storageaccount_1703039827783
Subscription: Azure for Students
Resource group: NetworkWatcherRG

Start time: 12/20/2023, 8:07:08 AM Correlation ID: c6080e4c-bb94-4401-b6a1-336c3d887aed

Deployment details

Next steps

Go to resource

Give feedback
Tell us about your experience with deployment

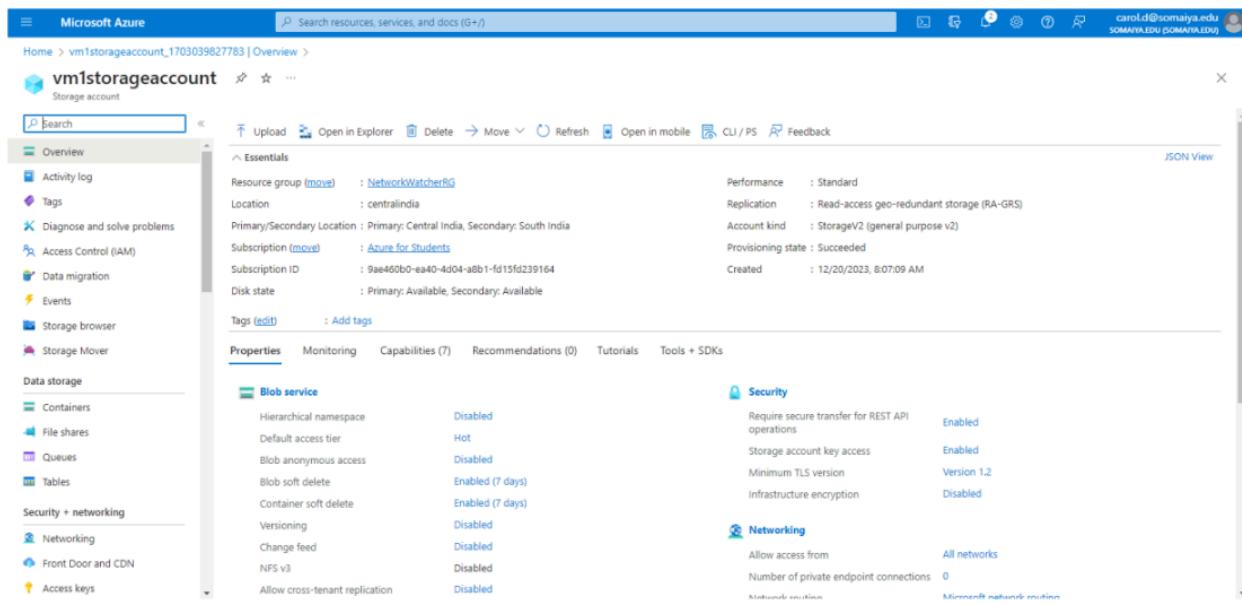
Cost Management
Get notified to stay within your budget and prevent unexpected charges on your bill.
Set up cost alerts >

Microsoft Defender for Cloud
Secure your apps and infrastructure
Go to Microsoft Defender for Cloud >

Free Microsoft tutorials
Start learning today >

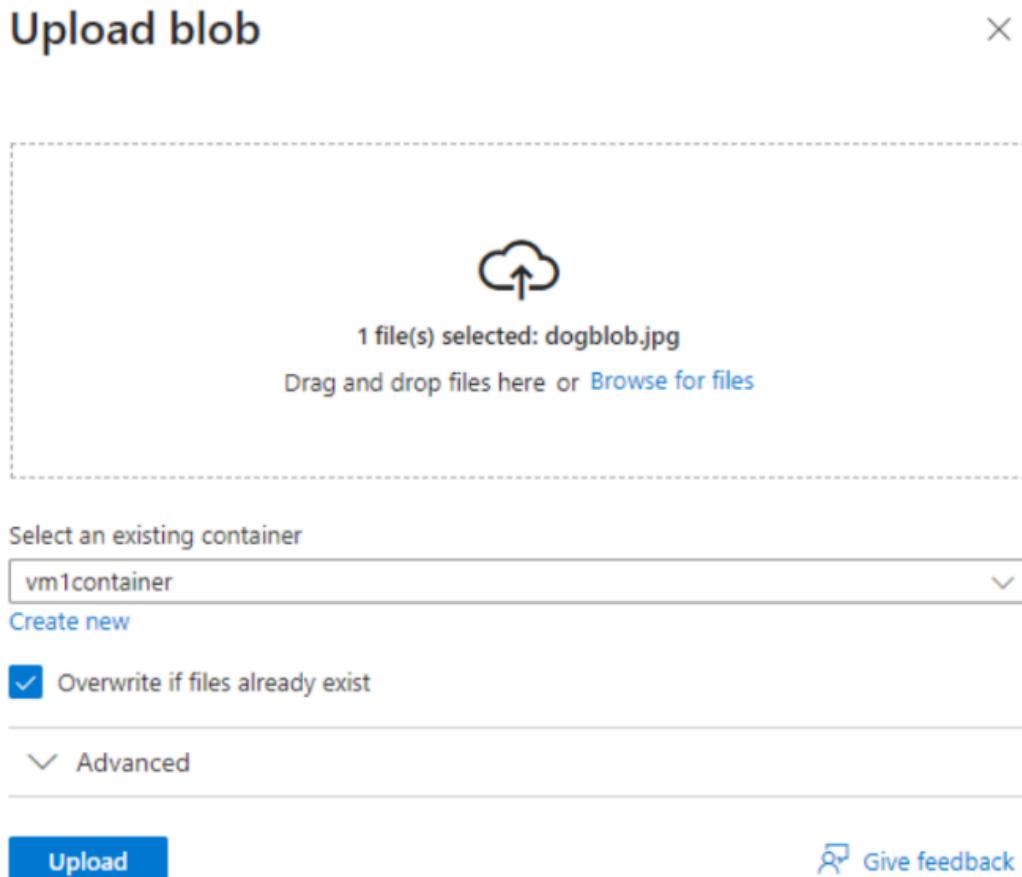
Work with an expert
Azure experts are service provider partners who can help manage your assets on Azure and be your first line of support.
Find an Azure expert >

14. Click on “Upload”.



The screenshot shows the Azure Storage Account Overview page for 'vm1storageaccount'. The 'Upload' button is highlighted in the top navigation bar. The page displays various account details such as Resource group, Location, Primary/Secondary Location, Subscription, Disk state, and Tags. It also includes sections for Properties, Monitoring, Capabilities, Recommendations, Tutorials, and Tools + SDKs. The Blob service and Security settings are visible on the left.

15. Download an image and save it. Upload the file by clicking on “Browse for files”. Create a new container and name it.



The screenshot shows the 'Upload blob' dialog box. It displays a cloud icon with an upward arrow and the text '1 file(s) selected: dogblob.jpg'. Below this, there's a placeholder text 'Drag and drop files here or [Browse for files](#)'. At the bottom, there's a dropdown menu labeled 'Select an existing container' with 'vm1container' selected, and a 'Create new' button. A checkbox labeled 'Overwrite if files already exist' is checked. There's also an 'Advanced' section with a dropdown arrow. At the very bottom are two buttons: 'Upload' and 'Give feedback'.

16. Navigate to “Storage Browser” and enter the blob container to see if the image file

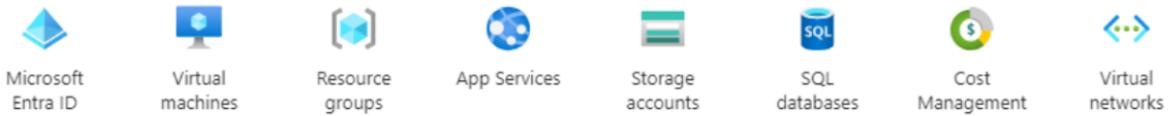
has been uploaded.

The screenshot shows the Microsoft Azure Storage browser interface for the storage account 'vm1storageaccount'. The left sidebar navigation bar includes links for Overview, Activity log, Tags, Diagnose and solve problems, Access Control (IAM), Data migration, Events, Storage browser (which is selected and highlighted in grey), Storage Mover, Data storage (Containers, File shares, Queues, Tables), and Security + networking (Networking, Front Door and CDN, Access keys). The main content area displays the 'vm1container' blob container. It shows two blobs: 'VM1Excel.xlsx' (Last modified: 12/20/2023, 8:12:46 AM, Size: 15.08 KiB) and 'dogblob.jpg' (Last modified: 12/20/2023, 8:22:28 AM, Size: 119.13 KiB). The interface includes standard file operations like Add Directory, Upload, Change access level, Refresh, Delete, Copy, Paste, Rename, Acquire lease, Break lease, and a search bar for blobs by prefix.

Name	Last modified	Access tier	Blob type	Size	Lease state
VM1Excel.xlsx	12/20/2023, 8:12:46 AM	Hot (Inferred)	Block blob	15.08 KiB	Available
dogblob.jpg	12/20/2023, 8:22:28 AM	Hot (Inferred)	Block blob	119.13 KiB	Available

Practical 4: Creating SQL database in Azure.

1. Go to Home and click on “SQL databases”



2. Click on “Create SQL database” to create a new database.

A screenshot of the Azure portal showing the "SQL databases" blade. The search bar at the top has "Search resources, services, and docs (G+)" and the user "carol.d@somaya.edu (SOMAYA.EDU)". Below the search bar are filter options: "Subscription equals all", "Resource group equals all", "Location equals all", and "Add filter". The main area shows a message: "No SQL databases to display" with the sub-instruction "Try changing or clearing your filters." A prominent blue button labeled "Create SQL database" is centered. At the bottom right is a "Give feedback" link.

3. Enter the details for the SQL Database Server such as name and location.

A screenshot of the "Create SQL Database Server" blade. The top navigation bar shows "Home > SQL databases > Create SQL Database" and the user "carol.d@somaya.edu (SOMAYA.EDU)". The main section is titled "Server details" with the sub-instruction "Enter required settings for this server, including providing a name and location. This server will be created in the same subscription and resource group as your database." It includes fields for "Server name" (set to "sqlservervm1") and "Location" (set to "(US) East US"). To the right of these fields is a callout box with three green checkmarks: "Server name should not contain reserved words.", "The specified server name is available.", and "Your server name can't start or end with hyphens '-' nor can it have two hyphens '--' in third and fourth places of the name.". Below the server details is an "Authentication" section with a note about Azure Active Directory (now Microsoft Entra ID). It includes a "Authentication method" section with three radio buttons: "Use Microsoft Entra-only authentication" (selected), "Use both SQL and Microsoft Entra authentication", and "Use SQL authentication". At the bottom left is a blue "OK" button.

4. Select the “Authentication method” as “Use SQL authentication”. Enter the admin login and password (Remember the login and password). Then click “Ok”

Microsoft Azure

Search resources, services, and docs (G+)

Home > SQL databases > Create SQL Database >

Create SQL Database Server

Location * (Asia Pacific) Central India

Authentication

Note: Azure Active Directory (Azure AD) is now Microsoft Entra ID. [Learn more](#)

Select your preferred authentication methods for accessing this server. Create a server admin login and password to access your server with SQL authentication, select only Microsoft Entra authentication [Learn more](#) using an existing Microsoft Entra user, group, or application as Microsoft Entra admin [Learn more](#), or select both SQL and Microsoft Entra authentication.

Authentication method: Use Microsoft Entra-only authentication
 Use both SQL and Microsoft Entra authentication
 Use SQL authentication

Server admin login * system

Password * *****

Confirm password * *****

OK

5. Under the “Review + create” tab, click on “Create”.

Home > SQL databases >

Create SQL Database

Product details

Estimated cost

Storage cost 428.31 INR / month + Compute cost 0.012520 INR / vCore second

Terms

By clicking "Create", I (a) agree to the legal terms and privacy statement(s) associated with the Marketplace offering(s) listed above; (b) authorize Microsoft to bill my current payment method for the fees associated with the offering(s), with the same billing frequency as my Azure subscription; and (c) agree that Microsoft may share my contact, usage and transactional information with the provider(s) of the offering(s) for support, billing and other transactional activities. Microsoft does not provide rights for third-party offerings. For additional details see [Azure Marketplace Terms](#).

Basics

Subscription	Azure for Students
Resource group	NetworkWatcherRG
Region	Central India
Database name	VM1
Server	(new) sqlservervm1
Authentication method	SQL authentication

Cost summary

General Purpose (GP_S_Gen5_1)	
Cost per GB (in INR)	10.30
Max storage selected (in GB)	x 41.6
ESTIMATED STORAGE COST / MONTH	428.31 INR
COMPUTE COST / VCORE SECOND	0.012520 INR

NOTES

¹ Serverless databases are billed in vCore seconds based on a combination of CPU and memory utilization. [Learn more about serverless billing](#)

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6. After deployment has been completed, click on “Go to resource”

The screenshot shows the Microsoft Azure Deployment Overview page for a completed deployment named "Microsoft.SQLDatabase.newDatabaseNewServer_6d8984ee865d4eba8e033". The deployment was successful, starting at 12/20/2023, 8:29:18 AM. It was created by "Azure for Students" in the "NetworkWatcherRG" resource group. The page includes sections for "Deployment details" and "Next steps", with a prominent "Go to resource" button. A sidebar on the right provides links to cost management, Microsoft Defender for Cloud, free tutorials, and expert support.

7. Click on “Properties”.

The screenshot shows the Microsoft Azure VM1 properties page for a SQL database named "VM1". The page displays essential information such as the resource group ("NetworkWatcherRG"), status ("Online"), location ("Central India"), and subscription ("Azure for Students"). It also shows connection strings, pricing tier ("General Purpose - Serverless: Gen5, 1 vCore"), and auto-pause delay ("1 hour"). The "Getting started" section provides links to "Configure access", "Connect to application", "Start developing", and "See connection strings".

8. Click on “Networking” and then select “Selected Networks” under Public access.

sqlservervm1 | Networking

Public access Private access Connectivity

Public network access

Public Endpoints allow access to this resource through the internet using a public IP address. An application or resource that is granted access with the following network rules still requires proper authorization to access this resource. [Learn more](#)

Public network access

Disable

Selected networks

Connections from the IP addresses configured in the Firewall rules section below will have access to this database. By default, no public IP addresses are allowed. [Learn more](#)

Please save public network access value before adding new virtual networks.

Virtual networks

Allow virtual networks to connect to your resource using service endpoints. [Learn more](#)

+ Add a virtual network rule

Rule	Virtual network	Subnet	Address range	Endpoint status	Resource group	Subscription	State
------	-----------------	--------	---------------	-----------------	----------------	--------------	-------

Firewall rules

Allow certain public internet IP addresses to access your resource. [Learn more](#)

+ Add your client IPv4 address (14.142.143.98) + Add a firewall rule

Save Discard

9. Click on “Add your client IPv4 address” and select the “Allow Azure services and resources to access this server” checkbox”. Then click “Save”

sqlservervm1 | Networking

+ Add your client IPv4 address (14.142.143.98) + Add a firewall rule

Rule name	Start IPv4 address	End IPv4 address
ClientIPAddress_2023-12-20_8-38-53	14.142.143.98	14.142.143.98

Exceptions

Allow Azure services and resources to access this server

Save Discard

10. Navigate to the “Query editor” tab. Create a table using SQL queries and insert values into the table.

VM1 (system)

Query 1

```
1 CREATE TABLE student
2 (id int,
3 name varchar(20)
4 );
```

Results Messages

Query succeeded: Affected rows: 0

VM1 (system)

Query 1

```
1 INSERT INTO student VALUES( 101, 'Carol');
```

Tables

- dbo.student
 - id (int, null)
 - name (varchar, null)

Views

Stored Procedures

Results Messages

Query succeeded: Affected rows: 1

11. Display the columns present in the table using the “SELECT” statement.

VM1 (system)

Query 1

```
1 SELECT * FROM student;
```

Tables

- dbo.student
 - id (int, null)
 - name (varchar, null)

Views

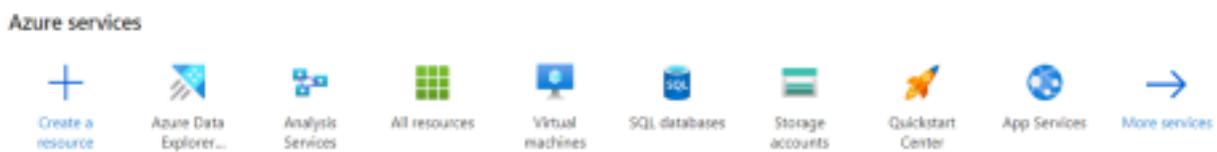
Stored Procedures

Results Messages

Search to filter items...	
id	name
101	Carol

Practical 5: Performing power BI in Azure.

1. Login into Azure and click on “More Services”



2. Under “All services”, click “Analytics”

All services

All

Favorites

Recents

Recommended

Categories

AI + machine learning

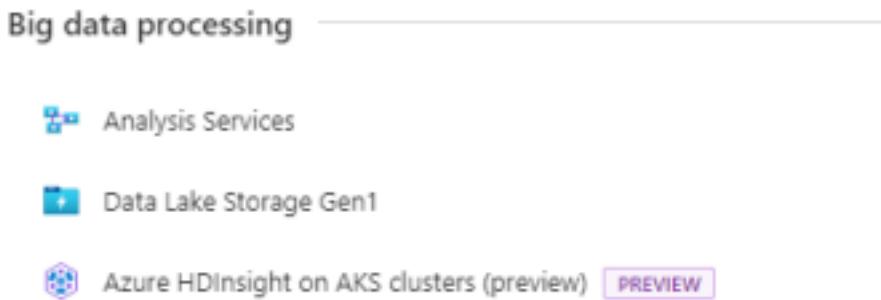
Analytics

Compute

Containers

Databases

3. Click on “Analysis Services”



4. Click on “Create” in Analysis Services

5. Enter the details and create a new resource group.

This screenshot shows the 'Analysis Services' blade in the Azure portal. At the top, there's a search bar and several filter options like 'Subscription equals all', 'Resource group equals all', and 'Location equals all'. Below that, there are fields for 'Name', 'Size', 'Server name', and 'Subscription'. A central message says 'No analysis services to display' with a note 'try changing or clearing your filters.' and a 'Learn more' link.

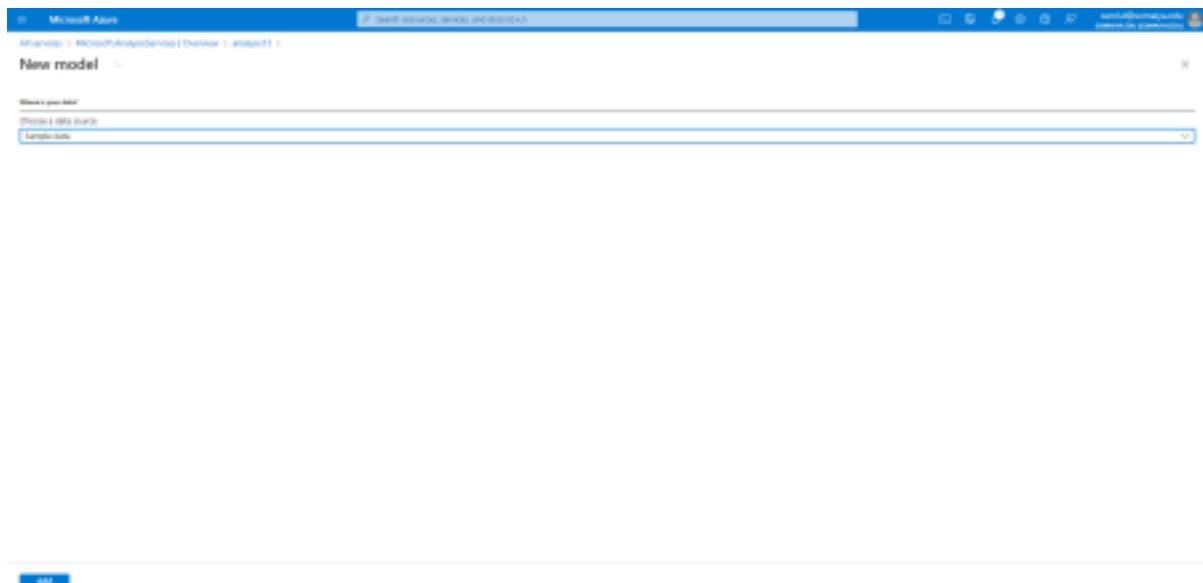
Select “B2 (80 Query Processing Units)” as the Pricing tier

6. After deployment is complete, click on “Go to resource”

7. Select “New model”

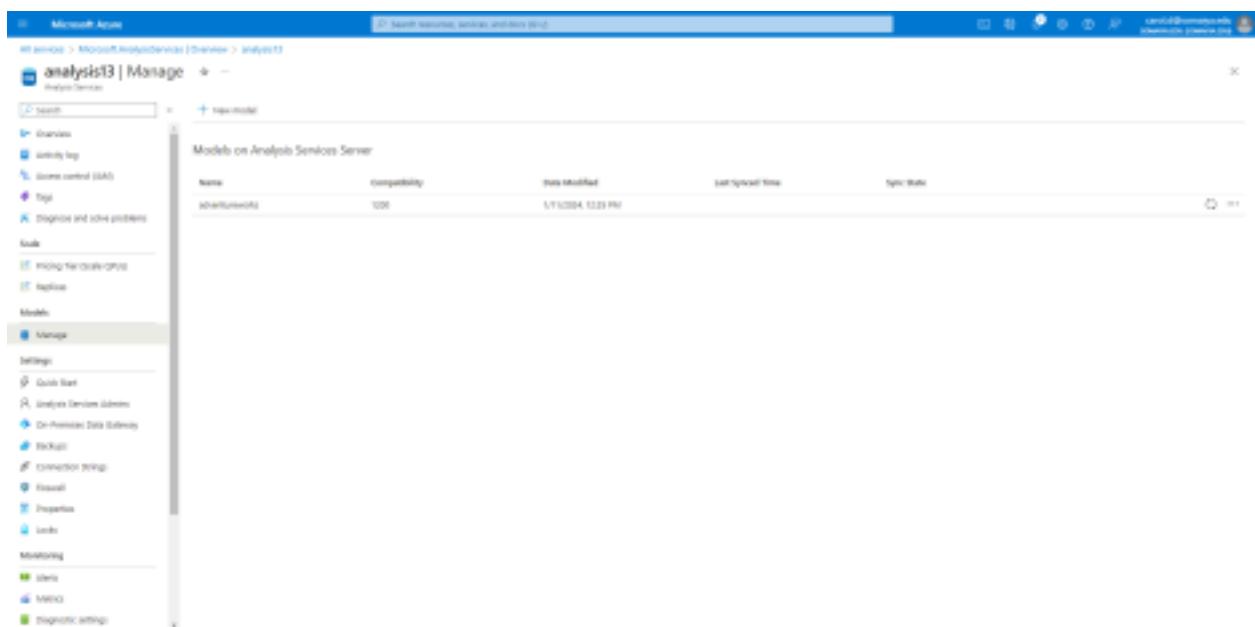
This screenshot shows the 'Microsoft.AnalysisServices | Overview' blade. It displays a message 'Your deployment is complete' with a green checkmark. Deployment details are listed: Deployment name: Microsoft.AnalysisServices, Subscription: Azure for Students, Resource group: analysisresource. To the right, deployment statistics are shown: Start time: 1/1/2024, 12:32:25 PM, Correlation ID: 21426601-45cc-4564-9bb7-e226629e1db98. Below the main message, there are sections for 'Deployment details' and 'Next steps', with a prominent blue 'Go to resource' button at the bottom.

8. Choose the data source as “Sample data” and then click on “Add”



The screenshot shows the Microsoft Azure portal interface. At the top, there's a blue header bar with the Microsoft Azure logo and some navigation icons. Below it, a search bar contains the text 'Search resources, services, pipelines, etc...'. The main content area has a title 'New model' and a sub-section 'Where's your data?'. A dropdown menu is open under 'Choose a data source', and the option 'Sample data' is highlighted with a blue selection bar.

Navigate to the “Manage” tab and the sample data will be visible there.

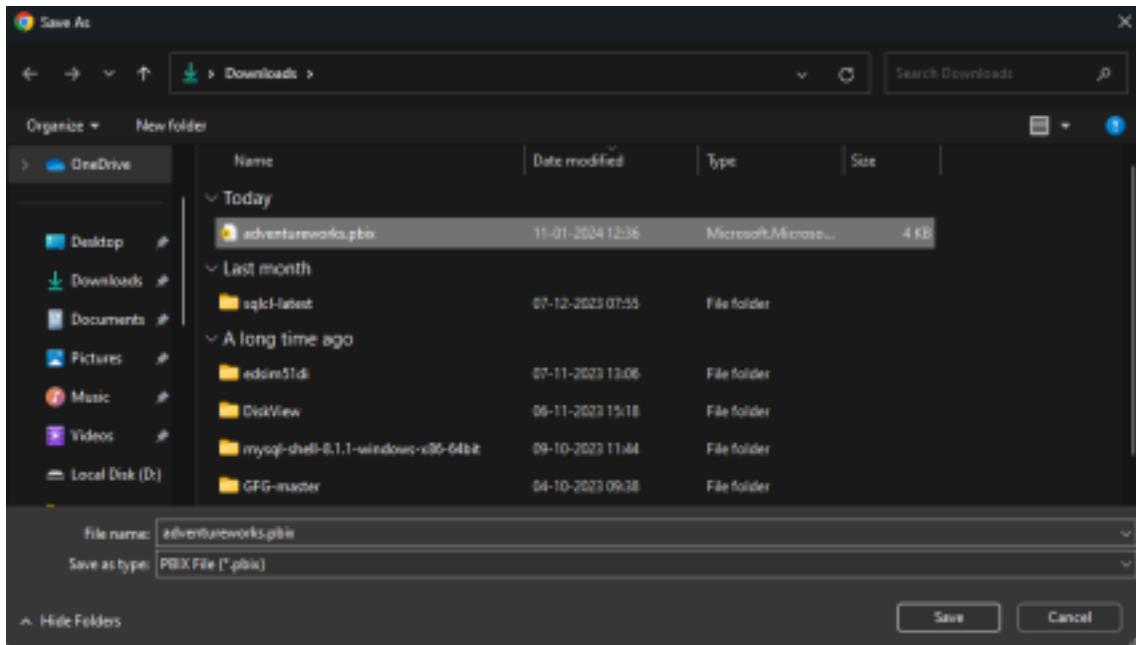


The screenshot shows the Microsoft Analysis Services blade in the Azure portal. The left sidebar has a tree view with 'Overview', 'Activity log', 'Access control (AAD)', 'Tags', 'Diagnose and solve problems', 'Scale', 'Metrics (Preview)', 'Replica', 'Models' (which is selected), 'Settings', 'Quick Start', 'Analytics Dataset Admins', 'On-Premises Data Gateway', 'Checklist', 'Connector Settings', 'Visuals', 'Properties', 'Links', 'Monitoring', 'Users', 'MDS', and 'Diagnostic settings'. The main content area is titled 'analysis13 | Manage' and shows a table titled 'Models on Analysis Services Server'. The table has columns: Name, Compatibility, Date Modified, Last Synced Time, and Sync Status. It lists one item: 'adventureworks' with compatibility '1200', last modified '1/11/2024, 12:23 PM', and sync status 'Synced'. There are also 'Edit' and 'Delete' buttons for the row.

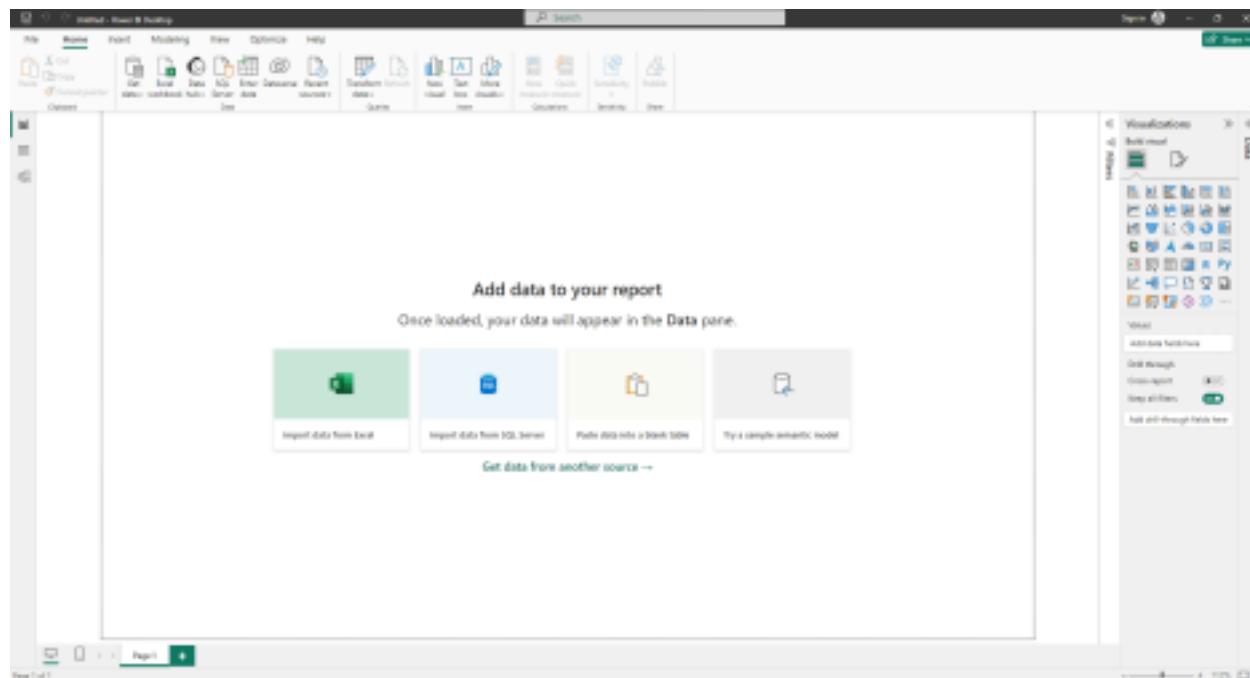
9. Right click on the sample data and select “Open in Power BI Desktop” Save the file



The screenshot shows the same 'Models on Analysis Services Server' table from the previous screenshot. A context menu is open over the 'adventureworks' row. The menu items are 'Open in Excel', 'Open in Power BI Desktop' (which is highlighted with a blue selection bar), and 'Open in Visual Studio'.



10. Once Power BI is opened, click on “Import data from Excel”



11. Add an excel sheet into Power BI and click on “Load”

The screenshot shows the Power BI Navigator window. On the left, there's a sidebar titled 'Navigator' with a search bar and 'Display Options'. Below these are two items: 'Book1.xlsx (2)' and 'Sheet1'. 'Sheet1' is selected, indicated by a checked checkbox and a highlighted background. The main area is titled 'Sheet1' and shows a preview of the data with the message 'Preview downloaded on Monday'. A table is displayed with the following data:

Region	Agent	Revenue
East	Carson	1468
west	Hedice	345
north	Kensi	587
south	Captin	781
East	Hoak	435
west	Jude	678
north	Hockey	458
south	Rum	1111
East	Juliet	257
west	Rayun	880
north	Rahul	587
south	Aayush	200

At the bottom right of the main area are three buttons: 'Load' (green), 'Transform Data' (white), and 'Cancel' (white).

12. We use Power BI in order to visualize the data stored.

On the right hand side of the screen, select the visualizations you want (In this case, it is table) and select the various columns you want to visualize.

Visualizations >>

Build visual

Columns

- Agent
- Region
- Sum of Revenue

Drill through

Cross-report Off

Keep all filters On

Add drill-through fields here

Data

- Table1
 - Agent
 - Region
 - Revenue

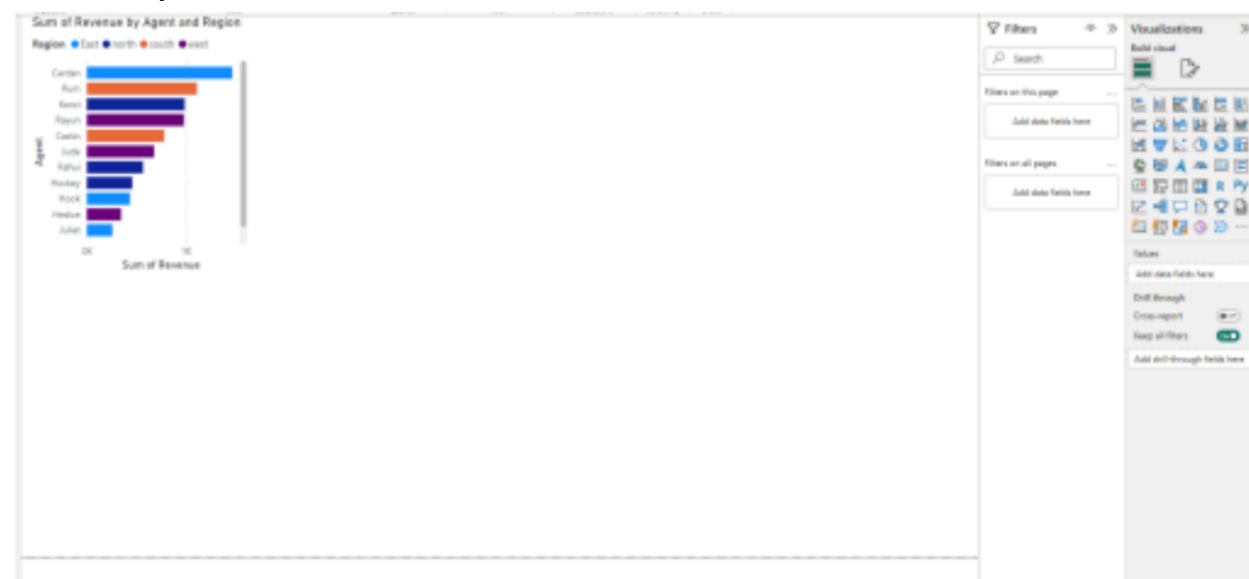
The output of the visualization is as shown below

Structure Formatting

The screenshot shows a data grid with three columns: Agent, Region, and Sum of Revenue. The data includes 11 rows of individual entries and one summary row at the bottom labeled 'Total'. The 'Region' column uses color coding: East (blue), North (dark blue), South (orange), and West (purple). The 'Sum of Revenue' column contains numerical values.

	Agent	Region	Sum of Revenue
	Aayush	south	200
	Cardan	East	1468
	Castin	south	781
	Hedice	west	345
	Hockey	north	458
	Hook	East	435
	Jude	west	678
	Juliet	East	257
	Kenzi	north	987
	Rahui	north	567
	Rayun	west	980
	Rum	south	1111
	Total		8267

13. Similarly, we can use other visualizations in order to visualize the the data



Practical 6: Case study- Microsoft Azure.

Cloud Computing Case Study on Microsoft Azure

Tauseem Chaudhary,

Somaiya Vidyavihar University

Date: April 2024

Abstract—Cloud computing is an emerging paradigm that provides a promise to revolutionize the way the software development industry operates. In this paper, we perform a thorough case study of Microsoft Azure a popular cloud computing platform. We thoroughly study various key concepts and features provided by this platform. This study will provide researchers and in-depth understanding of various aspects of Microsoft Azure.

I. INTRODUCTION

A rapid growth in networking technologies and newly enabled features has resulted in a tremendous growth in user data and computation capability requirement for application design [1]–[8]. Cloud computing is a promising new paradigm that provides agility, scalability, and efficiency to the software design methodologies of the information technology (IT) industry. Further, its use can enable the design and development of various new applications for wireless communication use cases [9]–[13].

Microsoft Azure is a cloud computing platform and infrastructure created by Microsoft for building, deploying, and managing applications and services through a global network of Microsoft-managed data centers. It provides both PaaS and IaaS services and supports many different programming languages, tools, and frameworks, including both Microsoft-specific and third-party software and systems.

Azure Storage is massively scalable, so a user can store and process hundreds of terabytes of data to support the big data scenarios required by scientific, financial analysis, and media applications. Further, the user can store the small amounts of data required for a small business website. Such capabilities are also required for development of new analytic features [14]–[16]. Wherever the user needs fall, the users pay only for the data they store.

Azure Storage currently stores tens of trillions of unique customer objects, and handles millions of requests per second on average.

II. BENEFITS OF AZURE STORAGE

Azure Storage supports clients using a diverse set of operating systems (including Windows and Linux) and a variety of programming languages (including .NET, Java, and C++) for convenient development. Azure Storage also exposes data resources via simple REST APIs, which are available to any client capable of sending and receiving data via HTTP/HTTPS.

III. DETAILS OF MICROSOFT AZURE WEBSITES

Microsoft Azure Web Sites is implemented as websites that are dynamically created on-demand on servers running Windows Server 2012 and IIS 8.0. When a client posts a request to a web site, Microsoft Azure Web Sites dynamically provisions the site on one of the Azure virtual machines pointing it at content stored in Azure Storage containers. The Azure Virtual Machines are deployed in groups called "Stamps," which may contain hundreds of such machines. Microsoft deploys these stamps in its Azure centers across the world and adds more stamps as demand grows.

IV. SERVICES PROVIDED BY MICROSOFT AZURE

Microsoft lists over 50 Azure services including: Azure Active Directory B2C, Azure Active Directory, Azure Active Directory Domain Services, API Management, Application Gateway, Visual Studio Application Insights, App Service, Automation, Backup, Batch, BizTalk Services, CDN, Cloud Services, Azure Container Service, Data Catalog, Data Factory, Data Lake Analytics, Data Lake Store, Azure DevTest Labs, AzureDNS, DocumentDB, Event Hubs, ExpressRoute, HDInsight, Azure IoT Hub, Key Vault, Load Balancer, Machine Learning, Managed Cache Service, Media Services, Mobile Engagement, Mobile Services, Multi-Factor Authentication, Notification Hubs, Operational Insights, Redis Cache, RemoteApp, Scheduler, Search, Security Center, Service Bus, Service Fabric, SiteRecovery, SQL Database, SQL Data Warehouse, SQL Server Stretch Database, Storage, StorSimple, Stream Analytics, Traffic Manager, Virtual Machines, Virtual Network, Visual Studio Team Services, VPN Gateway.

V. KEY FEATURES PROVIDED BY MICROSOFT AZURE

The key features of Microsoft Azure are covered below:

A. Compute

These services provide virtual machines, containers, batch processing, and remote application access.

- App services, platform as a service (PaaS) environment letting developers easily publish and manage websites.
- Websites, high density hosting of websites allows developers to build sites using ASP.NET, PHP, Node.js, or Python and can be deployed using FTP, Git, Mercurial, or Team Foundation Server. This feature was announced in preview form in June 2012 at the Meet Microsoft Azure event. Customers can create websites in PHP, ASP.NET, Node.js, or Python, or select from several open source applications from a gallery to deploy. This comprises one aspect of the platform as a service (PaaS) offerings for the Microsoft Azure Platform. It was renamed to Web Apps in April 2015.
- WebJobs, applications which can be deployed to a Web App to implement background processing. That can be invoked on a schedule, on demand or can run continuously. The Blob, Table, and Queue services can be used to communicate between Web Apps and Web Jobs and to provide state.

Refer to fig. 1 to view various services covered under Compute feature of Microsoft Azure.

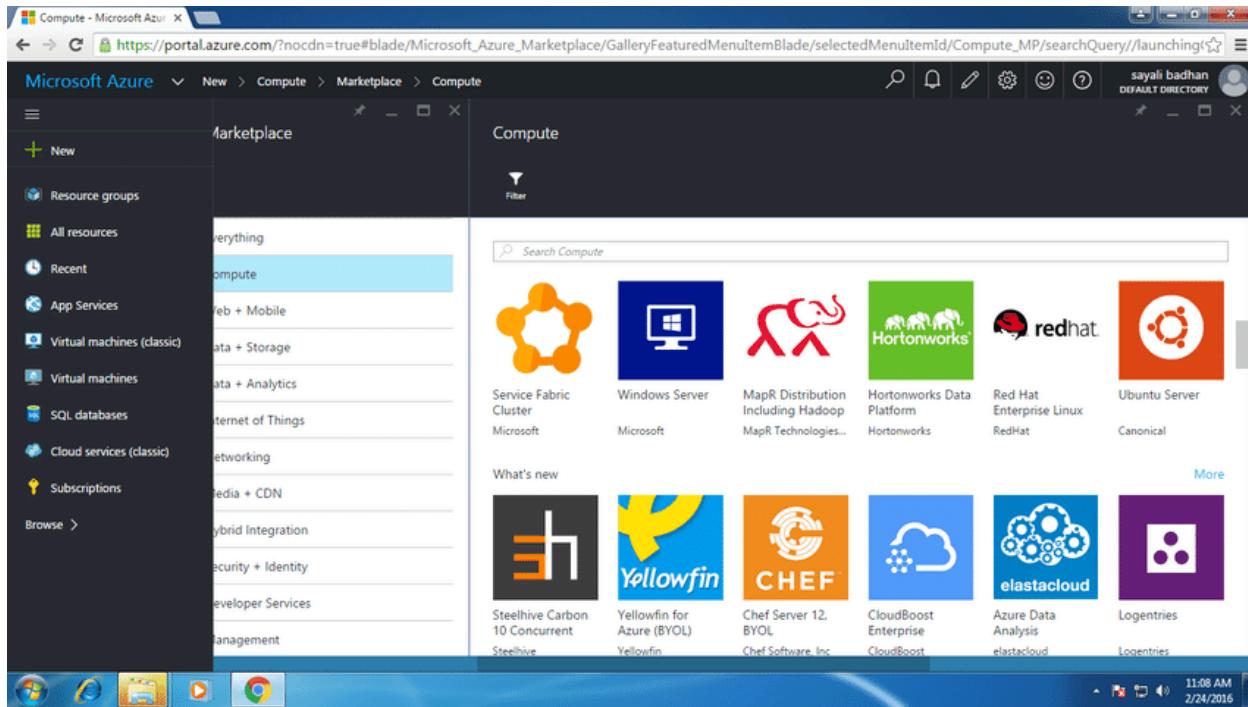


Fig. 1: Services under Compute feature

B. Networking

This group includes virtual networks, dedicated connections and gateways, as well as services for traffic management, load balancing and domain name system (DNS) hosting.

- Virtual Network, a hosted Virtual private network.
- Azure DNS, a DNS domain hosting service. It provides domain name resolution services using the cloud infrastructure of Microsoft Azure. The Azure DNS services are integrated with other Azure services in terms of APIs, billing, credentials. The Azure DNS service is built upon the highly scalable cloud infrastructure provided by Microsoft Azure. The deployment is Anycast based and the service has a high global footprint to provide faster network resolution. Azure DNS is currently open for public preview.
- ExpressRoute allows creation of private connections between Azure datacenters and infrastructure that's on your premises or in a colocation environment. ExpressRoute connections don't go over the public Internet (sometimes called "dark fiber") and offer more reliability, faster speeds (it's like a leased line), lower latencies (one hop to Azure), and may offer higher security than typical Internet connections. In some cases, using ExpressRoute connections to transfer data between on-premises systems and Azure can also yield significant cost benefits.

Refer to fig. 2 to view various services covered under Networking feature of Microsoft Azure.

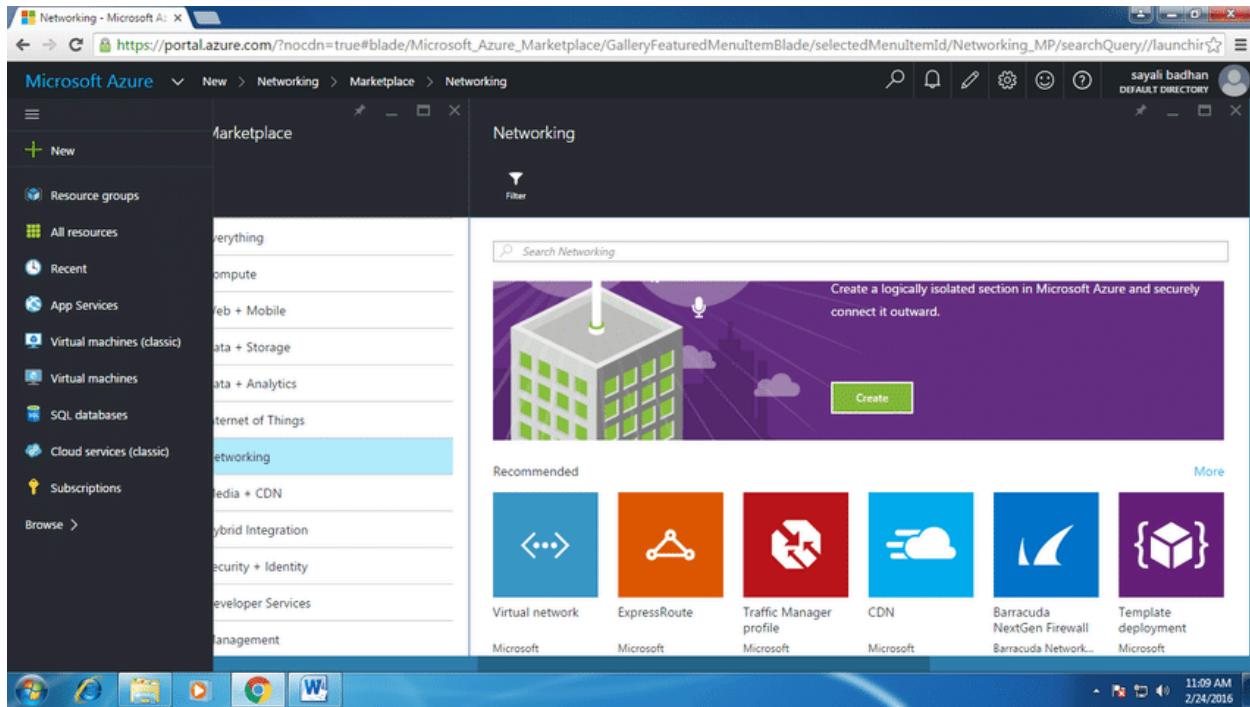


Fig. 2: Services under Networking feature

C. Data+Storage

This category includes Database offerings for SQL and NoSQL, as well as unstructured and cached cloud storage. Azure Storage provides the flexibility and hyper-scale needed to store and retrieve large amounts of data. Use Azure Blob Storage (Object Storage) to store unstructured data, such as documents and media files. Use Azure Table Storage for structured NoSQL data. Use Azure Queue Storage to reliably store messages. And use SMB-based Azure File Storage for existing or new applications—no code changes are required.

- SQL Database, formerly known as SQL Azure Database, works to create, scale, and extend applications into the cloud using Microsoft SQL Server technology. It also integrates with Active Directory and Microsoft System Center and Hadoop.
- Azure Search provides text search and a subset of [OData]'s structured filters using REST or SDK APIs.
- DocumentDB is a NoSQL database service that implements a subset of the [SQL] SELECT statement on [JSON] documents.
- Redis Cache is a managed implementation of Redis.
- StorSimple manages storage tasks between on-premises devices and cloud storage.

Refer to fig. 3 to view various services covered under Data+Storage feature of Microsoft Azure.

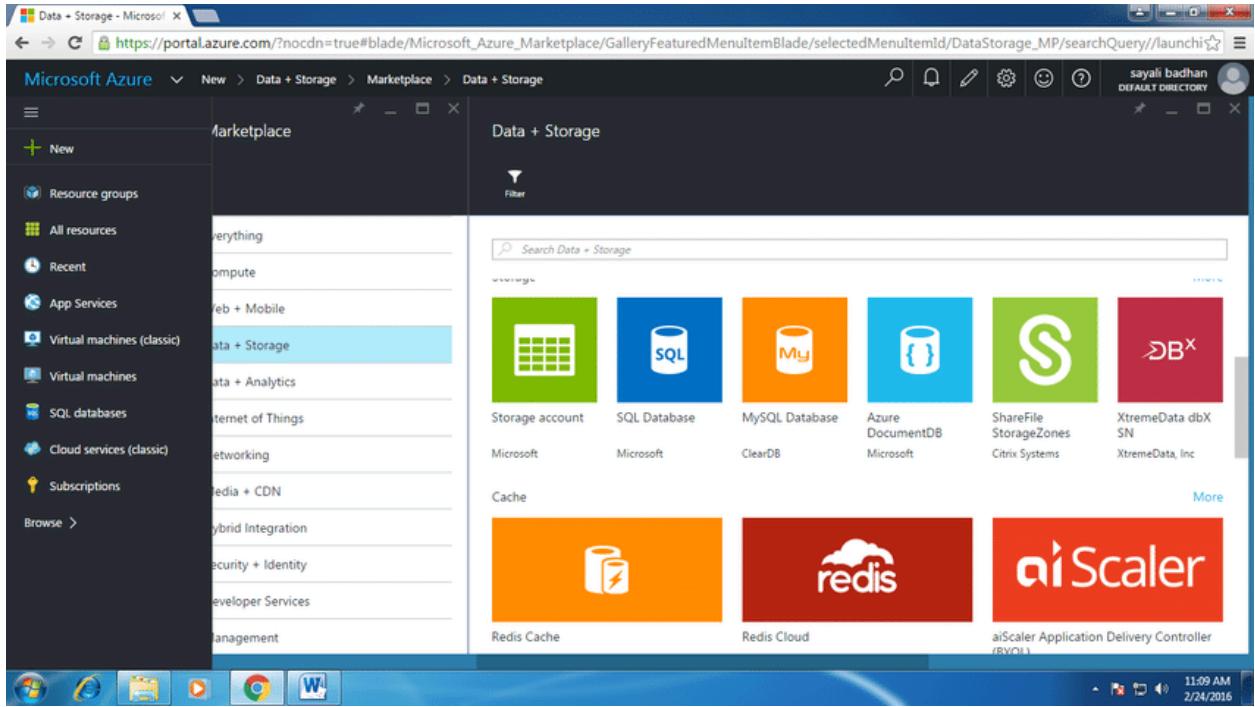


Fig. 3: Services under the Data+Storage feature

VI. CONCLUSION

In this paper, we study about one cloud computing platform: Microsoft Azure. First, we study what is Microsoft Azure. Following this, we go through its benefits and various services provided by Microsoft Azure. Finally, we explore different features provided by Microsoft Azure like compute, data+storage, Networking in detail.

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Practical 7: Case study- Amazon EC2

A CASE STUDY OF AMAZON WEB SERVICES: AMAZON EC2

Tauseem Chaudhary,
Somaiya Vidyavihar University
Date: April 2024

Abstract-A tremendous growth in user data has led to design and development of a number of analytic tools. To support such tools, efficient cloud computing services have become the need of the hour. This paper studies Amazon Web Services, a popular cloud computing platform. The paper provides an overview of features of the platform such as AWS security and identity, computation, storage, content delivery, etc.

I. INTRODUCTION

A rapid growth of network usage has led to an increasing transmission of user data over it [1]–[8]. User data not only exposes what users want but also provides an insight into how users think and behave. Consequently, a number of analytic tools [9]–[16] have been developed to process such user data to generate interesting trends from them. However, to support such features, efficient cloud computing platforms are extremely important.

Amazon Web Services (AWS) is a collection of cloud computing services, also called services that make up a cloud-computing platform offered by Amazon.com. These services operate from 12 geographical regions across the world. The most central and well-known of these services arguably include Amazon Elastic Compute Cloud, also known as "EC2", and Amazon Simple Storage Service, also known as "S3". Amazon markets AWS as a service to provide large computing capacity more quickly and more cheaply than a client company building an actual physical server farm.

II. LOCATIONS OF SERVICE

AWS is located in 12 geographical "regions":

- US East (Northern Virginia), where the majority of AWS servers are based
- US West (northern California)
- US West (Oregon)
- Brazil (Sao Paulo)
- Europe (Ireland and Germany)
- Southeast Asia (Singapore)
- East Asia (Tokyo, Seoul, Beijing)

- Australia (Sydney)

There is also a "GovCloud", based in the Northwestern United States, provided for U.S. government customers, complementing existing government agencies already using the US East Region. Each Region is wholly contained within a single country, and all of its data and services stay within the designated Region.

III. AWS SECURITY AND IDENTITY

#A. AWS Identity and Access Management (IAM)

AWS Identity and Access Management (IAM) is a web service that helps you securely control access to AWS resources for your users. You use IAM to control who can use your AWS resources (authentication) and what resources they can use and in what ways (authorization).

#B. Features

- Shared access to your AWS account
- Granular permissions
- Secure access to AWS resources for applications that run on Amazon EC2
- Multi-factor authentication (MFA)
- Identity federation
- Identity information for assurance
- PCI DSS Compliance
- Integrated with many AWS services
- Eventually Consistent
- Free to use
- AWS SDKs

#C. AWS Certificate Manager (ACM)

AWS Certificate Manager (ACM) handles the complexity of provisioning, deploying, and managing certificates provided by ACM (ACM Certificates) for your AWS-based websites and applications.

IV. COMPUTE FEATURE OF AWS: AMAZON EC2

Amazon Elastic Compute Cloud (Amazon EC2) provides scalable computing capacity in the Amazon Web Services (AWS) cloud. Using Amazon EC2 eliminates your need to invest in hardware upfront, so you can develop and deploy applications faster. You can use Amazon EC2 to launch as many or as few virtual servers as you need, configure security and networking, and manage storage. Amazon EC2 enables you to scale up or down to handle changes in requirements or spikes in popularity, reducing your need to forecast traffic.

#A. Features of Amazon EC2

- Virtual computing environments, known as instances
- Preconfigured templates for your instances, known as Amazon Machine Images (AMIs)
- Various configurations of CPU, memory, storage, and networking capacity for your instances, known as instance types
- Secure login information for your instances using key pairs
- Storage volumes for temporary data that's deleted when you stop or terminate your instance, known as instance store volumes
- Persistent storage volumes for your data using Amazon Elastic Block Store (Amazon EBS), known as Amazon EBS volumes
- Multiple physical locations for your resources, such as instances and Amazon EBS volumes, known as regions and Availability Zones

#B. How to Get Started with Amazon EC2

The first thing you need to do is get set up to use Amazon EC2. After you are set up, you are ready to complete the Getting Started tutorial for Amazon EC2. Whenever you need more information about a feature of Amazon EC2, you can read the technical documentation.

V. STORAGE & CONTENT DELIVERY: CLOUDFRONT

Amazon CloudFront is a content delivery web service. It integrates with other Amazon Web Services products to give developers and businesses an easy way to distribute content to end users with low latency, high data transfer speeds, and no minimum usage commitments.

Amazon CloudFront can be used to deliver your entire website, including dynamic, static, streaming, and interactive content using a global network of edge locations. Requests for your content are automatically routed to the nearest edge location, so content is delivered with the best possible performance. Amazon CloudFront is optimized to work with other Amazon Web Services, like Amazon Simple Storage Service (Amazon S3), Amazon Elastic Compute Cloud (Amazon EC2), Amazon Elastic Load Balancing, and Amazon Route 53. Amazon CloudFront also works seamlessly with any non-AWS origin server, which stores the original, definitive versions of your files.

VI. DATABASE: RDS

Amazon Relational Database Service (Amazon RDS) is a web service that makes it easier to set up, operate, and scale a relational database in the cloud. It provides cost-efficient, resizable capacity for an industry-standard relational database and manages common database administration tasks. Amazon RDS manages backups, software patching, automatic failure detection, and recovery. In order to deliver a managed service experience, Amazon RDS does

not provide shell access to DB instances, and it restricts access to certain system procedures and tables that require advanced privileges. You can have automated backups performed when you need them, or create your own backup snapshot. These backups can be used to restore a database, and the Amazon RDS restore process works reliably and efficiently.

VII. CONCLUSION

We studied various Amazon Web Services (AWS) which is a collection of cloud computing services that make up a cloud-computing platform offered by Amazon.com. Also studied about Amazon EC2 in detail.

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This format presents a structured and detailed overview of the Amazon EC2 case study, following the guidelines provided in the previous example. You can use this as a reference or modify it as per your requirements.

Practical 8: Case study- Oracle cloud.

A CASE STUDY OF ORACLE CLOUD

Tauseem Chaudhary,
Somaiya Vidyavihar University
Date: April 2024

Abstract

The demand for scalable, secure, and reliable cloud computing services has led to the rise of various cloud platforms. This paper delves into Oracle Cloud, a comprehensive cloud computing platform offered by Oracle Corporation. It provides an overview of key features such as compute, storage, networking, security, and database services, highlighting its benefits and advantages.

I. INTRODUCTION

With the exponential growth of data and the need for advanced computing capabilities, cloud computing has become an integral part of modern business operations. Oracle Cloud is a cloud computing service offered by Oracle Corporation, providing a wide range of services to support various business needs. This paper aims to explore the features and benefits of Oracle Cloud, focusing on its compute, storage, networking, security, and database offerings.

II. ORACLE CLOUD REGIONS

Oracle Cloud operates in multiple geographic regions across the globe, allowing users to deploy resources closer to their end-users for improved performance and compliance. Some of the key regions include:

- North America (US)
- Europe (UK, Germany, Switzerland, Netherlands)
- Asia Pacific (Japan, India, Australia)
- Middle East (UAE, Saudi Arabia)
- South America (Brazil)

Each region is designed to comply with local data privacy and sovereignty laws, ensuring data residency and regulatory compliance.

III. COMPUTE SERVICES: ORACLE COMPUTE

Oracle Compute is a core service within Oracle Cloud, offering scalable and flexible compute resources for various workloads. Key features include:

- Virtual Machine Instances: Create and manage virtual machines (VMs) with customizable CPU, memory, and storage configurations.
- Bare Metal Instances: Provision dedicated physical servers for high-performance and security-sensitive applications.
- Container Engine: Run and manage Docker containers at scale with Oracle's Kubernetes-based container service.
- Functions: Serverless computing platform for running code without provisioning or managing servers.

Oracle Compute enables users to deploy, scale, and manage applications with ease, supporting diverse workload requirements.

IV. STORAGE SERVICES: ORACLE STORAGE

Oracle Storage provides reliable and scalable storage solutions for data management and backup. Key offerings include:

- Object Storage: Store and retrieve large amounts of unstructured data such as images, videos, and documents.
- Block Volumes: High-performance block storage for VMs and bare metal instances, with options for encryption and replication.
- File Storage: Fully managed file storage service for shared file systems, suitable for enterprise applications and databases.
- Archive Storage: Cost-effective long-term storage for data archival and compliance needs.

With Oracle Storage, users can securely store, manage, and access their data while benefiting from scalability and durability.

V. NETWORKING SERVICES: ORACLE NETWORKING

Oracle Networking services provide the foundation for connecting and managing cloud resources. Key features include:

- Virtual Cloud Networks (VCNs): Software-defined networks for isolating and segmenting cloud resources.
- Load Balancing: Distribute incoming traffic across multiple compute instances for improved performance and availability.
- VPN Connect: Securely connect on-premises data centers to Oracle Cloud using encrypted VPN tunnels.
- FastConnect: Dedicated private connections between on-premises infrastructure and Oracle Cloud data centers for low-latency, high-bandwidth networking.

Oracle Networking empowers users to build secure, scalable, and high-performance networks for their cloud environments.

VI. SECURITY SERVICES: ORACLE SECURITY

Security is a top priority for Oracle Cloud, with a range of built-in security services and controls. Key security features include:

- Identity and Access Management (IAM): Manage user identities, roles, and access policies to control resource permissions.
- Security Zones: Isolate and protect critical workloads by defining security boundaries within Oracle Cloud.
- Encryption: Secure data at rest and in transit with encryption capabilities for storage volumes, databases, and network traffic.
- Security Monitoring: Real-time monitoring and alerting for potential security threats and vulnerabilities.
- Compliance Reporting: Generate compliance reports and audits to meet regulatory requirements.

Oracle Cloud's robust security framework ensures data protection, compliance, and threat detection for users' cloud environments.

VII. DATABASE SERVICES: ORACLE DATABASE

Oracle Database services offer a range of database options tailored to different business needs.

Key offerings include:

- Autonomous Database: Self-driving, self-secur ing, and self-repairing database service for high-performance, automated data management.
- Exadata Cloud Service: Fully managed Oracle Exadata infrastructure for mission-critical database workloads with high availability and performance.
- Database Backup: Automated and scalable backup solutions for Oracle databases, ensuring data protection and disaster recovery.
- Database Migration: Tools and services for migrating on-premises databases to Oracle Cloud with minimal downtime and effort.

Oracle Database services empower organizations to leverage powerful database technologies with the simplicity and scalability of the cloud.

VIII. CONCLUSION

In conclusion, Oracle Cloud offers a comprehensive suite of cloud computing services designed to meet the diverse needs of modern businesses. From compute and storage to networking, security, and databases, Oracle Cloud provides a scalable, secure, and reliable platform for running mission-critical workloads and applications. By leveraging Oracle Cloud's capabilities, organizations can accelerate innovation, reduce costs, and drive business growth in the digital era.

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5. "Getting Started with Oracle Compute" tutorial by Oracle Cloud.
6. "Oracle Database Services: A Comprehensive Guide" by Oracle Corporation.

This case study provides a detailed overview of Oracle Cloud, focusing on its key services, features, and benefits. It can serve as a reference for understanding the capabilities and advantages of Oracle's cloud computing platform.

Practical 9: Case study- Google cloud.

A CASE STUDY OF GOOGLE CLOUD

Tauseem Chaudhary,
Somaiya Vidyavihar University
Date: April 2024

Abstract

In the rapidly evolving landscape of cloud computing, Google Cloud has emerged as a prominent player, offering a wide array of services for businesses of all sizes. This case study delves into the key features and benefits of Google Cloud, exploring its compute, storage, networking, security, and machine learning capabilities.

I. INTRODUCTION

Cloud computing has become a cornerstone of modern IT infrastructure, enabling businesses to scale, innovate, and stay competitive. Google Cloud, the cloud computing platform by Google, provides a suite of services designed to meet the demands of today's digital landscape. This case study aims to explore the diverse offerings of Google Cloud, highlighting its versatility and advantages.

II. GOOGLE CLOUD REGIONS

Google Cloud operates in a global network of regions and zones, allowing users to deploy resources closer to their end-users for improved performance. Some key regions include:

- North America (US)
- Europe (UK, Germany, Netherlands)
- Asia Pacific (Singapore, Japan, India)
- South America (Brazil)
- Australia

Each region is designed to provide low-latency, high-availability environments with robust data residency options for compliance.

III. COMPUTE ENGINE: GOOGLE COMPUTE

Google Compute Engine is a core component of Google Cloud, offering flexible and scalable virtual machine (VM) instances. Key features include:

- Custom Machine Types: Create VMs with customized CPU, memory, and storage configurations to meet specific workload requirements.
- Predefined Machine Types: Choose from a range of predefined machine types optimized for general-purpose, memory-intensive, or compute-intensive workloads.
- Managed Instance Groups: Automatically manage and scale groups of VM instances based on demand, ensuring high availability and reliability.
- Google Kubernetes Engine (GKE): Managed Kubernetes service for deploying, managing, and scaling containerized applications.

Google Compute Engine provides users with the agility and flexibility to run various workloads efficiently in the cloud environment.

IV. STORAGE SERVICES: GOOGLE STORAGE

Google Cloud Storage offers scalable, durable, and cost-effective storage solutions for businesses of all sizes. Key offerings include:

- Cloud Storage Standard: Highly available and durable object storage for storing unstructured data such as images, videos, and backups.
- Cloud Storage Nearline: Cost-effective storage for data that is accessed less frequently but requires quick access when needed.
- Cloud Storage Coldline: Low-cost archival storage for data that is accessed infrequently and stored for long-term retention.
- Cloud Filestore: Managed file storage for enterprise applications, providing high performance and compatibility with NFS protocols.

With Google Cloud Storage, users can securely store, access, and manage their data with ease, ensuring high availability and durability.

V. NETWORKING SERVICES: GOOGLE NETWORKING

Google Cloud Networking offers a robust and scalable network infrastructure to connect and optimize cloud resources. Key features include:

- Virtual Private Cloud (VPC): Securely isolate and control network traffic within Google Cloud environments using customizable VPC networks.

- Cloud Load Balancing: Distribute incoming traffic across multiple instances or regions for improved availability and performance.
- Cloud Interconnect: Establish private, high-bandwidth connections between on-premises networks and Google Cloud using dedicated interconnects or VPNs.
- Network Intelligence Center: Gain visibility and control over network performance and security with real-time monitoring, diagnostics, and insights.

Google Networking services enable users to build secure, reliable, and performant networks tailored to their specific needs.

VI. SECURITY SERVICES: GOOGLE SECURITY

Security is a top priority for Google Cloud, with a comprehensive set of tools and services to protect cloud environments. Key security features include:

- Identity and Access Management (IAM): Manage user identities and control access to resources with fine-grained permissions and policies.
- Cloud Identity-Aware Proxy (IAP): Enforce access controls based on user identity and context, securing applications running on Google Cloud.
- Cloud Security Scanner: Detect and fix security vulnerabilities in web applications hosted on Google Cloud.
- Google Cloud Armor: Protect applications and services from Distributed Denial of Service (DDoS) attacks with built-in defenses and WAF capabilities.
- Encryption: Encrypt data at rest and in transit using Google-managed encryption keys or customer-supplied keys for enhanced data protection.

Google Cloud's robust security framework ensures compliance, data integrity, and threat prevention for users' cloud environments.

VII. MACHINE LEARNING SERVICES: GOOGLE ML

Google Cloud offers a suite of machine learning (ML) and artificial intelligence (AI) tools to enable businesses to derive insights and make informed decisions. Key ML services include:

- Cloud AI Platform: Managed platform for building, training, and deploying ML models at scale with TensorFlow and scikit-learn.
- AutoML: Automated machine learning service for building custom ML models without extensive expertise in ML algorithms.
- Vision AI: Pre-trained models for image recognition, object detection, and optical character recognition (OCR).
- Natural Language AI: APIs for sentiment analysis, entity recognition, and language translation for text-based data.

- Recommendations AI: Personalized recommendation engines for enhancing customer experiences and increasing engagement.

With Google Cloud's ML services, businesses can harness the power of AI to unlock insights, automate tasks, and drive innovation.

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