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MS Data Science

DevOps Semester Project

Key Links:

Dockerized App

<https://app.codelessops.site/>

Metabase App

<https://bi.codelessops.site/>

Github Repo

https://github.com/muhammaduzair99/nodeapp_uzair

DockerHub Repo

<https://hub.docker.com/repository/docker/uzair99/nodeapp-project/general>

Video Link:

<https://www.loom.com/share/a80efbe3184643518c73a8cd911beb32?sid=eac72e1e-a494-4a06-a506-0f931c4eae51>

Project Report: Secure Analytics Infrastructure with Dockerized Metabase on AWS

1. Project Overview

This project involved designing and deploying a scalable, secure, and production-grade analytics infrastructure on AWS. The core components included:

- Dockerized **Metabase** as a BI tool
 - **RDS MySQL and PostgreSQL** for analytics datasets
 - **EC2 Auto Scaling Group** for application backend
 - **Application Load Balancer (ALB)** with HTTPS
 - **Nginx reverse proxy and Certbot SSL**
 - Infrastructure-as-Code using **Terraform**
-

2. Objectives

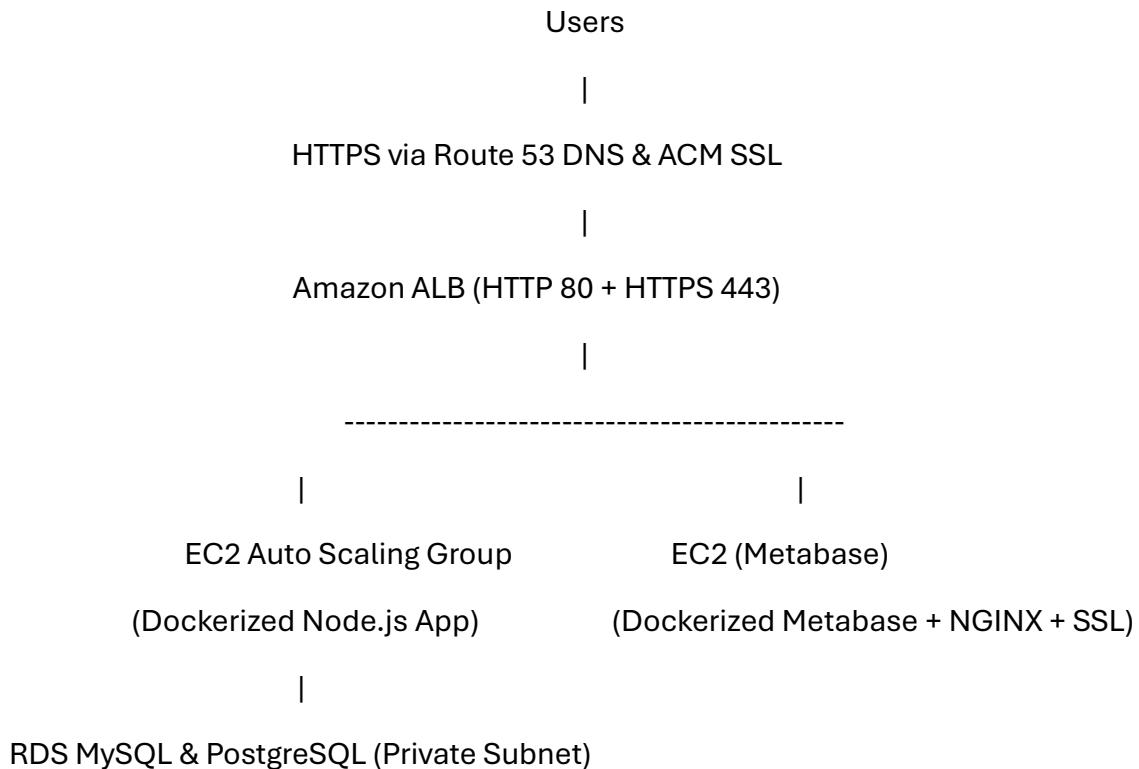
- Build a cost-effective, containerized analytics infrastructure
 - Ensure data security using HTTPS and restricted database access
 - Enable scalable deployments with Auto Scaling EC2 and ALB
 - Connect and visualize data from both MySQL and PostgreSQL in Metabase
-

3. Technologies Used

Component	Technology
Cloud Provider	AWS (EC2, RDS, ALB, Route 53, IAM)
Containerization	Docker, Docker Compose
Web Server & SSL	NGINX, Certbot (Let's Encrypt)
Infrastructure Code	Terraform (~> v1.5.0)
Backend App	Node.js (Dockerized, exposed on port 3000)
Database Engines	Amazon RDS (MySQL & PostgreSQL)

Component	Technology
Analytics	Metabase (Dockerized)

4. Architecture Diagram



5. Implementation Steps

A. RDS Setup

- Created **PostgreSQL** and **MySQL** instances via terraform.
- Configured database users, security groups, and external access.

B. Dockerized Node.js Application

- Dockerized an Express.js app with endpoints `/`, `/mysql`, and `/pgsql`.
- Configured the app to connect securely to both databases using `.env`.

C. Auto Scaling & Load Balancer

- Configured a Launch Template and Auto Scaling Group for Node.js backend.
- ALB forwards HTTPS traffic to EC2s running the app via port 3000.

- SSL enabled using AWS ACM and listener redirect from HTTP to HTTPS.

D. Metabase EC2 Deployment (Ubuntu)

- Created a dedicated Ubuntu EC2 instance using Terraform.
 - Installed Docker, NGINX, and Certbot via user_data script.
 - Used Docker Compose to run Metabase on port 3001.
 - Configured NGINX reverse proxy and issued SSL via Let's Encrypt.
-

6. SSH & Tunneling for DBeaver Access

- Created SSH tunnels from local machine to:
 - Metabase server for admin access (HTTPS)
 - PostgreSQL and MySQL RDS via bastion or public access
 - Verified database connection via **DBeaver** GUI tool.
-

7. Connecting Metabase to RDS

- Logged into <https://bi.codelessops.site>
 - Connected to both:
 - MySQL: mysql-db.c3wk6qw2orem.us-east-2.rds.amazonaws.com
 - PostgreSQL: postgres-db.c3wk6qw2orem.us-east-2.rds.amazonaws.com
 - Used muzair12 as DB user, verified credentials.
 - Visualized tables using Metabase's GUI (sample queries, charts).
-

8. Sample Visualizations

- Created dashboards in Metabase showing:
 - Server time from both DBs
 - Comparative row counts
 - Sample table previews

- Time series (if applicable data present)
-

9. Key Highlights

- Full HTTPS deployment with free SSL using Certbot
 - Seamless ALB routing to Dockerized app on EC2
 - Reusable Terraform modules and scripts
 - Docker Compose used for clean container orchestration
 - Metabase running stably on Ubuntu EC2 with minimal config
-

10. Challenges and Fixes

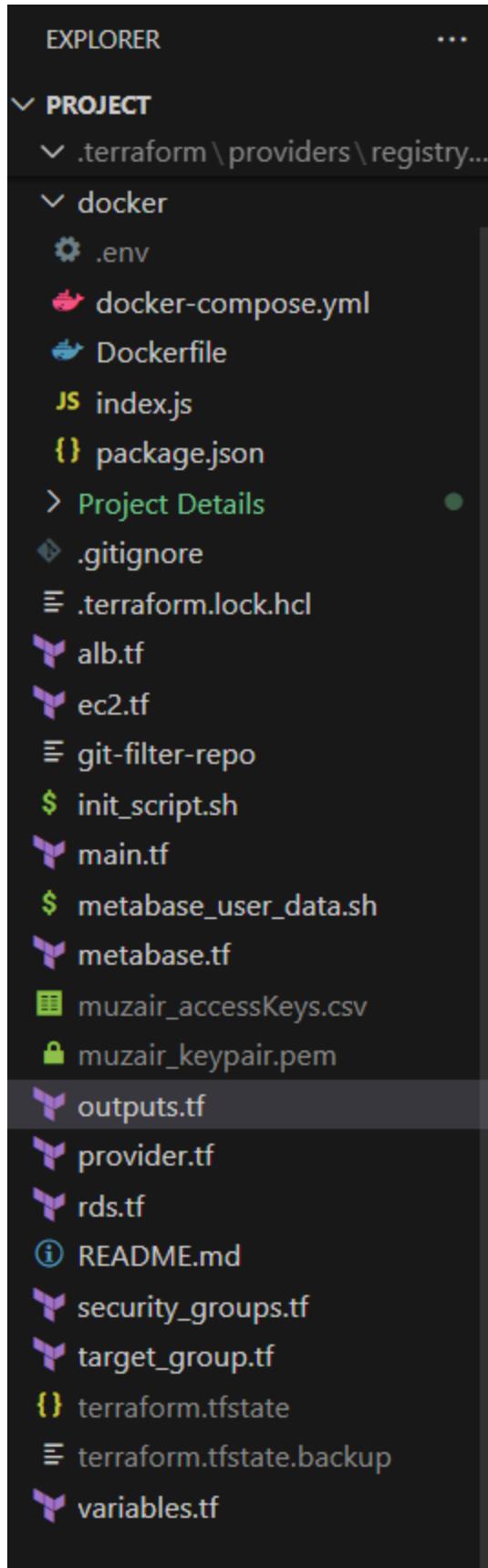
Issue	Solution
Certbot not supported on Amazon Linux 2 Switched Metabase instance to Ubuntu 24.04	
Instance IP changed on every apply	Used Route 53 DNS + ACM certificate
Connection issues from Metabase to RDS Allowed port access via Security Group	
Docker container restart behavior	Added restart: always in Docker Compose
User Data debugging	Used cat /var/log/cloud-init-output.log

11. Future Improvements

- Add S3 backup for Metabase and RDS snapshots
 - Auto-renew SSL certificates via system cron job
 - Replace hardcoded credentials with AWS Secrets Manager
 - Implement monitoring (e.g., CloudWatch or Grafana)
-

12. Conclusion

This project successfully demonstrates how to deploy a secure, scalable, and containerized analytics platform on AWS using Metabase. The full infrastructure was provisioned via Terraform, ensuring reproducibility and modularity. The final outcome provides a robust base for data visualization and business intelligence use cases in real-time or scheduled data analysis environments.



us-east-2.console.aws.amazon.com/ec2/home?region=us-east-2#Instances:

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aws EC2 Instances

EC2

- Dashboard
- EC2 Global View
- Events
- Instances**
 - Instances
 - Instance Types
 - Launch Templates
 - Spot Requests
 - Savings Plans
 - Reserved Instances
 - Dedicated Hosts
 - Capacity Reservations
- Images
 - AMIs
 - AMI Catalog
- Elastic Block Store
 - Volumes
 - Snapshots

CloudShell Feedback

Last updated less than a minute ago

Instances (3) Info

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IP
web-instance	i-0e4dc1e1ce80a2d48	Running	t3.micro	3/3 checks passed	View alarms +	us-east-2b	ec2-18-1
database-inst...	i-0d313cc12916ecfd0	Running	t3.micro	3/3 checks passed	View alarms +	us-east-2b	ec2-3-14!
web-instance	i-0f4f96ebaa034075b	Running	t3.micro	3/3 checks passed	View alarms +	us-east-2c	ec2-18-2

Select an instance

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us-east-2.console.aws.amazon.com/rds/home?region=us-east-2#databases:

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Aurora and RDS Databases

Aurora and RDS

- Dashboard
- Databases**
 - Query editor
 - Performance insights
 - Snapshots
 - Exports in Amazon S3
 - Automated backups
 - Reserved instances
 - Proxies
- Subnet groups
- Parameter groups
- Option groups
- Custom engine versions
- Zero-ETL Integrations New
- Events
- Event subscriptions

CloudShell Feedback

Databases (2)

DB identifier	Status	Role	Engine	Region ...	Size
mysql-db	Available	Instance	MySQL Co...	us-east-2b	db.t3.micro
postgres-db	Available	Instance	PostgreSQL	us-east-2c	db.t3.micro

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us-east-1.console.aws.amazon.com/route53/v2/hostedzones?region=us-east-2#ListRecordSets/Z0198126PCSHG2JY84ZH

Route 53 > Hosted zones > codelessops.site

Route 53

- Dashboard
- Hosted zones**
- Health checks
- Profiles [New](#)
- ▼ IP-based routing
 - CIDR collections
- ▼ Traffic flow
 - Traffic policies
 - Policy records
- ▼ Domains
 - Registered domains
 - Requests
- ▼ Resolver
 - VPCs
 - Inbound endpoints
 - Outbound endpoints
 - Rules

CloudShell Feedback

Records (11) DNSSEC signing Hosted zone tags (0)

Records (1/11) Info Delete record Import zone file Create record

Automatic mode is the current search behavior optimized for best filter results. [To change modes go to settings.](#)

Filter records by property or value Type Routing p... Alias

Record ...	Type	Routin...	Differ...	Alias	Value/Route traffic to
codelessop...	NS	Simple	-	No	ns-1849.awsdns-39.co.uk ns-1137.awsdns-14.org. ns-26.awsdns-03.com. ns-731.awsdns-27.net.
codelessop...	SOA	Simple	-	No	ns-1849.awsdns-39.co.uk
_0851a03...	CNAME	Simple	-	No	_b5f1a1162f65c8f736d1
app.codel...	A	Simple	-	Yes	app-alb-918654397.us-e
_2903730...	CNAME	Simple	-	No	_a5a4d2adb6343eadf05f

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Records (1/11) Info Delete record Import zone file Create record

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Record ...	Type	Routin...	Differ...	Alias	Value/Route traffic to
codelessop...	NS	Simple	-	No	ns-1849.awsdns-39.co.uk ns-1137.awsdns-14.org. ns-26.awsdns-03.com. ns-731.awsdns-27.net.
codelessop...	SOA	Simple	-	No	ns-1849.awsdns-39.co.uk
_0851a03...	CNAME	Simple	-	No	_b5f1a1162f65c8f736d1
app.codel...	A	Simple	-	Yes	app-alb-918654397.us-e
_2903730...	CNAME	Simple	-	No	_a5a4d2adb6343eadf05f
bi.codeless...	A	Simple	-	No	3.145.114.154
_56d97e8...	CNAME	Simple	-	No	_370c3b9666f330d1ff2d
_d54ec12...	CNAME	Simple	-	No	_ae5fb5f19ca71a2afb6:

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Record details

Edit record

Record name

Record type A

Value

Alias Yes

TTL (seconds) -

Routing policy Simple

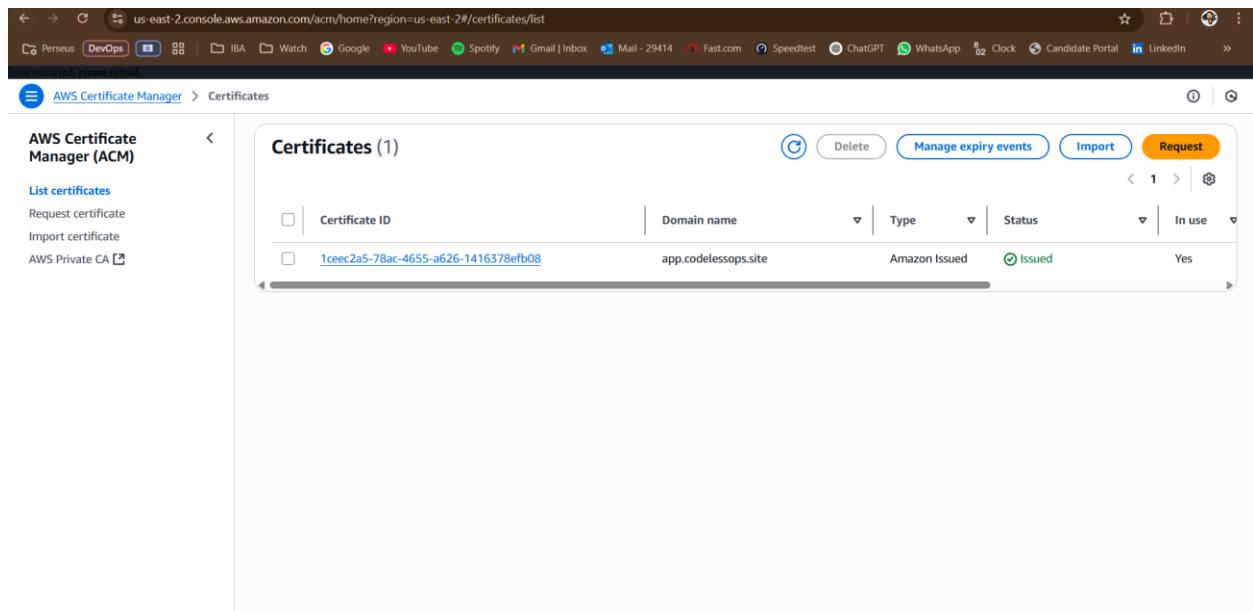
us-east-2.console.aws.amazon.com/acm/home?region=us-east-2#certificates/list

AWS Certificate Manager (ACM) > Certificates

Certificates (1)

Certificate ID	Domain name	Type	Status	In use
1ceec2a5-78ac-4655-a626-141637befb08	app.codelessops.site	Amazon Issued	Issued	Yes

Error occurred, please reload.



us-east-2.console.aws.amazon.com/ec2/home?region=us-east-2#LoadBalancers

aws EC2 > Load balancers

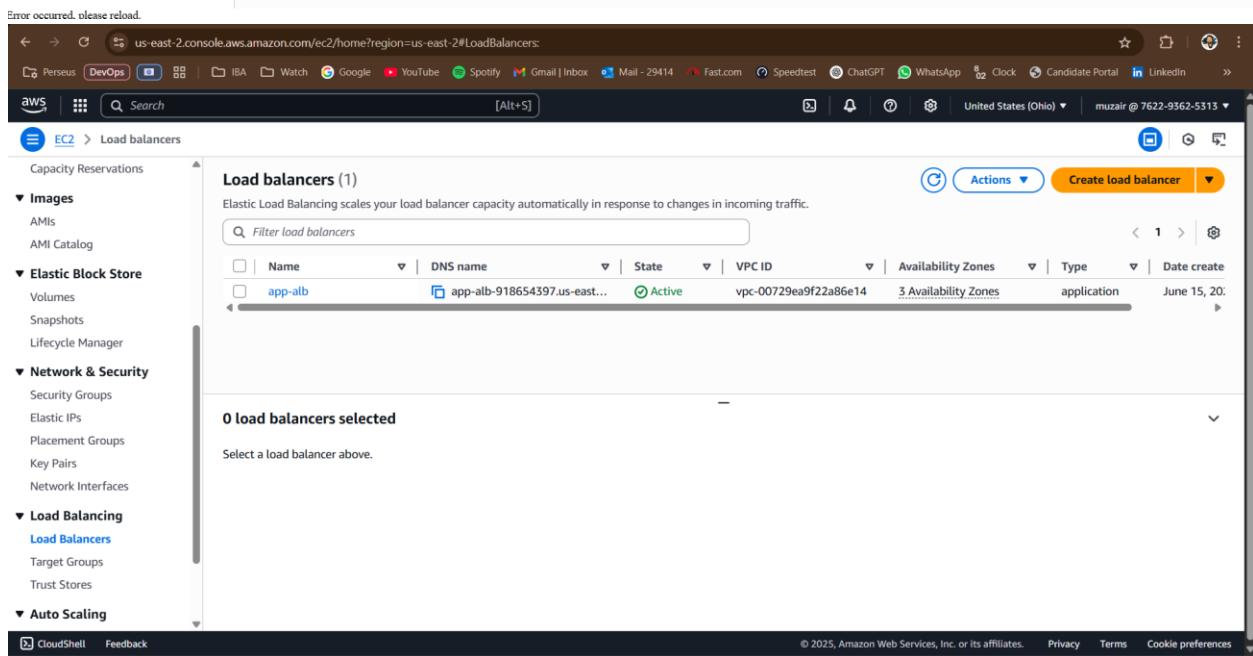
Load balancers (1)

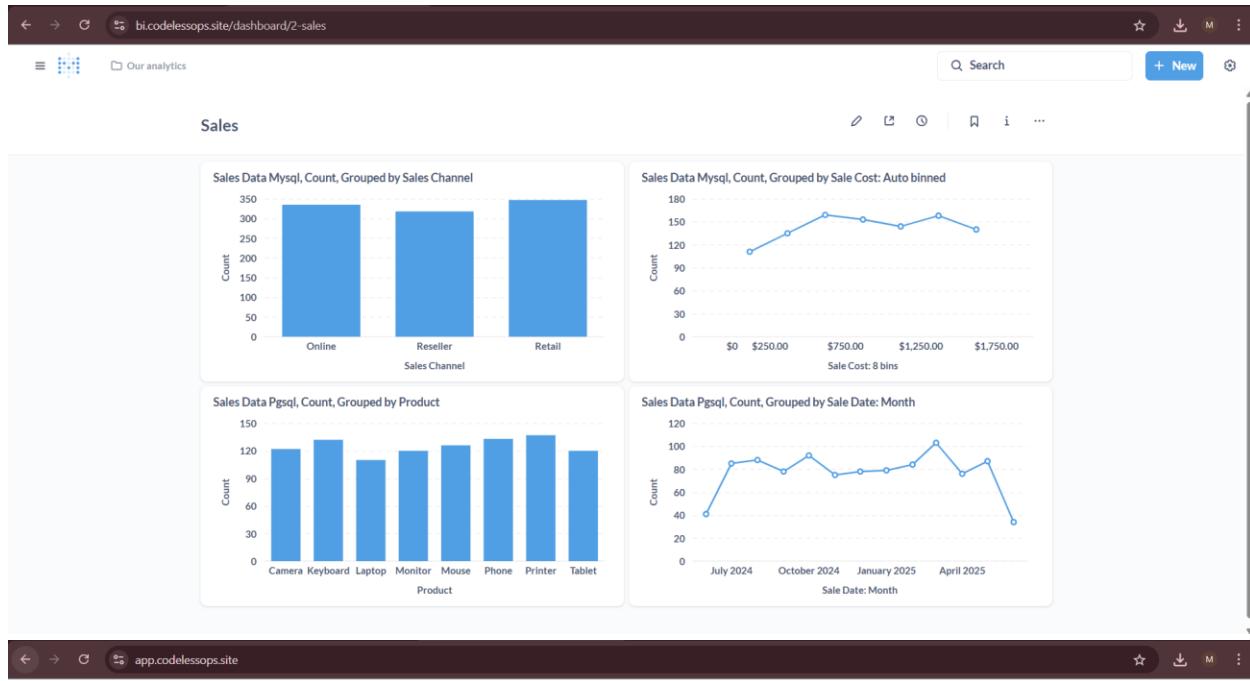
Name	DNS name	State	VPC ID	Availability Zones	Type	Date create
app-alb	app-alb-918654397.us-east...	Active	vpc-00729ea9f22a86e14	3 Availability Zones	application	June 15, 2023

0 load balancers selected

Select a load balancer above.

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app.codelessops.site

Hello from Dockerized Node.js App with RDS connections!

DBeaver 25.1.0 - <mydb 2> Script-2

File Edit Navigate Search SQL Editor Database Window Help

Auto mydb 2 public@mydb

Database Navigator Projects

mydb mysql://db-34k6w2orem.us-east-2.rds.amazonaws.com:3306

mydb 2 postgres://db-c34k6w2orem.us-east-2.rds.amazonaws.com:5432

mydb-Script-4 *<mydb 2> Script-2

```
CREATE TABLE sales_data_pgsql (
    Sale_ID VARCHAR(20) PRIMARY KEY,
    Customer_Name VARCHAR(100),
    Product VARCHAR(100),
    Quantity INTEGER,
    Sale_Price FLOAT,
    Sale_Date DATE,
    Region VARCHAR(50)
);

select Sale_ID, Customer_Name, Product, Quantity, Sale_Price, Sale_Date
from sales_data_pgsql
order by Sale_Date
limit 5;
```

Project - General

Name: DataSource

Lookmarks Dashboards Diagrams Scripts

Connection: mydb

hub.docker.com/repository/docker/uzair99/nodeapp-project/general

uzair99 Docker Personal

Repositories Collaborations Settings Default privacy Notifications Billing Usage Pulls Storage

uzair99/nodeapp-project General

Last pushed 4 days ago · Repository size: 446.3 MB

Add a description Add a category

General Tags Image Management Beta Collaborators Webhooks Settings

Tags

This repository contains 6 tag(s).

Tag	OS	Type	Pulled	Pushed
0.6		Image	4 days	4 days
0.5		Image	4 days	4 days
0.4		Image	4 days	4 days
0.3		Image	4 days	4 days
0.2		Image	less than 1 day	7 days

See all

Docker commands

To push a new tag to this repository:

```
docker push uzair99/nodeapp-project:tagname
```

Using 0 of 1 private repositories. Get more

Public view

buildcloud

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← → ⌂ github.com/muhammaduzair99/nodeapp_uzair

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Type [] to search

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main 1 Branch 0 Tags Go to file Add file Code About

Muhammad Uzair final commit 8d792ed · 9 minutes ago 11 Commits

Project Details	Description	Time Ago
Dbeaver progress	5 hours ago	
connected RDS	4 days ago	
.gitignore	first commit	last week
.terraform.lock.hcl	first commit	last week
README.md	first commit	last week
alb.tf	update1	last week
ec2.tf	first commit	last week
git-filter-repo	first commit	last week
init_script.sh	progress with RDS	last week
main.tf	first commit	last week

No description, website, or topics provided.

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Packages No packages published Publish your first package

Languages

