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Team: Cloud **Date: 18/07/2024**

Task: Deploy an Amazon EKS Cluster using Terraform (Major Project).

Solution:

Step 1: Install Terraform on Windows

1) Download Terraform:

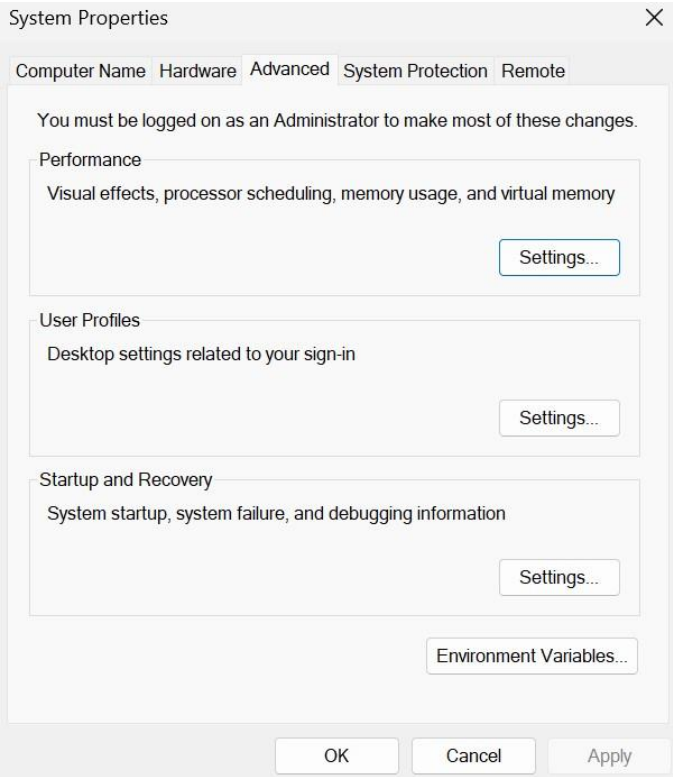
 Go to the Terraform downloads page.
Download the appropriate version for Windows.

2) Install Terraform:

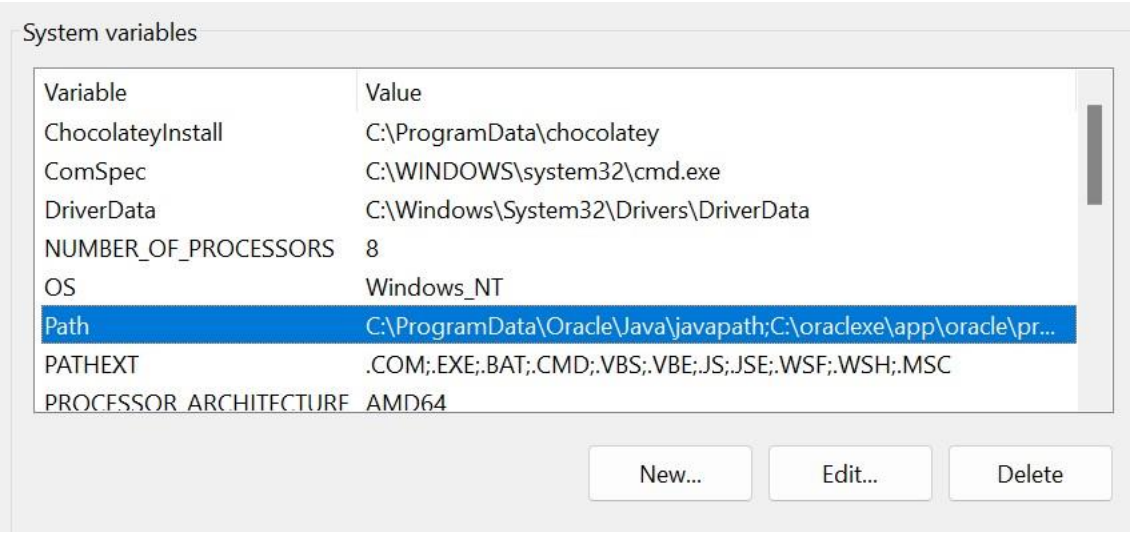
- Extract the downloaded zip file.
- Move the terraform.exe file to a directory included in your system's PATH (e.g., C:\Program Files\Terraform).
- Copy (e.g., C:\Program Files\Terraform) Path to your system "Environment variable".

Set terraform path in Environment variable using below images.

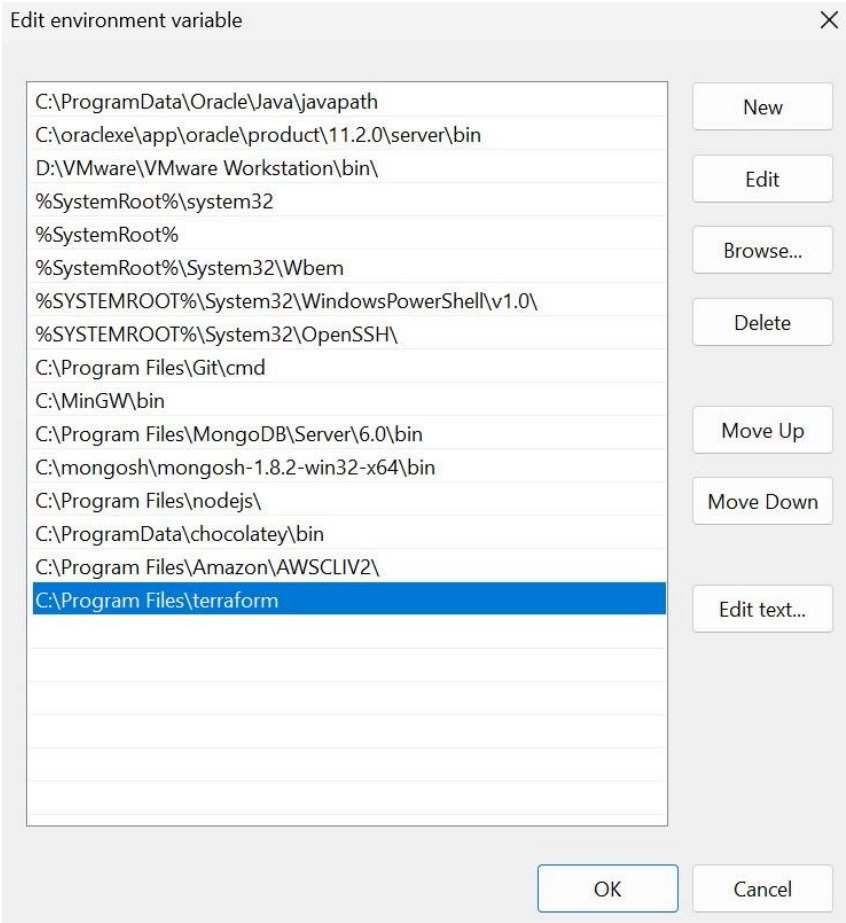
- Search Environment variable in windows search bar or else in settings.
- Click on Environment variable.



- In system variable Click on “Path” and then click “Edit”.



- Add new path



Click “ok” and environment variable path is set for terraform.

3) To check Terraform is install in the system:

 Search cmd and Run as administrator
cd C:\Program Files\Terraform
 terraform --version

```
C:\Windows\System32>cd C:\Program Files\Terraform

C:\Program Files\terraform>terraform --version
Terraform v1.9.0
on windows_amd64
```

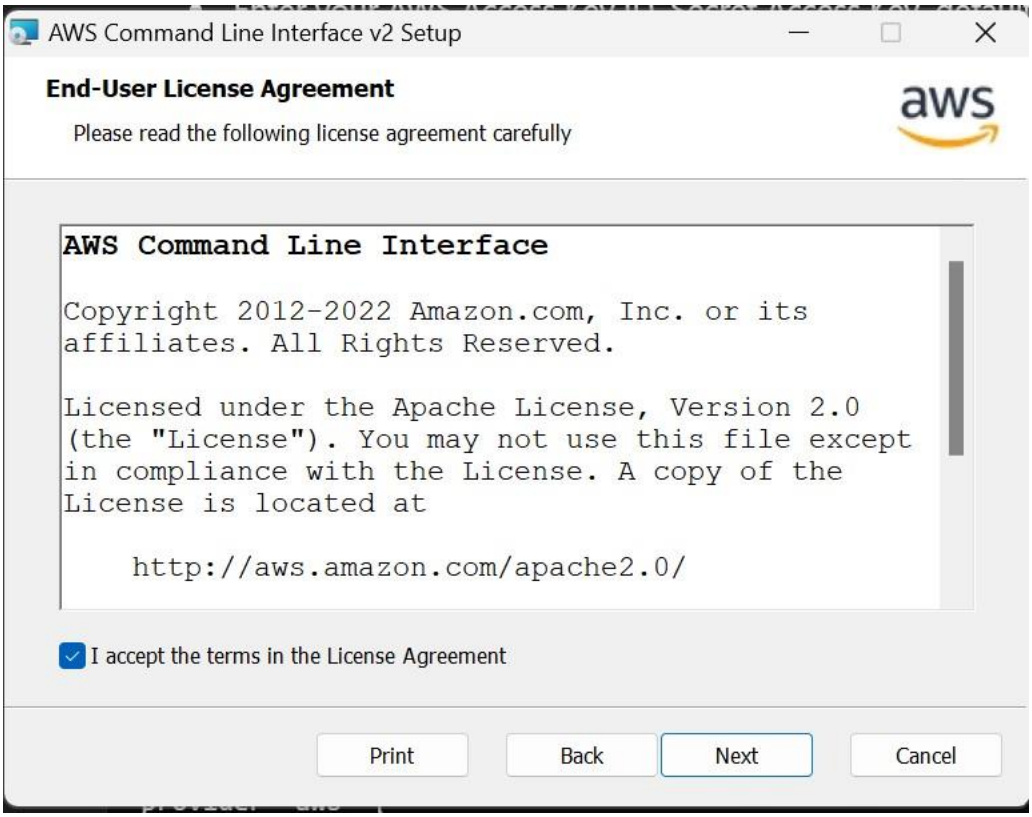
Step 2: Configure AWS Credentials for Terraform.

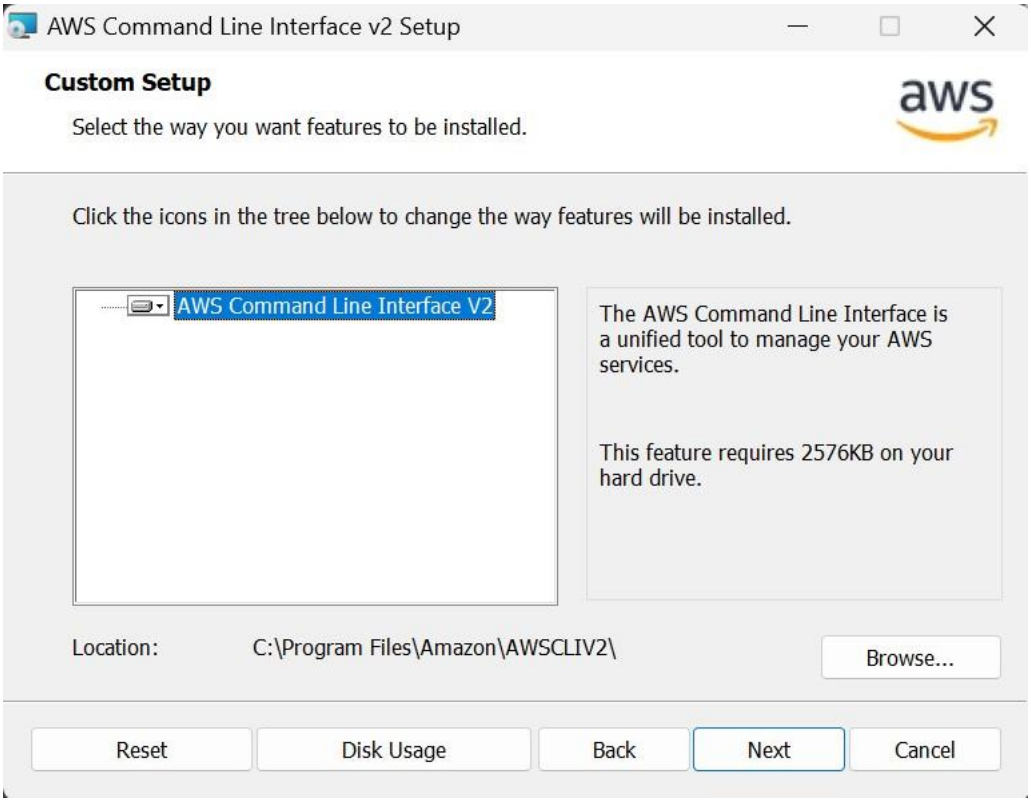
1) Install AWS CLI (if not already installed): ▯ Download the

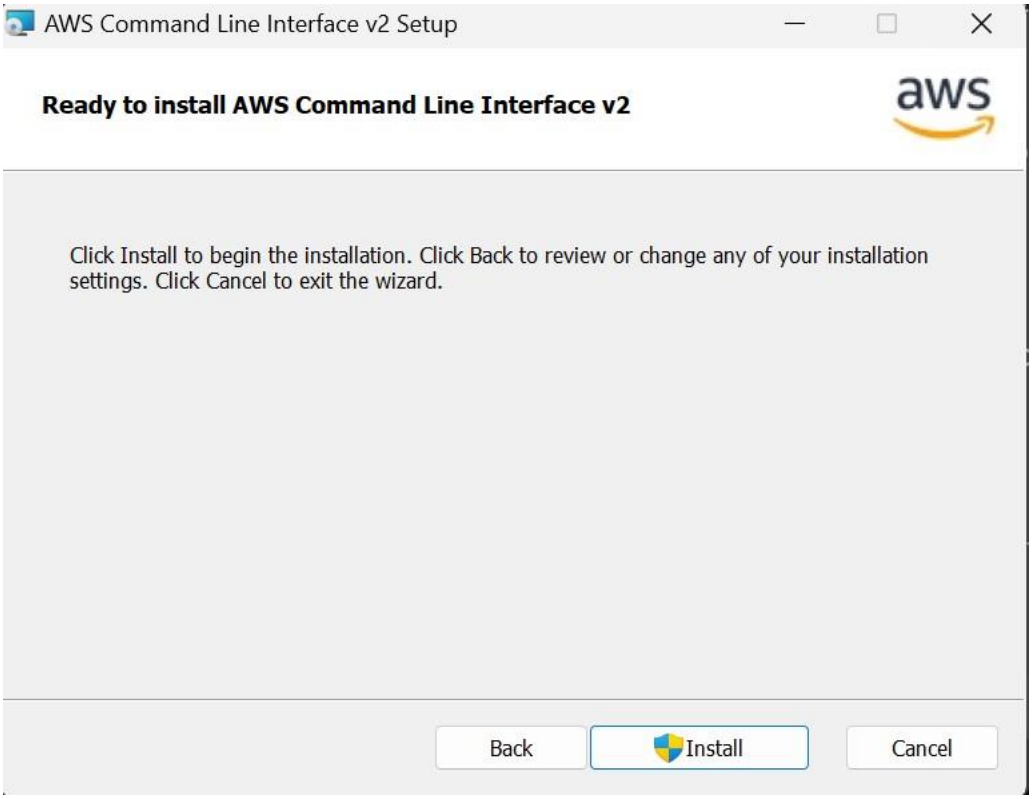
AWS CLI from the [AWS CLI installation page](#).

▯ Follow the installation instructions.

```
C:\Program Files>cd..

C:\>msiexec.exe /i https://awscli.amazonaws.com/AWSCLIV2.msi
```

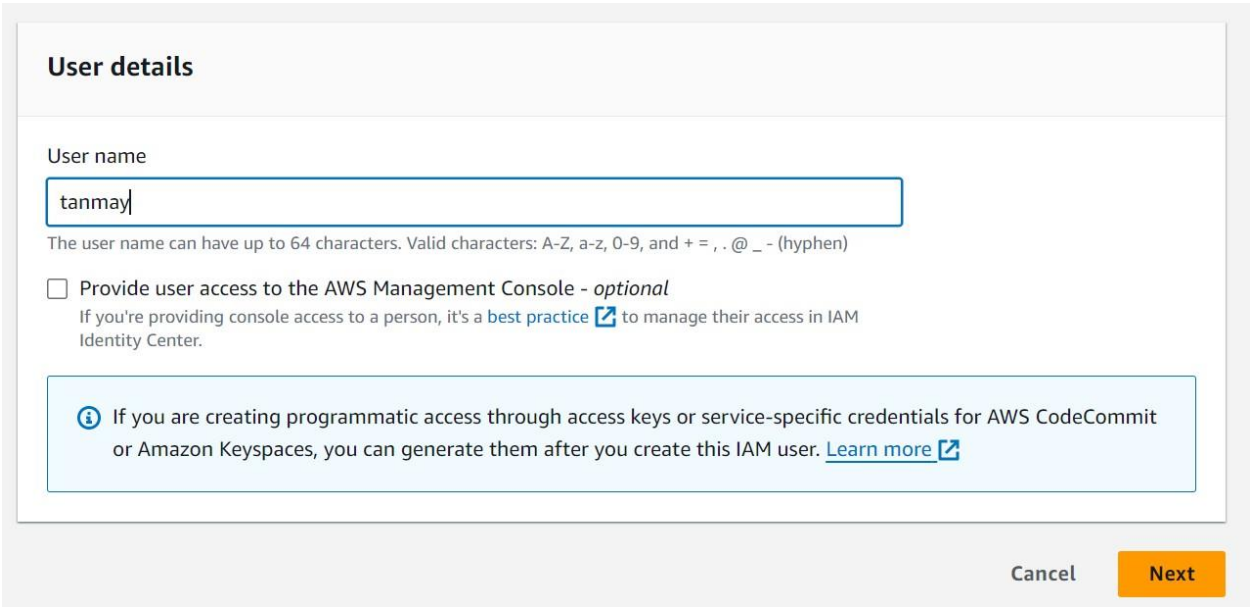

AWS Command Line Interface v2 Setup
End-User License Agreement
Please read the following license agreement carefully
aws
AWS Command Line Interface
Copyright 2012-2022 Amazon.com, Inc. or its affiliates. All Rights Reserved.
Licensed under the Apache License, Version 2.0 (the "License"). You may not use this file except in compliance with the License. A copy of the License is located at
http://aws.amazon.com/apache2.0/
I accept the terms in the License Agreement
Print
Back
Next
Cancel


AWS Command Line Interface v2 Setup
Custom Setup
Select the way you want features to be installed.
aws
Click the icons in the tree below to change the way features will be installed.
AWS Command Line Interface V2
The AWS Command Line Interface is a unified tool to manage your AWS services.
This feature requires 2576KB on your hard drive.
Location:
C:\Program Files\Amazon\AWSCLIV2\
Browse...
Reset
Disk Usage
Back
Next
Cancel



2) Create IAM user to get AWS Access Key ID, Secret Access Key.

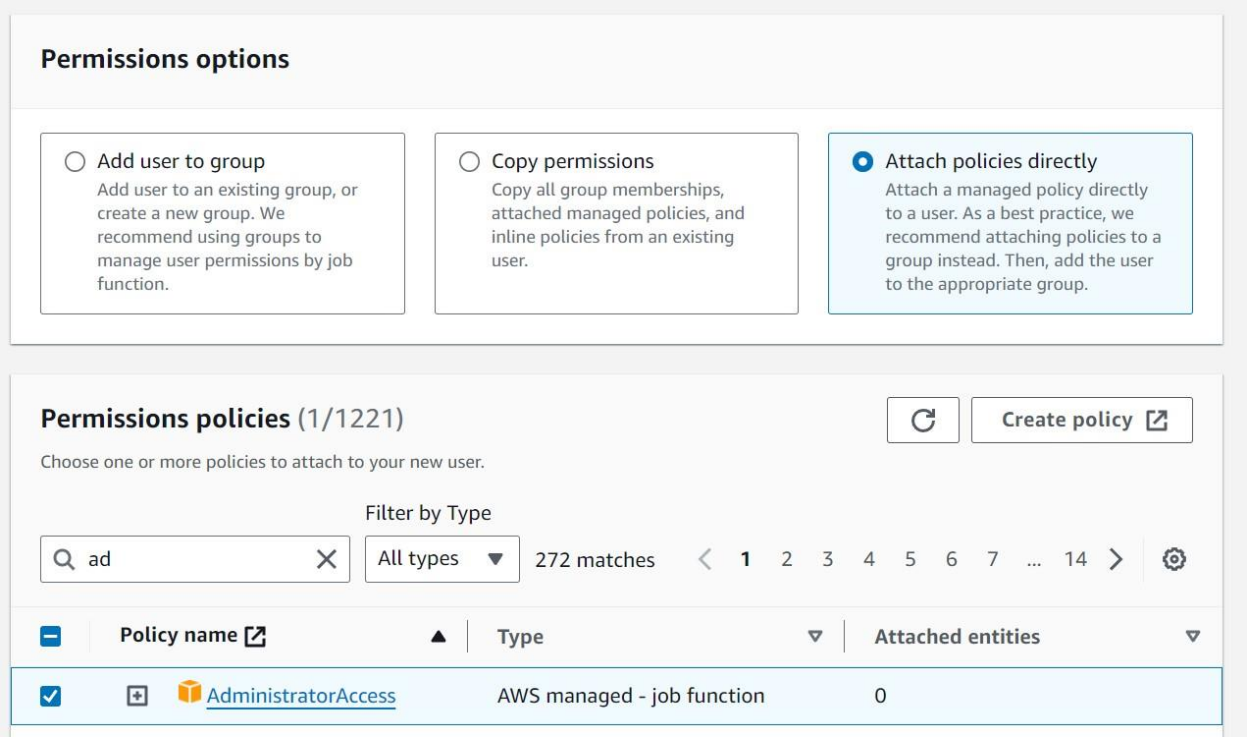
- **Go to IAM in AWS console.**
- **Create user by following below images.**



- **We have attach administrator access for the demonstration purpose in the production scenario it is not the best practice.**

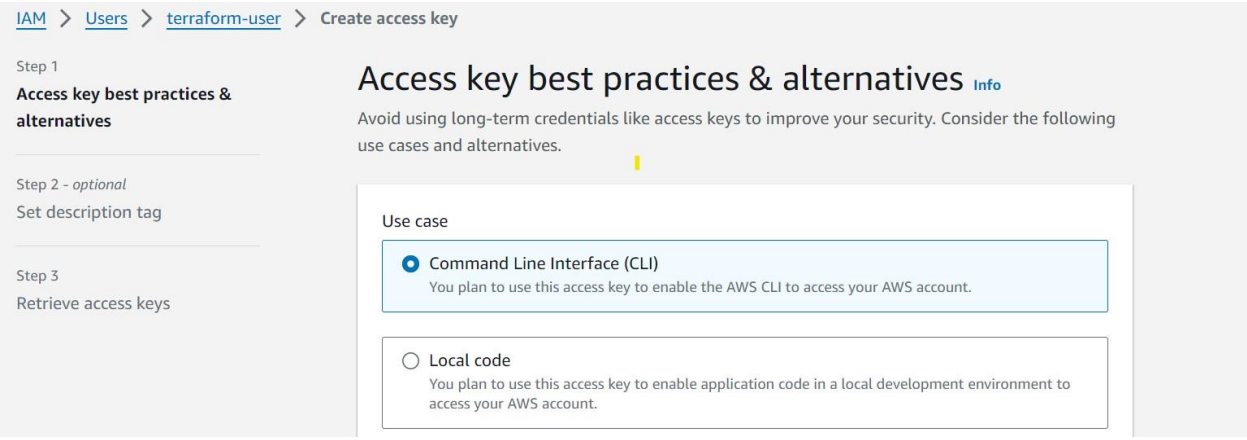
- **In the terraform script we have added the IAM role and policy so the process should be done in the secure and independent way.**

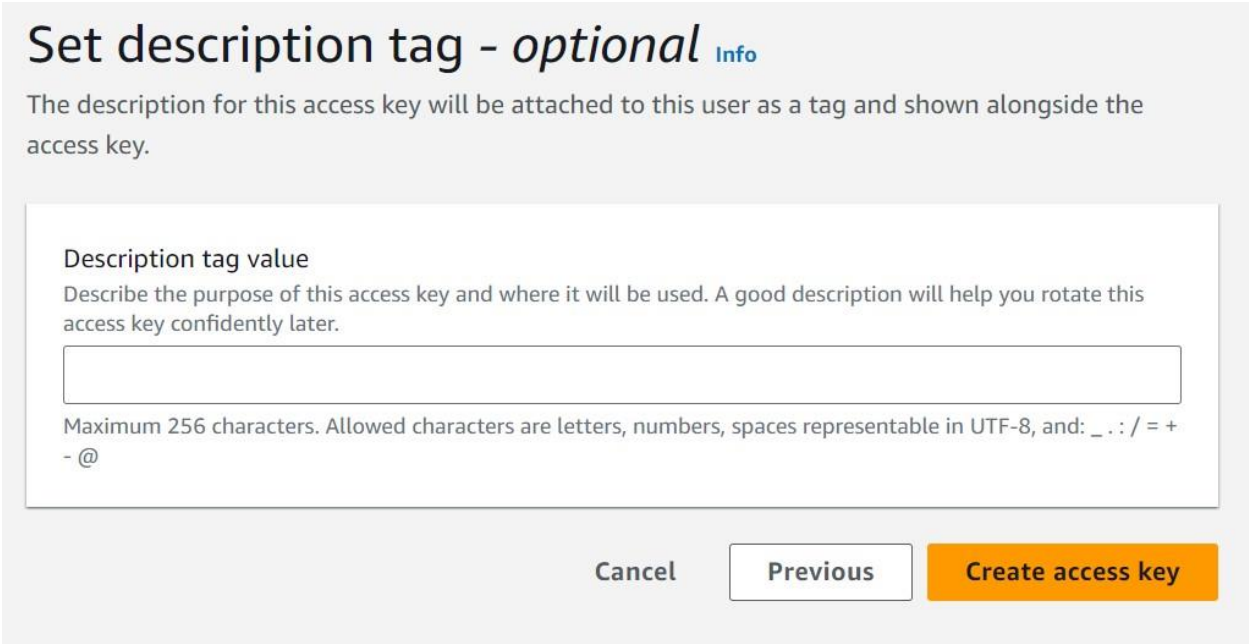
- Select **"Attach policies directly"**
- Select **"Administrator Access"**

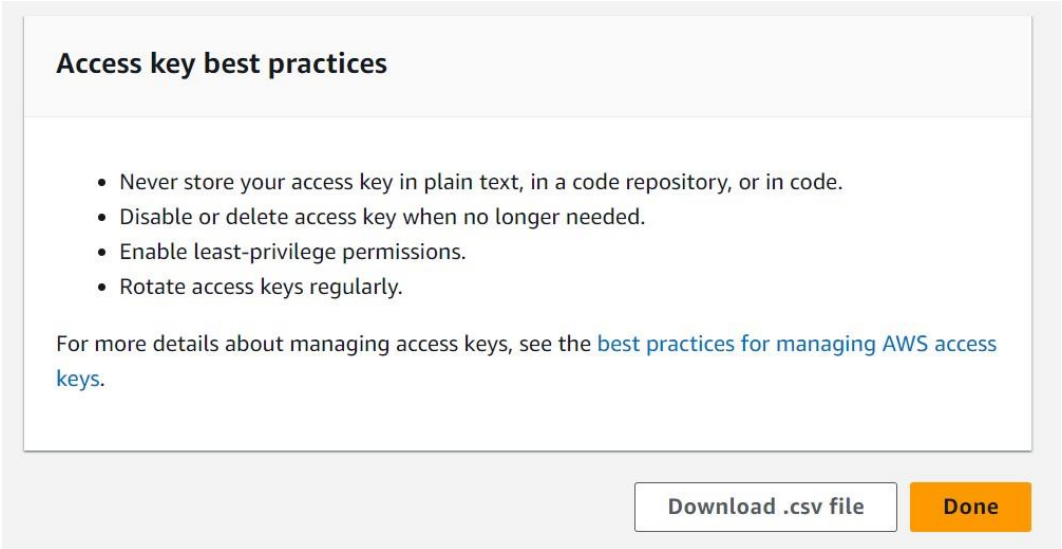


Review and create the user.

- **Click on Created user**
- **At top in Summary click "create access key" and follow below step.**



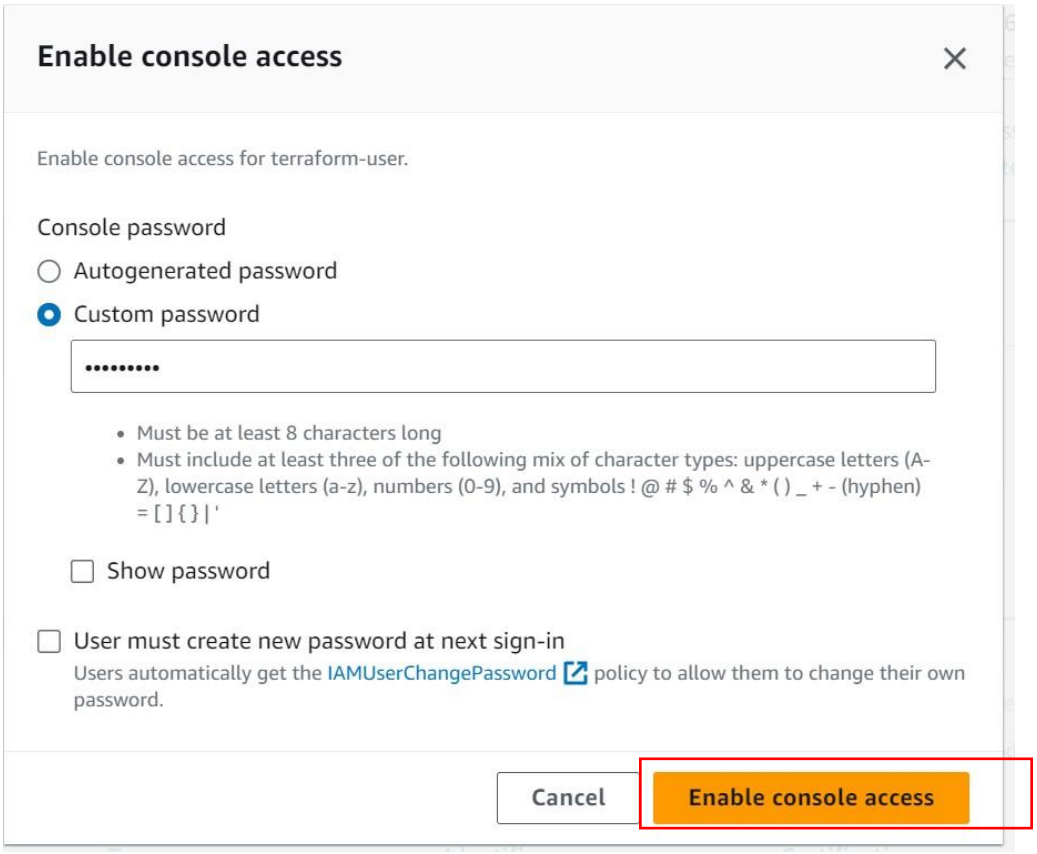


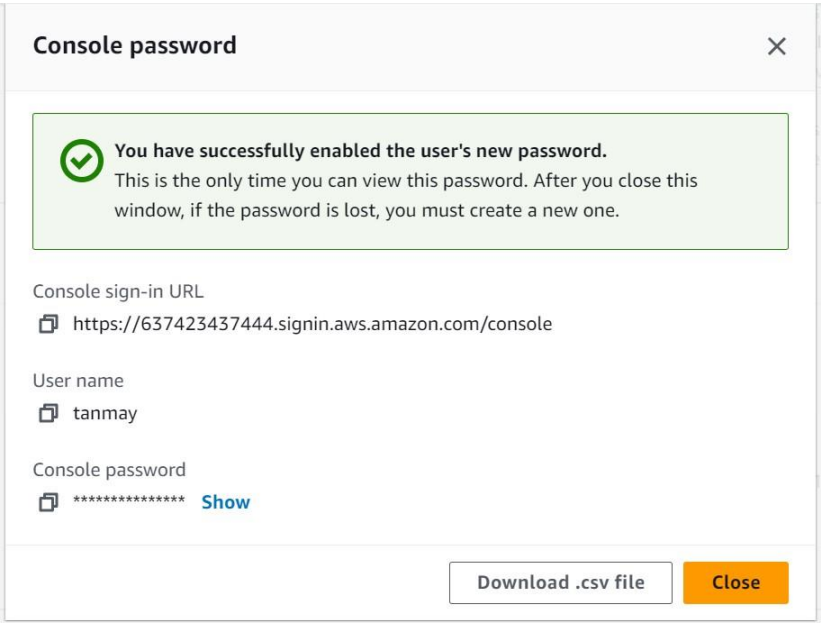


Download .csv file for further steps.

Create password for IAM user

- **Click on created user.**
- **Go to security credentials and set user password.**





Download the .csv file to take user access.

3) **Configure AWS CLI**:

- Open Command Prompt (cmd) and run "**aws configure**".
- Enter your AWS Access Key ID, Secret Access Key, default region name (e.g., us-east2), and default output format (e.g., json).

```
C:\Windows\System32>aws configure
AWS Access Key ID [****************QBMP]:
AWS Secret Access Key [****************uCUf]:
Default region name [us-east-2]:
Default output format [json]:
```

For default region name (choose your region)

For default output format Press "enter".

Step 3: Create a Terraform Configuration for the EKS-Cluster.

1) Create a Directory for Terraform Files:

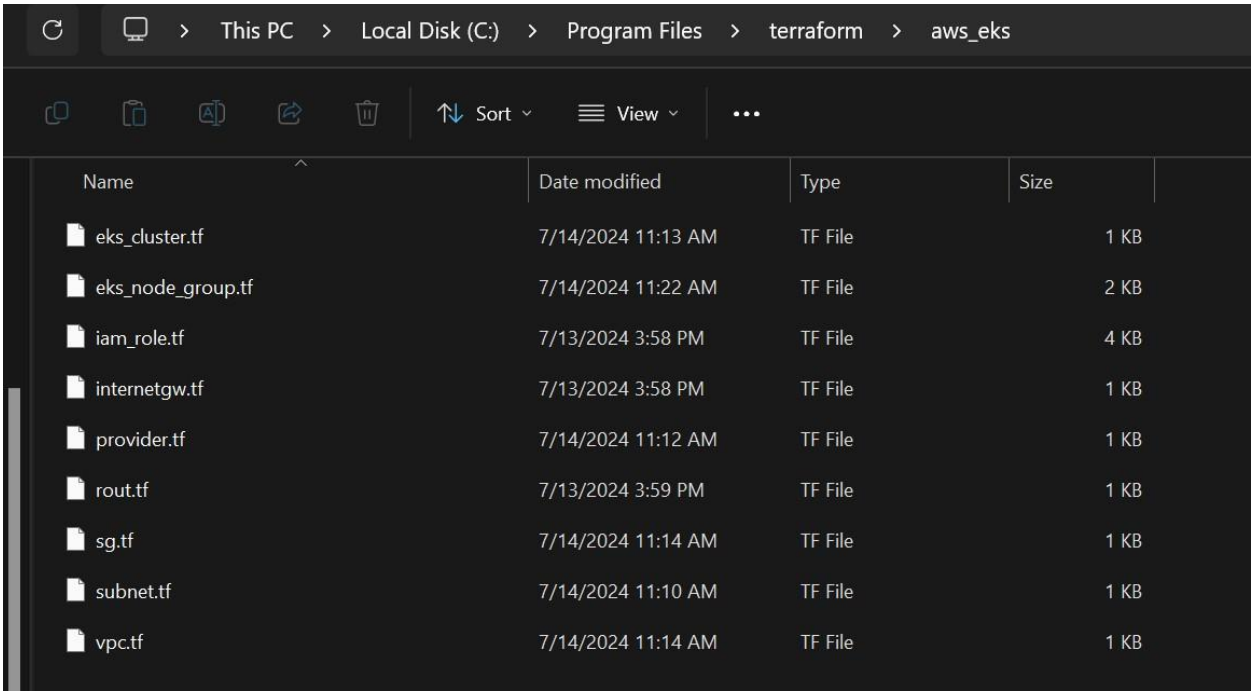
- Create a new directory for your Terraform project, e.g., C:\terraform\aws_eks.

2) Create main.tf File:

- Inside the project directory, create a nine files and add the following Terraform configuration:

1. eks_cluster.tf
2. eks_node_group.tf
3. iam_role.tf
4. internetgw.tf
5. provider.tf
6. rout.tf
7. sg.tf
8. subnet.tf
9. vpc.t

- We have provision the eks cluster in ohio (us-east-2) region and done the configuration according to that.
- So you can choose your region and do the necessary changes in the below configuration files.



eks_cluster file

```
resource "aws_eks_cluster" "eks" {

name     = "eks-cluster"   role_arn =

aws_iam_role.master.arn



  vpc_config {     subnet_ids = [aws_subnet.public-1.id,

aws_subnet.public-2.id]

  }


  depends_on = [

aws_iam_role_policy_attachment.AmazonEKSClusterPolicy,

aws_iam_role_policy_attachment.AmazonEKSServicePolicy,

aws_iam_role_policy_attachment.AmazonEKSVPCResourceController,

aws_iam_role_policy_attachment.AmazonEKSVPCResourceController,

    #aws_subnet.pub_sub1,

#aws_subnet.pub_sub2,

  ]


}
```

eks_node_group.tf file(part 1)

```
resource " aws_instance" "kubectl-server" {

  key_name                = "mykey" //replace with your created key
ami                     = "ami -0862be96e41dcbf74" //replace with your instance ami id
instance_type           = "t2.micro"
associate_publ  ic_ip_address = true
          subnet_id               =
aws_subnet.public        -1.id

vpc_security_group_ids     = [aws_security_group.allow_tls.id]



tags = {
   Name = "kubectl"

}


         }



resource "aws_eks_node_group" "node-grp" {

cluster_name    = aws_eks_cl uster.eks.name

node_group_name = "pc-node-group"

node_role_arn   = aws_iam_role.worker.arn

subnet_ids      = [aws_subnet.public-1.id, aws_subnet.public-2.id]

capacity_type   = "ON_DEMAND"
          disk_size
= "20"
instance_types  = ["t2.small"]



remote_access {

  ec2_ssh_key             = "mykey" //Create your own key in aws key management and enter the name
```

```
  source_security_group_ids = [aws_security_group.allow_tls.id]

}
```

eks_node_group.tf file (part 2)

```
  labels = tomap({ env = "dev" })


  scaling_config {
desired_size = 2
max_size     = 3     min_size
= 1
  }


  update_config {
max_unavailable = 1
  }


  depends_on = [
aws_iam_role_policy_attachment.AmazonEKSWorkerNodePolicy,
aws_iam_role_policy_attachment.AmazonEKS_CNI_Policy,
aws_iam_role_policy_attachment.AmazonEC2ContainerRegistryReadOnly,
    #aws_subnet.pub_sub1,
#aws_subnet.pub_sub2,
  ]
}
```

iam_role.tf file (part1)

```
resource    "aws_iam_role"    "master"    {
name = "ed-eks-master"

  assume_role_policy = <<POLICY
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "eks.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
POLICY
}

resource "aws_iam_role_policy_attachment" "AmazonEKSClusterPolicy"
{   policy_arn = "arn:aws:iam::aws:policy/AmazonEKSClusterPolicy"   role
= aws_iam_role.master.name
}

resource "aws_iam_role_policy_attachment" "AmazonEKSServicePolicy"
{   policy_arn = "arn:aws:iam::aws:policy/AmazonEKSServicePolicy"   role
= aws_iam_role.master.name
}
```

iam_role.tf (part2)

```
resource "aws_iam_role_policy_attachment" "AmazonEKSVPCResourceController"
{   policy_arn = "arn:aws:iam::aws:policy/AmazonEKSVPCResourceController"   role
= aws_iam_role.master.name
}


resource    "aws_iam_role"    "worker"    {
name = "ed-eks-worker"


  assume_role_policy = <<POLICY
{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Effect": "Allow",
      "Principal": {
        "Service": "ec2.amazonaws.com"
      },
      "Action": "sts:AssumeRole"
    }
  ]
}
POLICY
}
resource "aws_iam_policy" "autoscaler" {
name          =   "ed-eks-autoscaler-policy"
policy = <<EOF
```

iam_role.tf (part3)

```
{
  "Version": "2012-10-17",
  "Statement": [
```

```
  {
    "Action": [
      "autoscaling:DescribeAutoScalingGroups",
      "autoscaling:DescribeAutoScalingInstances",
      "autoscaling:DescribeTags",
      "autoscaling:DescribeLaunchConfigurations",
      "autoscaling:SetDesiredCapacity",
      "autoscaling:TerminateInstanceInAutoScalingGroup",
      "ec2:DescribeLaunchTemplateVersions"
    ],
    "Effect": "Allow",
    "Resource": "*"
  }
 ]
}
EOF

}

resource "aws_iam_role_policy_attachment" "AmazonEKSWorkerNodePolicy" {
policy_arn = "arn:aws:iam::aws:policy/AmazonEKSWorkerNodePolicy"   role
= aws_iam_role.worker.name
}
```

iam_role.tf (part4)

```
resource "aws_iam_role_policy_attachment" "AmazonEKS_CNI_Policy"
{   policy_arn = "arn:aws:iam::aws:policy/AmazonEKS_CNI_Policy"   role
= aws_iam_role.worker.name
}

resource "aws_iam_role_policy_attachment" "AmazonSSMManagedInstanceCore"
{   policy_arn = "arn:aws:iam::aws:policy/AmazonSSMManagedInstanceCore"   role
= aws_iam_role.worker.name
}

resource "aws_iam_role_policy_attachment" "AmazonEC2ContainerRegistryReadOnly"
{   policy_arn = "arn:aws:iam::aws:policy/AmazonEC2ContainerRegistryReadOnly"   role
= aws_iam_role.worker.name
}

resource "aws_iam_role_policy_attachment" "x-ray" {
  policy_arn = "arn:aws:iam::aws:policy/AWSXRayDaemonWriteAccess"
role       = aws_iam_role.worker.name
}

resource "aws_iam_role_policy_attachment" "s3" {
  policy_arn = "arn:aws:iam::aws:policy/AmazonS3ReadOnlyAccess"
role       = aws_iam_role.worker.name
}

resource "aws_iam_role_policy_attachment" "autoscaler"
{   policy_arn = aws_iam_policy.autoscaler.arn   role       =
aws_iam_role.worker.name
}

resource "aws_iam_instance_profile" "worker"
{   depends_on = [aws_iam_role.worker]   name
= "ed-eks-worker-new-profile"   role       =
aws_iam_role.worker.name
}
```

internetgw.tf file

```
resource "aws_internet_gateway" "gw" {   vpc_id = aws_vpc.main.id


  tags = {

    Name = "main"

  }

}
```

provider.tf file

```
terraform                          {

required_providers {      aws =

{     source  = "hashicorp/aws"

version = "4.66.1"

    }

  }

}


provider "aws" {
  region = "us-east-2" //replace with your region
}
```

rout.tf

```
resource     "aws_route_table"     "rtb"     {
vpc_id = aws_vpc.main.id

  route   {              cidr_block   =   "0.0.0.0/0"
gateway_id = aws_internet_gateway.gw.id
  }

  tags = {
    Name = "MyRoute"
  }
}

resource "aws_route_table_association" "a-1" {
subnet_id      = aws_subnet.public-1.id
route_table_id = aws_route_table.rtb.id
}

resource "aws_route_table_association" "a-2" {
subnet_id      = aws_subnet.public-2.id
route_table_id = aws_route_table.rtb.id
}
```

sg.tf

```
resource "aws_security_group" "allow_tls"
{   name       = "allow_tls"   description =
"Allow TLS inbound traffic"   vpc_id      =
aws_vpc.main.id

  ingress {     description = "TLS
from VPC"     from_port   = 22
to_port     = 22     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 = "allow_tls"
  }
}
```

subnet.tf

```
resource "aws_subnet" "public-1" {

  vpc_id                  = aws_vpc.main.id   cidr_block
= "10.0.1.0/24"
  availability_zone       = "us-east-2a" //replace with your zone
  map_public_ip_on_launch = true


  tags = {

    Name = "public-sub-1"

  }

}


resource "aws_subnet" "public-2" {

  vpc_id                  = aws_vpc.main.id   cidr_block
= "10.0.2.0/24"
  availability_zone       = "us-east-2b" //replace with your zone
  map_public_ip_on_launch = true


  tags = {

    Name = "public-sub-2"

  }

}
```

vpc.tf

```
resource "aws_vpc" "main" {
cidr_block = "10.0.0.0/16"

  tags = {
    Name = "VPC-main" //replace with your
name
  }
}
```

3) Initialize Terraform:

- Open Command Prompt and navigate to your project directory.
- Run "**terraform init"** to initialize the project.

```
C:\Program Files\terraform\aws-eks>terraform init
Initializing the backend...
Initializing provider plugins...
- Finding latest version of hashicorp/aws...
- Installing hashicorp/aws v5.57.0...
- Installed hashicorp/aws v5.57.0 (signed by HashiCorp)
Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
```

4) Apply Terraform Configuration:

- Run "**terraform apply".**
- Review the plan output and confirm the apply by typing "**yes**".

```
C:\Program Files\terraform\aws_eks>terraform apply
aws_iam_policy.autoscaler: Refreshing state... [id=arn:aws:iam::637423437444:policy/ed-eks-autoscaler-policy]
aws_iam_role.worker: Refreshing state... [id=ed-eks-worker]
aws_iam_role.master: Refreshing state... [id=ed-eks-master]

Note: Objects have changed outside of Terraform

Terraform detected the following changes made outside of Terraform since the last "terraform apply" which may have affected this plan:

  # aws_iam_policy.autoscaler has changed
  ~ resource "aws_iam_policy" "autoscaler" {
      + arn    = "arn:aws:iam::637423437444:policy/ed-eks-autoscaler-policy"
        id     = "arn:aws:iam::637423437444:policy/ed-eks-autoscaler-policy"
        name   = "ed-eks-autoscaler-policy"
        # (2 unchanged attributes hidden)
    }

  # aws_iam_role.master has changed
  ~ resource "aws_iam_role" "master" {
      + arn                   = "arn:aws:iam::637423437444:role/ed-eks-master"
        id                    = "ed-eks-master"
        name                  = "ed-eks-master"
        # (5 unchanged attributes hidden)
    }
```

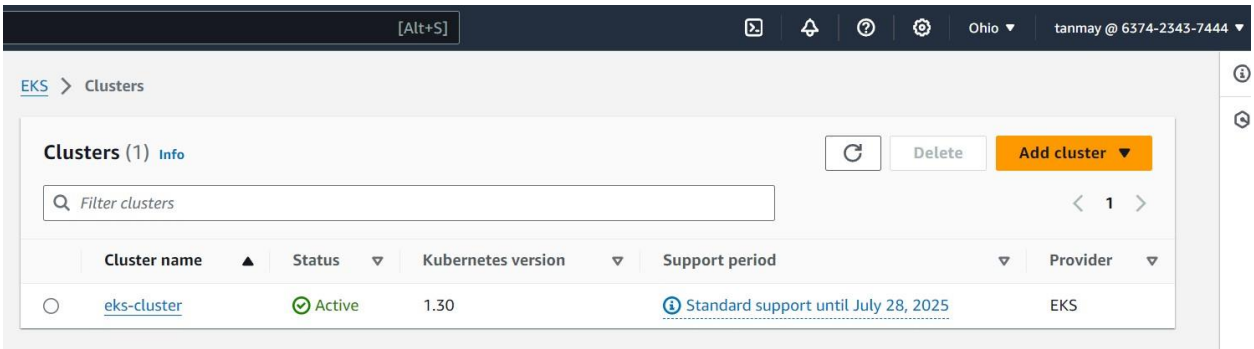
```
aws_eks_node_group.node-grp: Creating...
aws_eks_node_group.node-grp: Still creating... [10s elapsed]
aws_eks_node_group.node-grp: Still creating... [20s elapsed]
aws_eks_node_group.node-grp: Still creating... [30s elapsed]
aws_eks_node_group.node-grp: Still creating... [40s elapsed]
aws_eks_node_group.node-grp: Still creating... [50s elapsed]
aws_eks_node_group.node-grp: Still creating... [1m0s elapsed]
aws_eks_node_group.node-grp: Still creating... [1m10s elapsed]
aws_eks_node_group.node-grp: Still creating... [1m20s elapsed]
aws_eks_node_group.node-grp: Still creating... [1m30s elapsed]
aws_eks_node_group.node-grp: Still creating... [1m40s elapsed]
aws_eks_node_group.node-grp: Still creating... [1m50s elapsed]
aws_eks_node_group.node-grp: Creation complete after 1m51s [id=eks-cluster:pc-node-group]

Apply complete! Resources: 25 added, 0 changed, 3 destroyed.
```

Step 4: Verify the EKS-Cluster Creation in AWS Console.

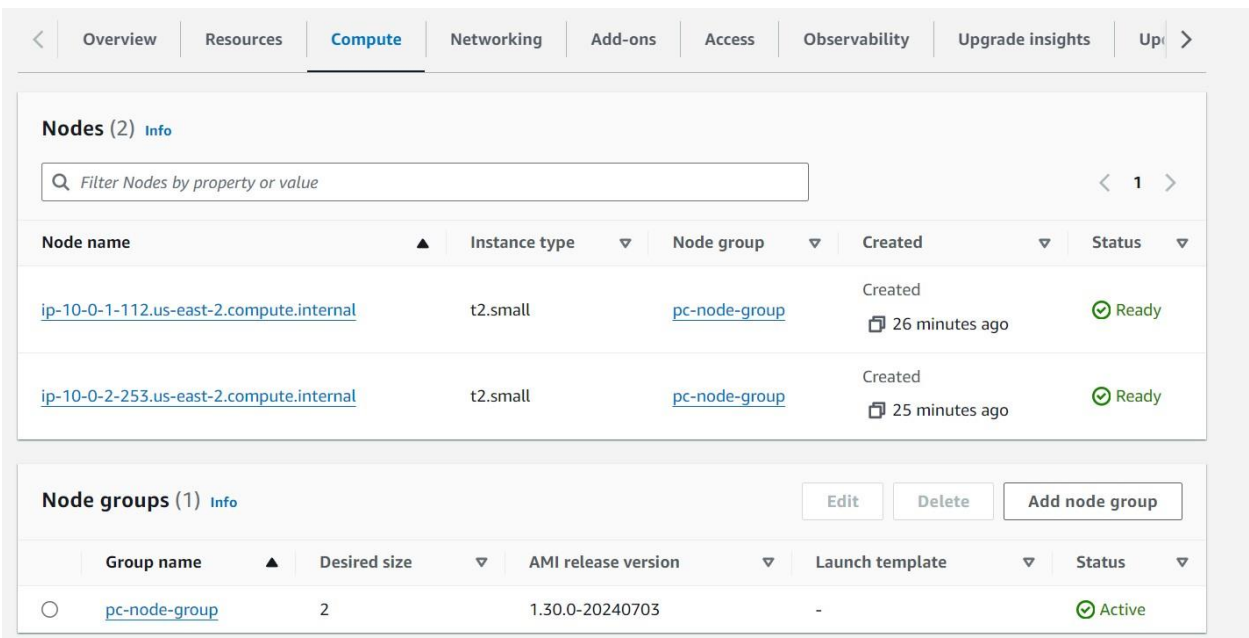
- Log in to your AWS Management Console.

- Navigate to the EKS dashboard.
- Verify that a new “EKS-cluster” is created in “us-east-2” region.

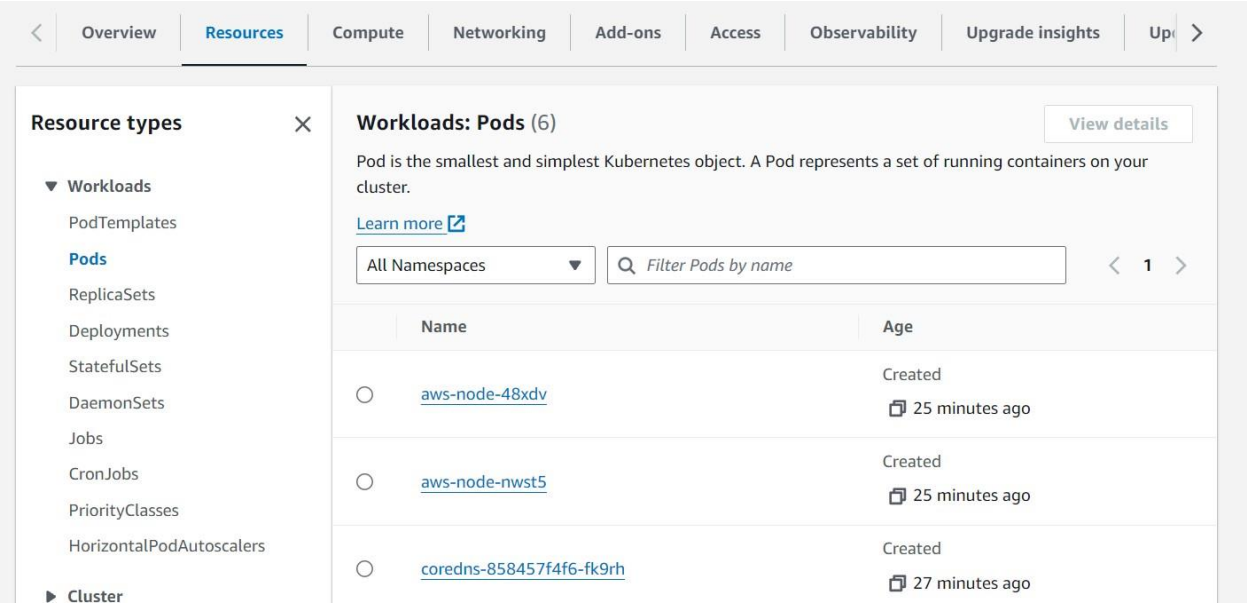
Below is the EKS-Cluster:



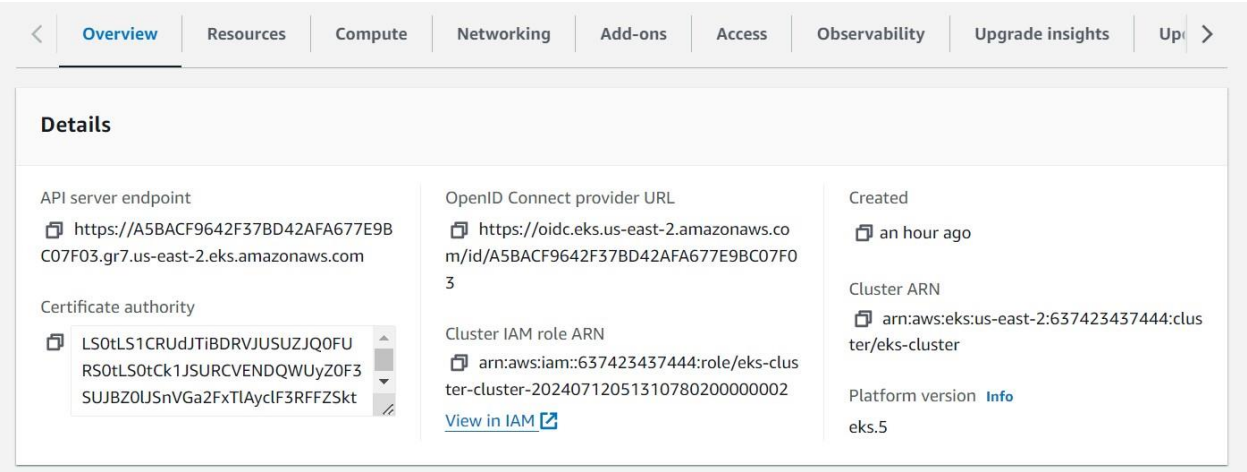
Cluster nodes and node groups:



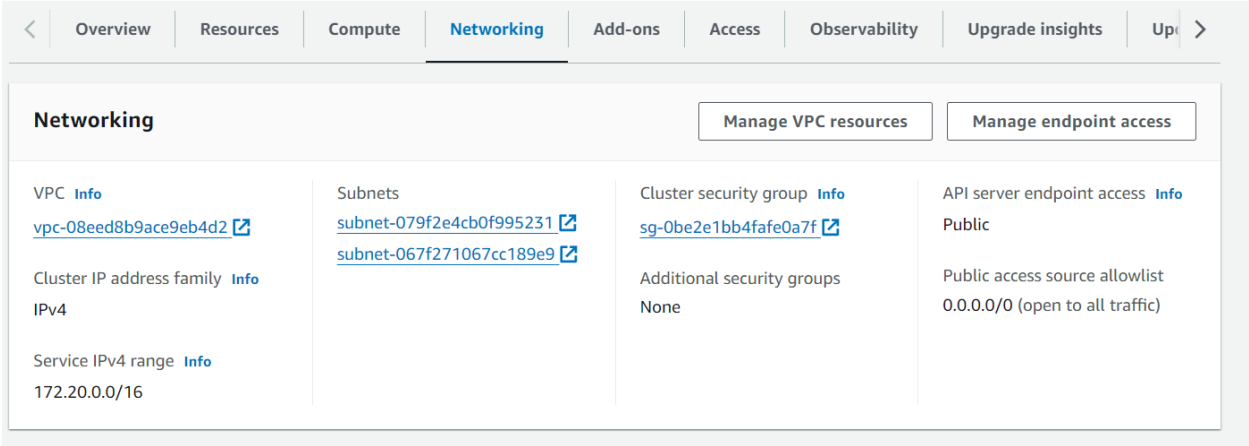
Pods:



Overview of cluster:

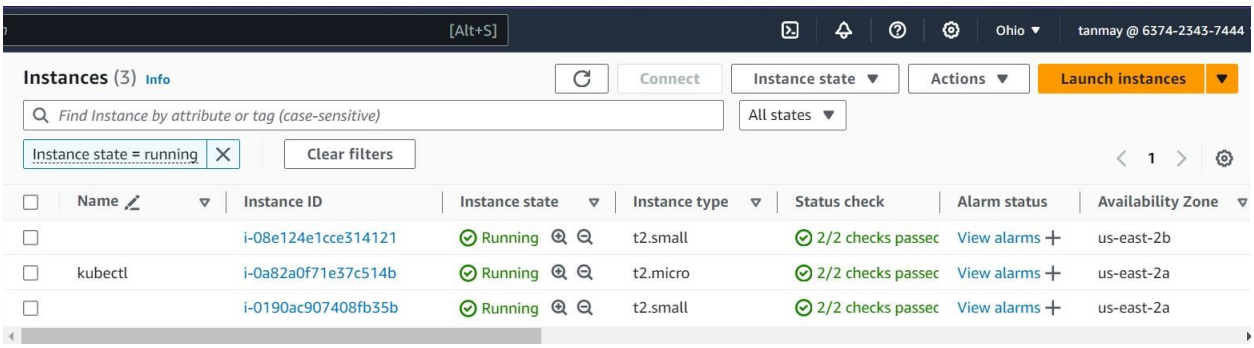


Vpc, Subnets and security groups:

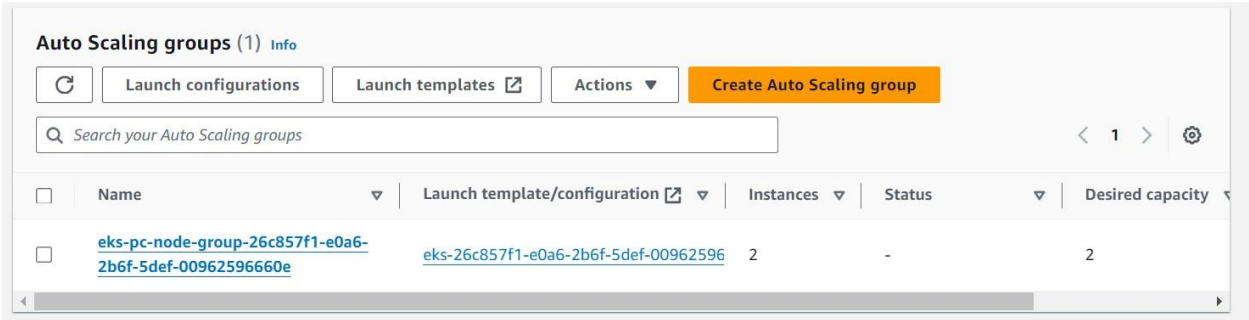


This are the three instances

- **Instances are Autoscaled: 2**
- **Main instance: 1**



- **Autoscaling for kubernetes instances**



To Check the kubernetes cluster in the cmd.

1) Update the context

- **aws eks update-kubeconfig --region “your region” --name “cluster-name”**

```
C:\Program Files\terraform\aws_eks>aws eks update-kubeconfig --region us-east-2 --name eks-cluster
Updated context arn:aws:eks:us-east-2:637423437444:cluster/eks-cluster in C:\Users\HP\.kube\config
```

2) Install kubernetes in windows cmd using below command:

- **curl.exe -O https://s3.us-west-2.amazonaws.com/amazon-eks/1.23.17/2024-0419/bin/windows/amd64/kubectl.exe**

```
C:\Program Files\terraform\aws_eks>curl.exe -O https://s3.us-west-2.amazonaws.com/amazon-eks/1.23.17/2024-04-19/bin/windows/amd64/kubectl.exe
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 44.3M  100 44.3M    0     0  1638k      0  0:00:27  0:00:27 --:--:-- 1276k
```

3) Check the version of kubernetes

- **kubectl version --client**

```
C:\Program Files\terraform\aws_eks>kubectl version --client
Client Version: version.Info{Major:"1", Minor:"23+", GitVersion:"v1.23.17-eks-ae9a62a", GitCommit:"d1eaa64fc31d03fc013272320eb765297d183bd8", GitTreeState:"clean", BuildDat
e:"2024-04-11T19:00:23Z", GoVersion:"go1.21.8", Compiler:"gc", Platform:"windows/amd64"}
```

4) Check the nodes present in the cluster that we have created just.

- **kubectl get nodes**

```
C:\Program Files\terraform\aws_eks>kubectl get nodes
NAME                                          STATUS   ROLES    AGE   VERSION
ip-10-0-1-112.us-east-2.compute.internal      Ready    <none>   17m   v1.30.0-eks-036c24b
ip-10-0-2-253.us-east-2.compute.internal      Ready    <none>   17m   v1.30.0-eks-036c24b
```

5) Get list services:

- **kubectl get svc**

```
C:\Program Files\terraform\aws_eks>kubectl get svc
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   172.20.0.1   <none>        443/TCP   21m
```