AWS EKS Deployment using Pulumi

Prerequisites

1. AWS Account with IAM user having sufficient permissions.
2. AWS CLI installed and configured with the IAM user.
3. Pulumi Installed.

Code

Create Pulumi Project directory.

Data Definition

1. Inside Pulumi Project, create *data.py* file.
2. Import the following:
    - pulumi_aws as aws
3. Call the following functions:
    - aws.ec2.get_ami()
4. The reference code is attached below.

```
import pulumi_aws as aws

linux_ami = aws.ec2.get_ami(
    most_recent = True,
    owners = ["137112412989"],

    filters = [
        {
            "name": "name",
            "values": ["al2023-ami-2023.5.20240819.0-kernel-6.1-x86_64"]
        },
        {
            "name": "virtualization-type",
            "values": ["hvm"]
        }
    ]
)
```

5. The definition of *data.py* is complete.

VPC Definition

1. Inside Pulumi Project, create *vpc.py* file.
2. Import the following:

    - pulumi_aws as aws
    - values
3. Call the following functions:
    - aws.ec2.Vpc()
    - aws.get_availability_zones()
    - for public
        - aws.ec2.InternetGateway()
        - aws.ec2.RouteTable()
        - aws.ec2.Subnet()
        - aws.ec2.RouteTableAssociation()
    - for private
        - aws.ec2.RouteTable()
        - aws.ec2.Subnet()
        - aws.ec2.RouteTableAssociation()
4. The reference code is attached below.

```
import pulumi_aws as aws
import values

vpc = aws.ec2.Vpc(
    'vpc',

    cidr_block = '10.0.0.0/16',
    instance_tenancy = 'default',
    enable_dns_hostnames = True,
    enable_dns_support = True,

    tags = {
        'Name': values.vpc_properties["vpc-name"]
    }
)

igw = aws.ec2.InternetGateway(
    'vpc-igw',

    vpc_id = vpc.id,

    tags = {
        'Name': values.vpc_properties['vpc-igw-name']
    }
)

vpc_public_rt = aws.ec2.RouteTable(
    'vpc-public-rt',

    vpc_id = vpc.id,
    routes = [
        aws.ec2.RouteTableRouteArgs(
            cidr_block = '0.0.0.0/0',
            gateway_id = igw.id,
```

```
        )
    ],

    tags={
        'Name': values.vpc_properties['vpc-public-rt-name']
    }
)

vpc_private_rt = aws.ec2.RouteTable(
    'vpc-private-rt',

    vpc_id = vpc.id,

    tags = {
        'Name': values.vpc_properties['vpc-private-rt-name']
    }
)

# Subnets, one for each AZ in a region
zones = aws.get_availability_zones()
public_subnet_ids = []
private_subnet_ids = []

for zone in zones.names:
    vpc_public_subnet = aws.ec2.Subnet(
        f'vpc-public-subnet-{zone}',

        vpc_id = vpc.id,
        cidr_block = f'10.0.{len(public_subnet_ids)}.0/24',
        availability_zone = zone,
        map_public_ip_on_launch = True,

        tags = {
            'Name': f'{values.vpc_properties["vpc-public-subnet-name"]}-{zone}'
        }
    )

    vpc_private_subnet = aws.ec2.Subnet(
        f'vpc-private-subnet-{zone}',

        vpc_id = vpc.id,
        cidr_block = f'10.0.{len(private_subnet_ids)+100}.0/24',
        availability_zone = zone,

        tags = {
            'Name': f'{values.vpc_properties["vpc-private-subnet-name"]}-{zone}'
        }
    )

    aws.ec2.RouteTableAssociation(
        f'vpc-public-rt-assoc-{zone}',

        route_table_id = vpc_public_rt.id,
        subnet_id = vpc_public_subnet.id
```

```
    )

    aws.ec2.RouteTableAssociation(
        f'vpc-private-rt-assoc-{zone}',

        route_table_id = vpc_private_rt.id,
        subnet_id = vpc_private_subnet.id
    )

    public_subnet_ids.append(vpc_public_subnet.id)
    private_subnet_ids.append(vpc_private_subnet.id)
```

5. The definition of *vpc.py* is complete.

RDS Definition

1. Inside Pulumi Project, create *rds.py* file.
2. Import the following:
    - pulumi
    - pulumi_aws as aws
    - vpc
    - data
    - values
3. Call the following functions:
    - for database
        - aws.rds.SubnetGroup()
        - aws.ec2.SecurityGroup()
        - aws.rds.Instance()
    - for bastion-host
        - aws.ec2.SecurityGroup()
        - aws.ec2.KeyPair()
        - aws.ec2.Instance()
4. Define the following output:
    - DB_HOST
    - bastion-host-ip
5. The reference code is attached below.

```
import pulumi
import pulumi_aws as aws
import vpc
import data
import values

db_subnet_group = aws.rds.SubnetGroup(
    "db-subnet-group",

    name = values.rds_properties["db-subnet-group-name"],
```

```
    subnet_ids = vpc.private_subnet_ids
)

db_sg = aws.ec2.SecurityGroup(
    'db-sg',

    vpc_id = vpc.vpc.id,

    ingress = [
        aws.ec2.SecurityGroupIngressArgs(
            from_port = 3306,
            to_port = 3306,
            protocol = 'tcp',
            cidr_blocks = ['0.0.0.0/0']
        )
    ],

    egress = [
        aws.ec2.SecurityGroupEgressArgs(
            from_port = 0,
            to_port = 0,
            protocol = -1,
            cidr_blocks = ["0.0.0.0/0"]
        )
    ],

    tags = {
        'Name': values.rds_properties['db-sg-name']
    }
)

db = aws.rds.Instance(
    "db",

    identifier = values.rds_properties["db-identifier"],
    allocated_storage = values.rds_properties["db-allocated-storage"],
    engine = values.rds_properties["db-engine"],
    engine_version = values.rds_properties["db-engine-version"],
    instance_class = values.rds_properties["db-instance-class"],
    username = values.rds_properties["db-username"],
    password = values.rds_properties["db-password"],
    publicly_accessible = values.rds_properties["db-publicly-accessible"],
    skip_final_snapshot = values.rds_properties["db-skip-final-snapshot"],
    db_subnet_group_name = db_subnet_group.name,

    vpc_security_group_ids = [
        db_sg.id
    ]
)

bastion_host_sg = aws.ec2.SecurityGroup(
    'bastion-host-sg',

    vpc_id = vpc.vpc.id,
```

```
    ingress = [
        aws.ec2.SecurityGroupIngressArgs(
            from_port = 22,
            to_port = 22,
            protocol = 'tcp',
            cidr_blocks = ['0.0.0.0/0']
        )
    ],

    egress = [
        aws.ec2.SecurityGroupEgressArgs(
            from_port = 0,
            to_port = 0,
            protocol = -1,
            cidr_blocks = ['0.0.0.0/0']
        )
    ],

    tags = {
        'Name': values.bastion_properties['bastion-host-sg-name']
    }
)

bastion_host_key_pub_file = open(values.bastion_properties["bastion-host-key-
public-file"],"r+")

bastion_host_key_pair = aws.ec2.KeyPair(
    "bastion-host-key-pair",

    key_name = "bastion-host-key-pair",
    public_key = bastion_host_key_pub_file.read()
)

bastion_host = aws.ec2.Instance(
    "bastion-host",

    ami = data.linux_ami.id,
    instance_type = values.bastion_properties["bastion-host-instance-type"],
    key_name = bastion_host_key_pair.id,
    subnet_id = vpc.public_subnet_ids[0],
    vpc_security_group_ids = [
        bastion_host_sg.id
    ],

    tags = {
        'Name': values.bastion_properties["bastion-host-name"]
    }
)

pulumi.export("DB_HOST", db.address)
pulumi.export("bastion-host-ip", bastion_host.public_ip)
```

6. The definition of *rds.py* is complete.

EKS Definition

1. Inside Pulumi Project, create *eks.py* file.
2. Import the following:
    - pulumi_aws as aws
    - vpc
    - values
    - json
3. Call the following functions:
    - aws.iam.Role()
    - aws.iam.RolePolicyAttachment()
    - aws.ec2.SecurityGroup()
    - aws.eks.Cluster()
    - aws.iam.Role()
    - aws.iam.RolePolicyAttachment()
    - aws.iam.RolePolicyAttachment()
    - aws.iam.RolePolicyAttachment()
    - aws.eks.NodeGroup()
4. The reference code is attached below.

```
import pulumi_aws as aws
import vpc
import values
import json

eks_cluster_role = aws.iam.Role(
    'eks-cluster-role',

    name = values.eks_properties["eks-cluster-role-name"],
    assume_role_policy = json.dumps(
        {
            'Version': '2012-10-17',
            'Statement': [
                {
                    'Action': 'sts:AssumeRole',
                    'Principal': {
                        'Service': 'eks.amazonaws.com'
                    },
                    'Effect': 'Allow'
                }
            ]
        }
    )
)

aws.iam.RolePolicyAttachment(
    'eks-cluster-role-AmazonEKSClusterPolicy',
```

```
    role = eks_cluster_role.id,
    policy_arn = 'arn:aws:iam::aws:policy/AmazonEKSClusterPolicy'
)


eks_cluster_sg = aws.ec2.SecurityGroup(
    'eks-cluster-sg',

    vpc_id = vpc.vpc.id,

    ingress = [
        aws.ec2.SecurityGroupIngressArgs(
            from_port = 80,
            to_port = 80,
            protocol = 'tcp',
            cidr_blocks = ['0.0.0.0/0']
        )
    ],
    egress = [
        {
            "from_port": 0,
            "to_port": 0,
            "protocol": -1,
            "cidr_blocks": ["0.0.0.0/0"]
        }
    ],

    tags = {
        'Name': values.eks_properties['eks-cluster-sg-name']
    }
)

eks_cluster = aws.eks.Cluster(
    'eks-cluster',

    name = values.eks_properties["eks-cluster-name"],
    role_arn = eks_cluster_role.arn,

    vpc_config = aws.eks.ClusterVpcConfigArgs(
        public_access_cidrs = ['0.0.0.0/0'],
        security_group_ids = [
            eks_cluster_sg.id
        ],
        subnet_ids = vpc.public_subnet_ids
    )
)

eks_node_group_role = aws.iam.Role(
    'eks-node-group-role',

    name = values.eks_properties["eks-node-group-role-name"],
    assume_role_policy = json.dumps(
        {
```

```
            'Version': '2012-10-17',
            'Statement': [
                {
                    'Action': 'sts:AssumeRole',
                    'Principal': {
                        'Service': 'ec2.amazonaws.com'
                    },
                    'Effect': 'Allow',
                }
            ]
        }
    )
)

aws.iam.RolePolicyAttachment(
    'eks-node-group-role-AmazonEKSWorkerNodePolicy',

    role = eks_node_group_role.id,
    policy_arn = 'arn:aws:iam::aws:policy/AmazonEKSWorkerNodePolicy'
)


aws.iam.RolePolicyAttachment(
    'eks-node-group-role-cni-policy-attachment',

    role = eks_node_group_role.id,
    policy_arn = 'arn:aws:iam::aws:policy/AmazonEKS_CNI_Policy'
)

aws.iam.RolePolicyAttachment(
    'eks-node-group-role-AmazonEC2ContainerRegistryReadOnly',

    role = eks_node_group_role.id,
    policy_arn = 'arn:aws:iam::aws:policy/AmazonEC2ContainerRegistryReadOnly'
)

eks_nodegroup = aws.eks.NodeGroup(
    'eks-node-group',

    node_group_name = values.eks_properties['eks-node-group-name'],
    cluster_name = eks_cluster.name,
    node_role_arn = eks_node_group_role.arn,

    subnet_ids = vpc.public_subnet_ids,
    instance_types = values.eks_properties["eks-instance-types"],

    scaling_config = aws.eks.NodeGroupScalingConfigArgs(
        desired_size = 2,
        max_size = 2,
        min_size = 2
    )
)
```

6. The definition of *eks.py* is complete.

Main Definition

1. Inside Pulumi Project, create *main.py* file.
2. Import the following:
    - vpc
    - rds
    - eks
3. The reference code is attached below.

```
import vpc
import rds
import eks
```

5. The definition of *main.py* is complete.

Values Definition

1. Inside Pulumi Project, create *values.py* file.
2. Define the following:
    - vpc_properties
    - rds_properties
    - bastion_properties
    - eks_properties
3. The reference code is attached below.

```
vpc_properties = {
    "vpc-name": "eks-vpc",
    "vpc-igw-name": "eks-vpc-igw",
    "vpc-public-rt-name": "eks-vpc-public-rt",
    "vpc-private-rt-name": "eks-vpc-private-rt",
    "vpc-public-subnet-name": "eks-vpc-public-subnet",
    "vpc-private-subnet-name": "eks-vpc-private-subnet"
}

rds_properties = {
    "db-subnet-group-name": "eks-db-subnet-group",
    "db-sg-name": "eks-db-sg",
    "db-identifier": "eks-db",
    "db-allocated-storage": 10,
    "db-engine": "mysql",
    "db-engine-version": "8.0",
    "db-instance-class": "db.t3.micro",
    "db-username": "root",
    "db-password": "password",
```

```
    "db-publicly-accessible": False,
    "db-skip-final-snapshot": True,
}

bastion_properties = {
    "bastion-host-sg-name": "eks-db-bastion-host-sg",
    "bastion-host-key-public-file": "../../../../../../../../../.ssh/bastion-
key.pub",
    "bastion-host-instance-type": "t2.micro",
    "bastion-host-name": "eks-db-bastion-host"
}

eks_properties = {
    "eks-cluster-role-name": "eks-cluster-role",
    "eks-cluster-sg-name": "eks-cluster-sg",
    "eks-cluster-name": "eks-cluster",
    "eks-node-group-role-name": "eks-node-group-role",
    "eks-node-group-name": "eks-node-group",
    "eks-instance-types": ["t2.medium"]
}
```

5. The definition of *values.py* is complete.

Provisioning the Infrastructure

Now we will provision the infrastructure by applying the above-created configuration files.

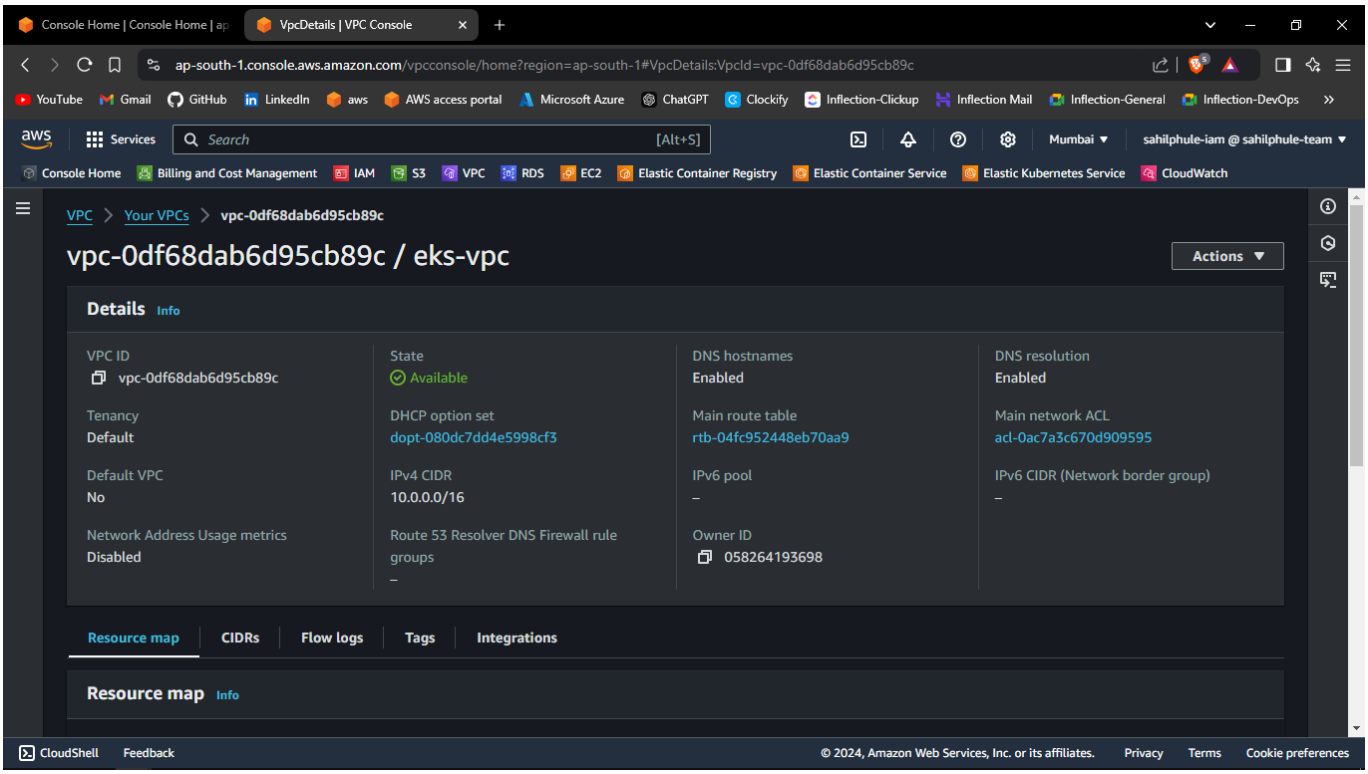
> Ensure AWS CLI is configured with appropriate AWS user credentials and enough permissions.

Steps:

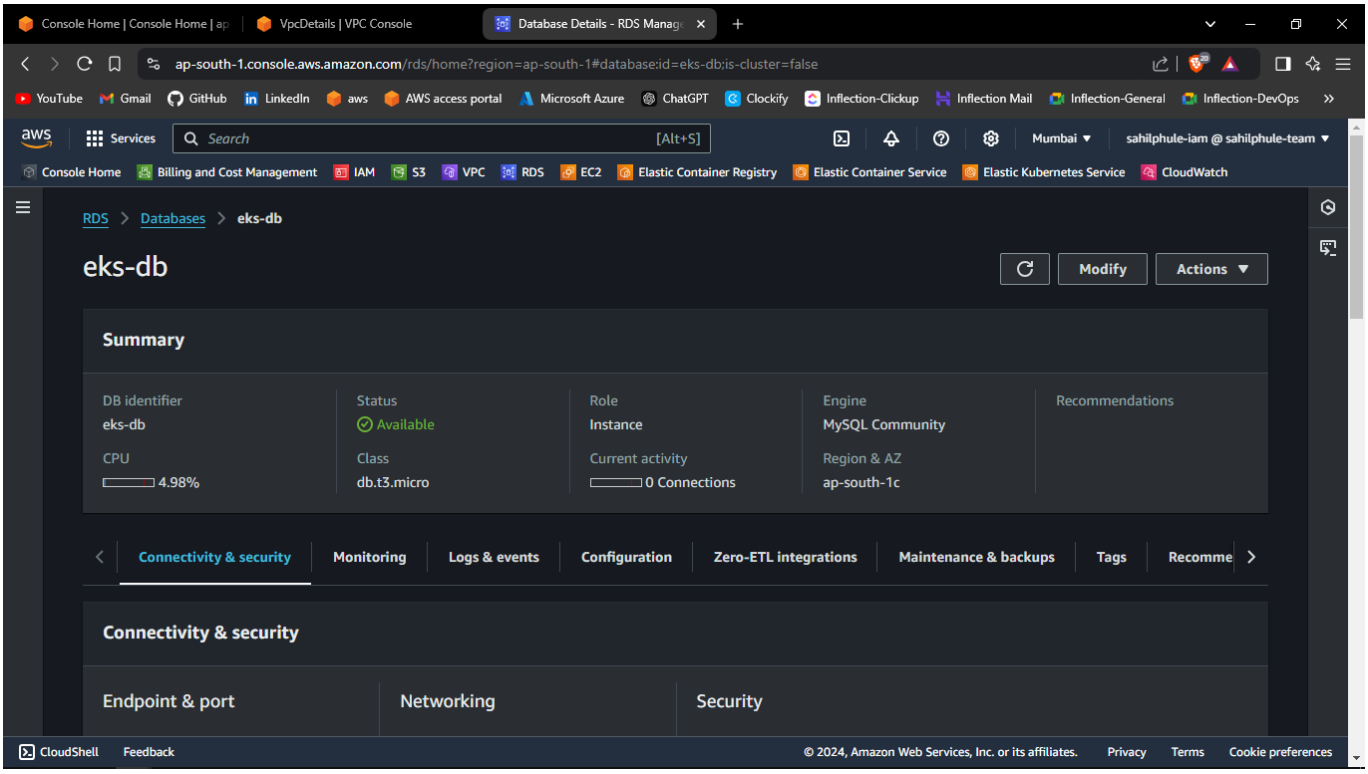
1. Open the PowerShell.
2. Change the directory to the above-created Pulumi Project.
3. Run the `pulumi new aws-python` command to initialize the *pulumi*.
4. Provide the appropriate values to prompts such as *project-name*, *project-description*, *stack-name*, *region-name*, etc.
5. Run the `pulumi up` command and if prompted, select `yes` to provision the infrastructure on to the AWS Cloud.
6. Head to the AWS Console, and verify the created resources.

Screenshots of Provisioned Infrastructure

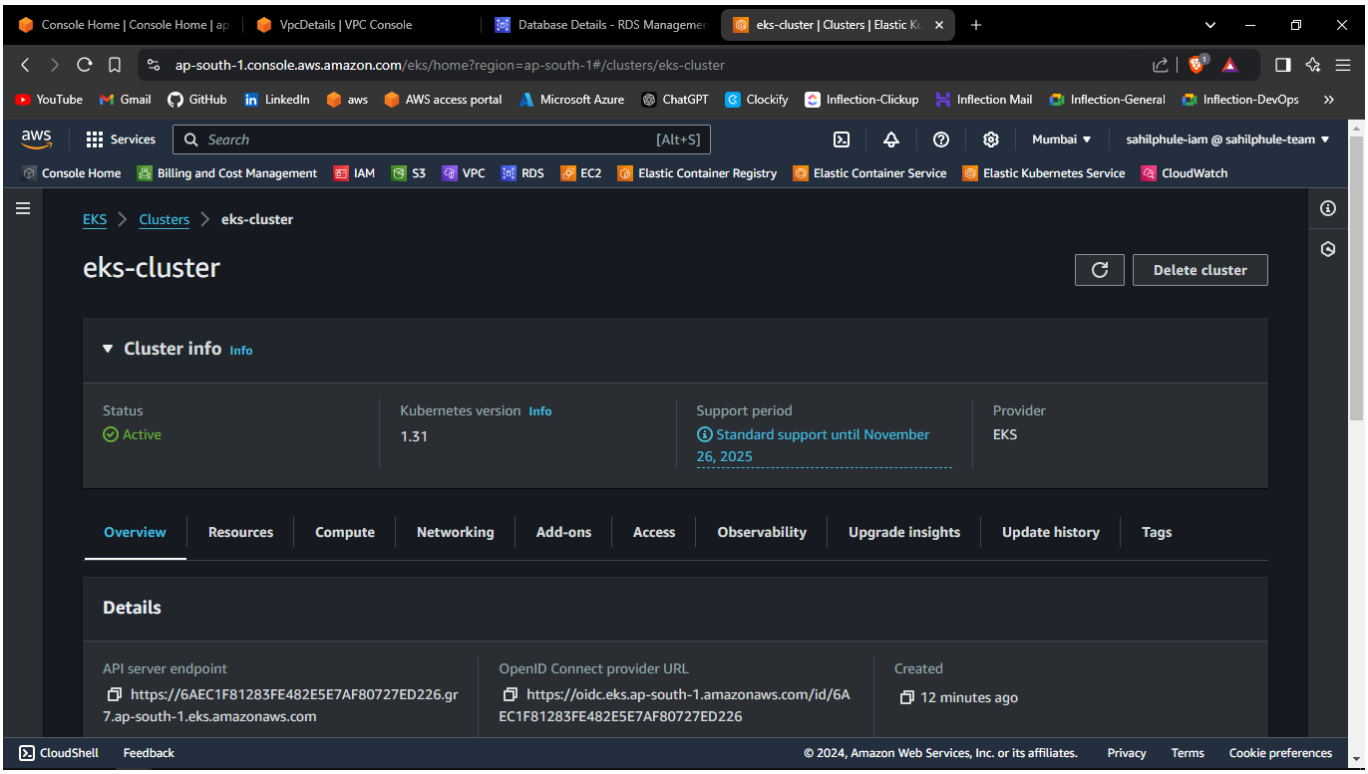
VPC Image



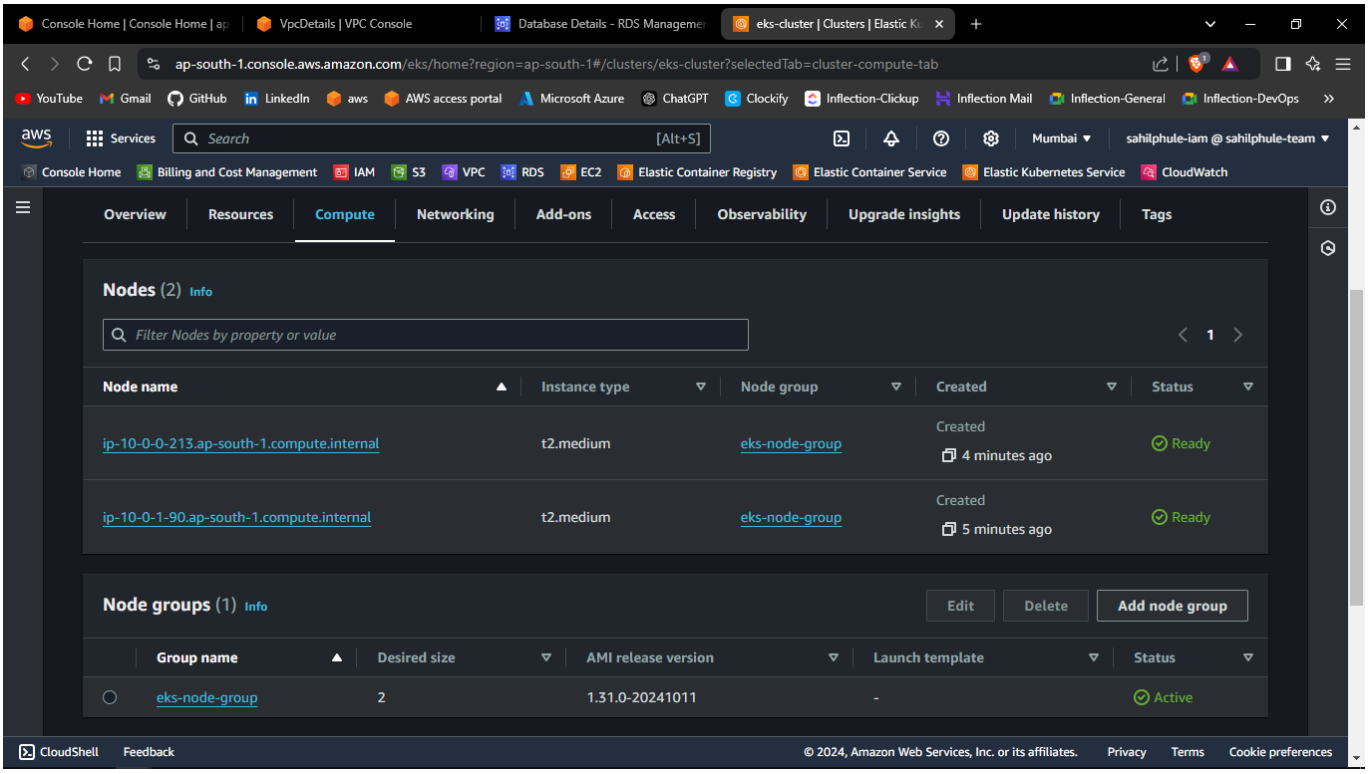
RDS Image



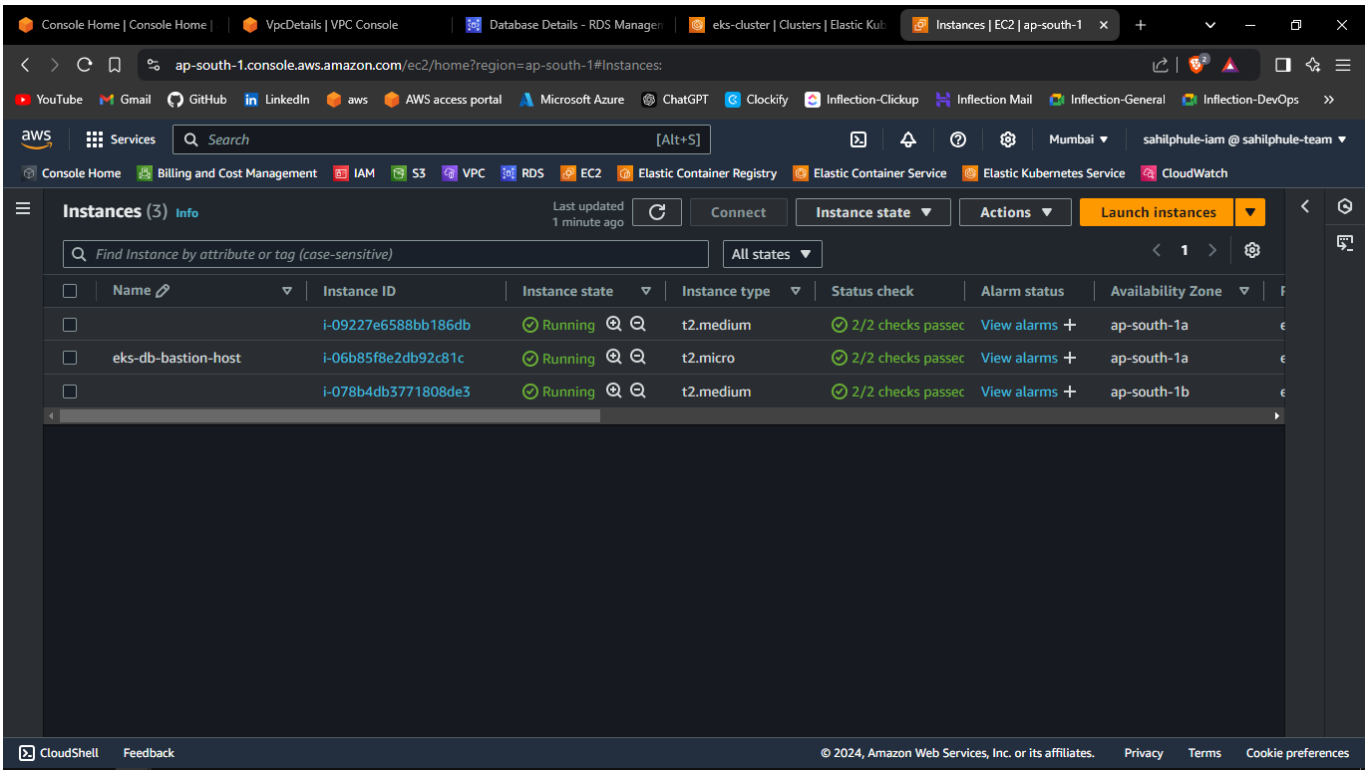
EKS Cluster Image



EKS Node Group Image



EKS Nodes Image



Connect to EKS Cluster from Powershell

1. Open a new Powershell window.
2. Run the following command to configure local kubectl with eks cluster
   `aws eks --region "region-name" update-kubeconfig --name "cluster-name"`
   Substitute *region-name* and *cluster-name* with the values defined in the above-created *values.py* file.
3. Now apply the Kubernetes manifest files of the application.
4. To list them all, run `kubectl get all`.

Powershell Image


powershell

5. If a Load Balancer type Service is present then try accessing the External IP of that service in the browser.

Browser Service Access


browser

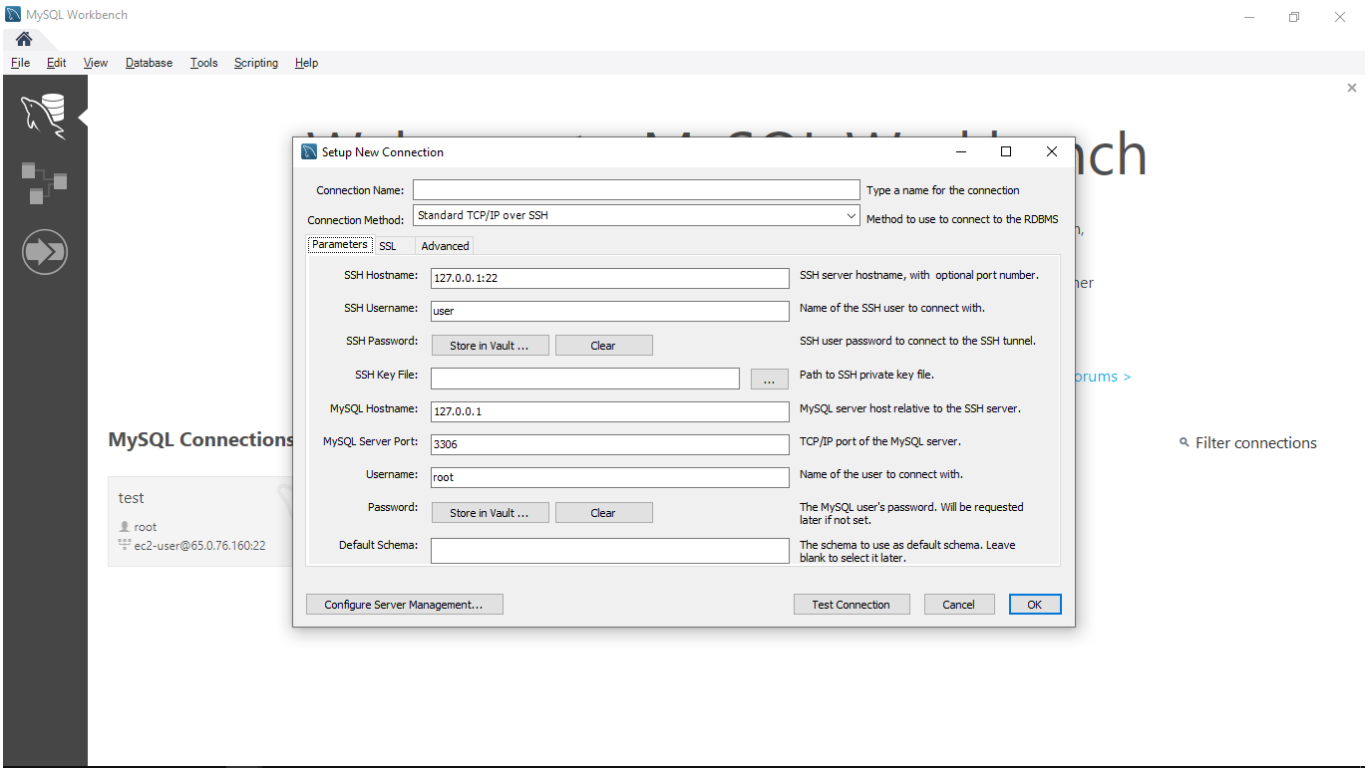
Connect to the RDS database through Bastion Host

1. Open MySQL Workbench.
2. Click Add Connection.
3. Select connection method as **Standard TCP/IP over SSH**.
4. In SSH Hostname, enter *bastion-host-ip:22* where bastion-host-ip is received from `pulumi stack output bastion-host-ip` command.
5. In SSH Username, enter *ec2-user*.

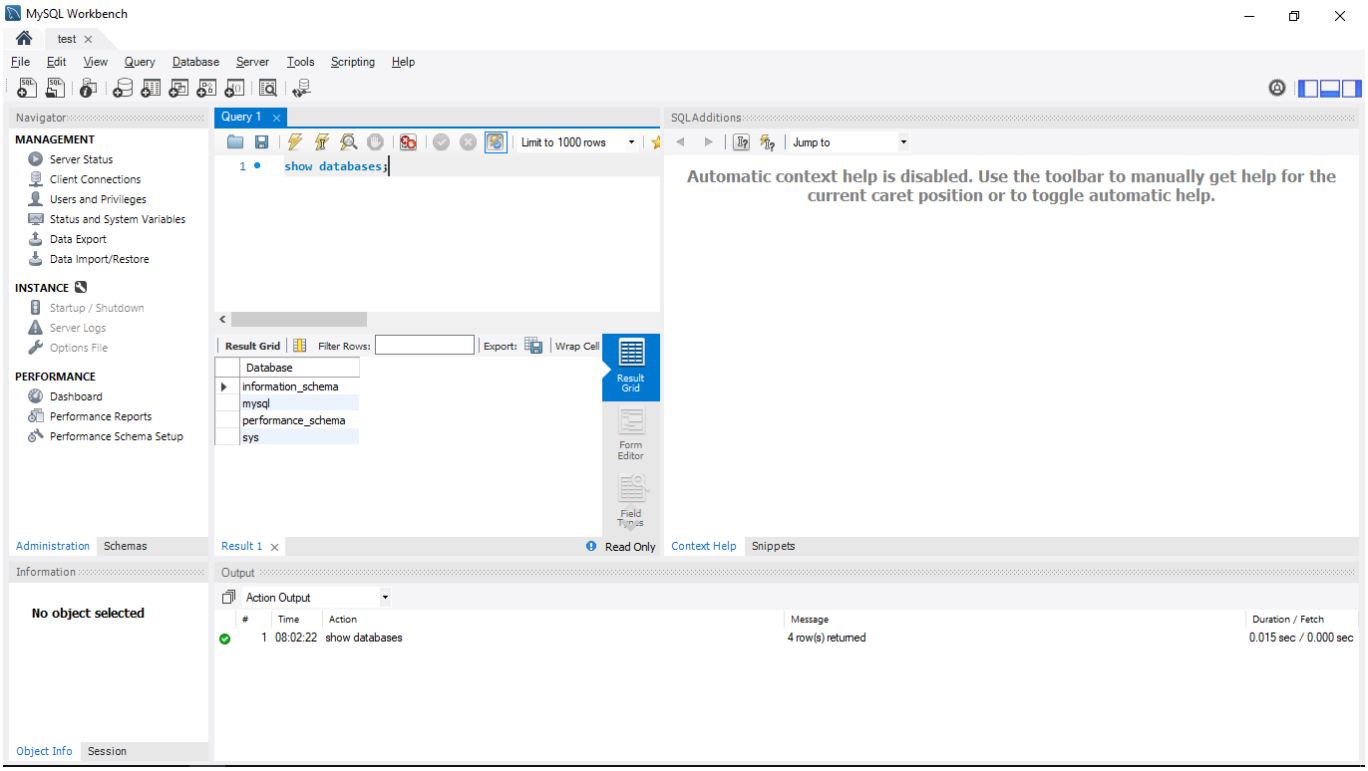
6. In SSH Key File, select *bastion-key.pem* file passed in above *values.py* file from your local computer.
7. In MySQL Hostname, enter *DB_HOST* where DB_HOST is received from `pulumi stack output DB_HOST`.
8. In the Password section, select *Store in Vault*, and enter the password passed in above-created *values.py* file.
9. Click *OK* and open the connection.
10. Now you can run mysql commands to access databases, and verify the successful connection of *eks-service*.

Screenshots of MySQL Workbench

Connection Page



Commands Page



Destroy the provisioned infrastructure

1. Firstly, delete all the Kubernetes Deployments.
2. To destroy infrastructure, change directory to the above created Pulumi Project.
3. Run `pulumi destroy` & if prompted, select `yes`.
4. Infrastructure will be destroyed.