# Creating a Custom Virtual Private Cloud

## Virtual Private Cloud (VPC)

It is a **virtual network** within the Amazon Web Services (AWS) cloud infrastructure. It allows you to create your **own private network** environment with separate IP address ranges, subnets, route tables, and security groups. This enables you to isolate your resources and control network traffic flow.

VPC allows you to create **subnets** within your virtual network. Subnets are logical divisions of the VPC IP address range that you can use to organize and isolate resources.

VPC enables internet connectivity for your resources. You can configure an **Internet Gateway** to allow outbound internet access from your VPC and set up **public** subnets for resources that need to be accessible from the internet.

**Network Address Translation** (NAT) gateways or instances can be used to enable internet access for **private** subnets.


There are two types of NAT available in AWS VPC:

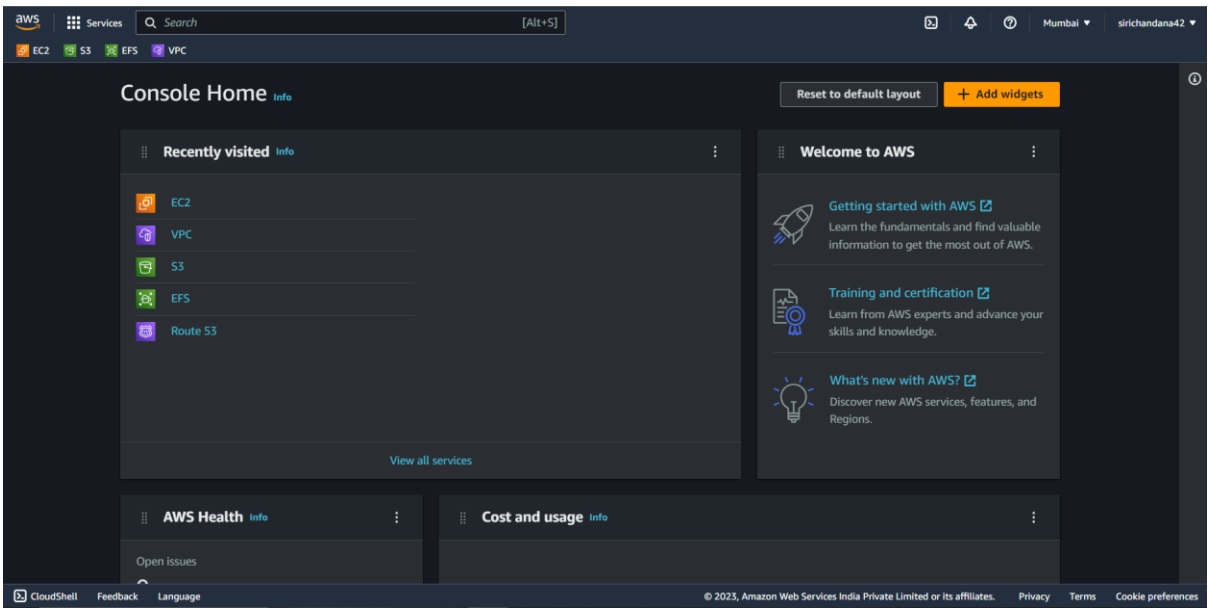
1. **NAT Gateway:**
    - A NAT Gateway is a managed service provided by AWS.
    - It is deployed in a public subnet and requires an Elastic IP address.
2. **NAT Instance:**
    - A NAT Instance is a regular EC2 instance that is deployed in a public subnet And configured to perform NAT.
    - Source and destination check should be disabled whenever we create an NAT using instance

VPC supports integration with AWS **VPN** and AWS **Direct Connect**. This allows you to securely connect your VPC to your on-premises network or other networks through encrypted VPN tunnels or dedicated network connections.

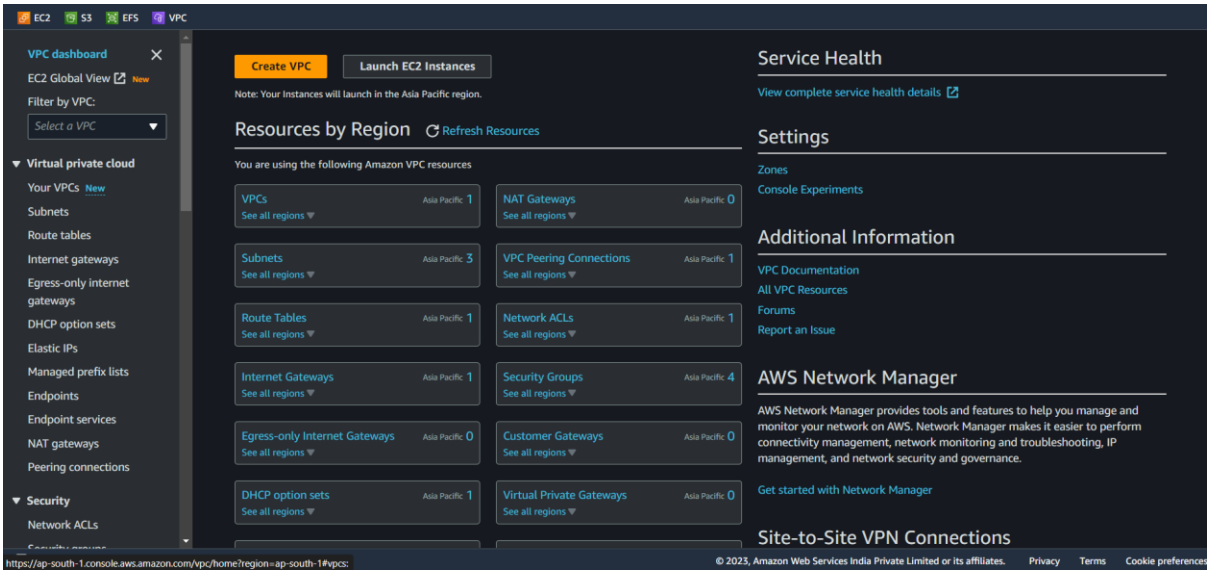
## Network Access Control List

Network Access Control Lists (NACLs) are a type of security control that you can use to filter and control inbound and outbound traffic at the subnet level in your Virtual Private Cloud.

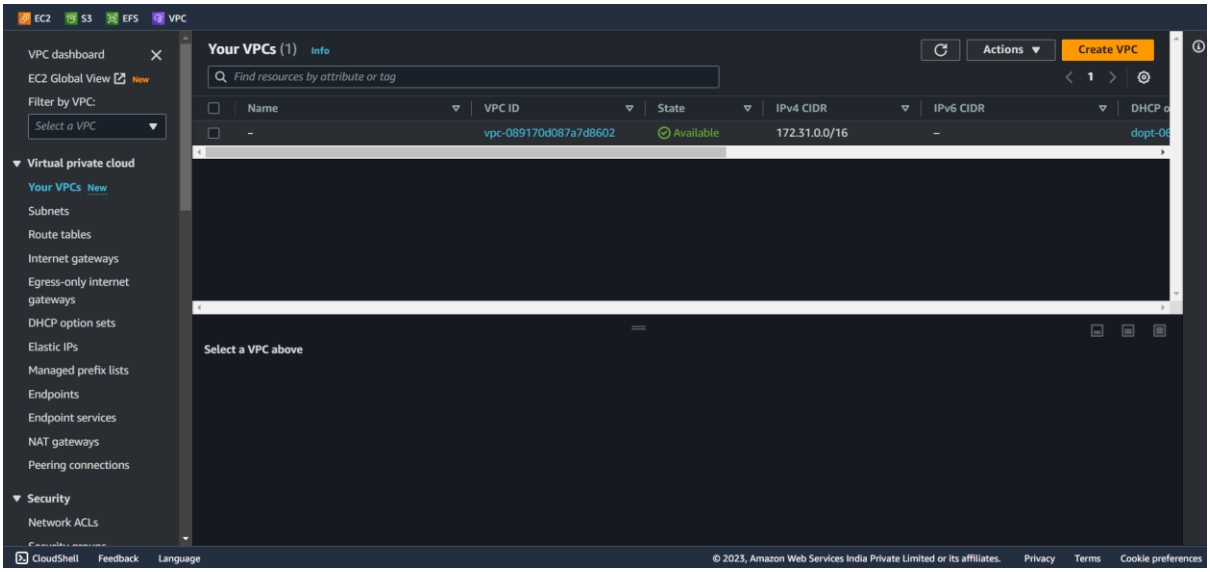
1. First Log in to your AWS free tier account and open your AWS management console and click on services and **select VPC**



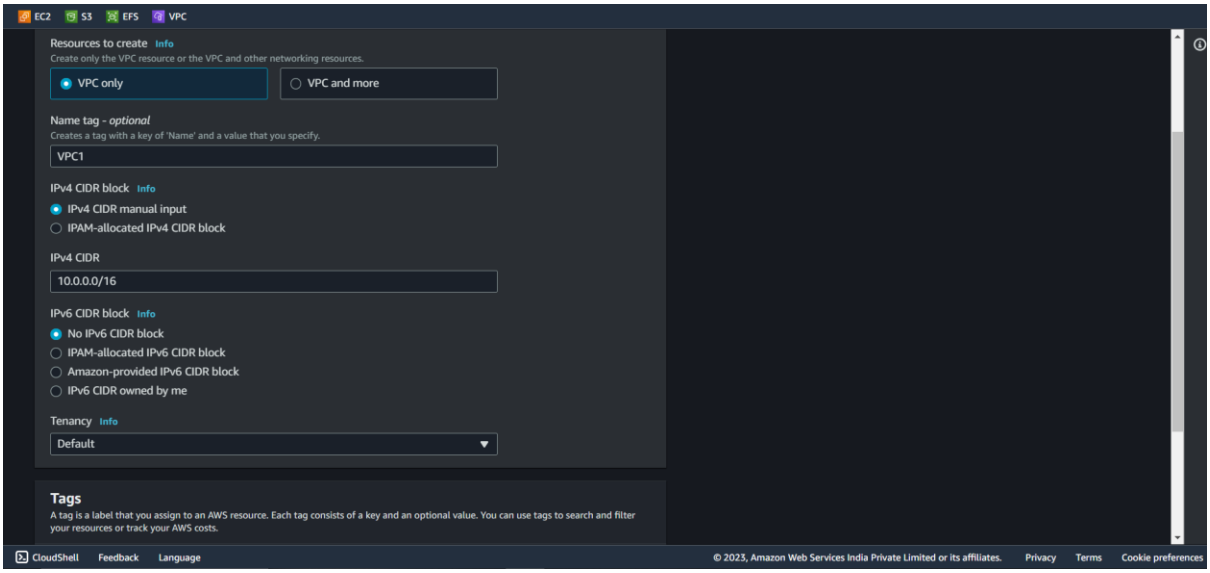

2. Now you will be redirected to VPC dashboard then click on your VPCs to **create a custom** virtual private cloud



3. Now click on **create VPC** to create a new custom VPC.

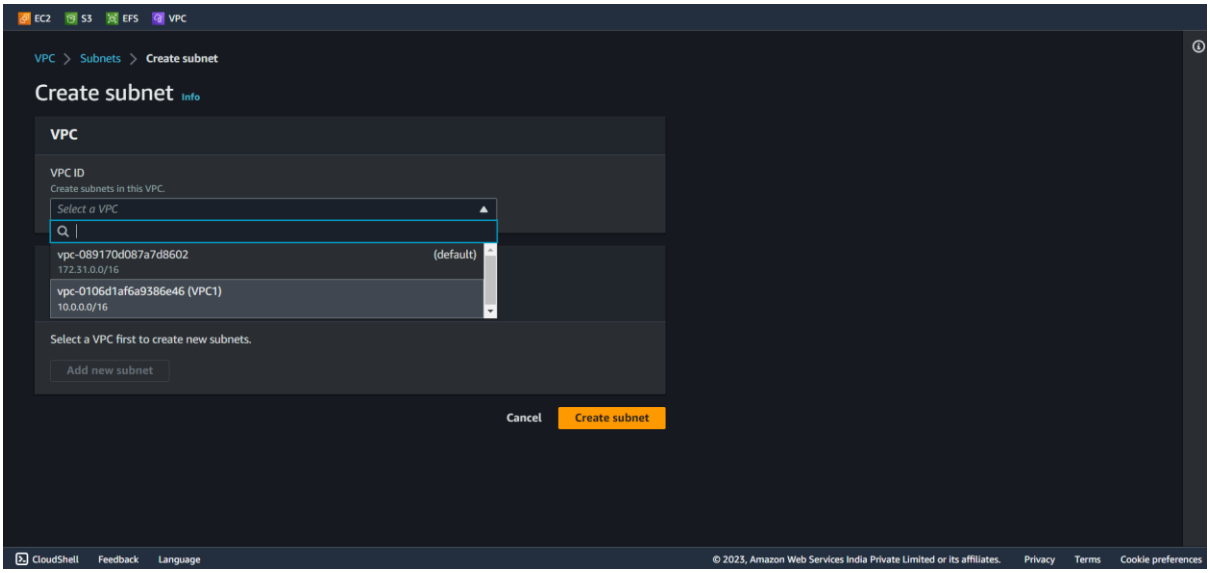



4. Now set a **name** for your VPC and assign **a valid CIDR** and click on create VPC.

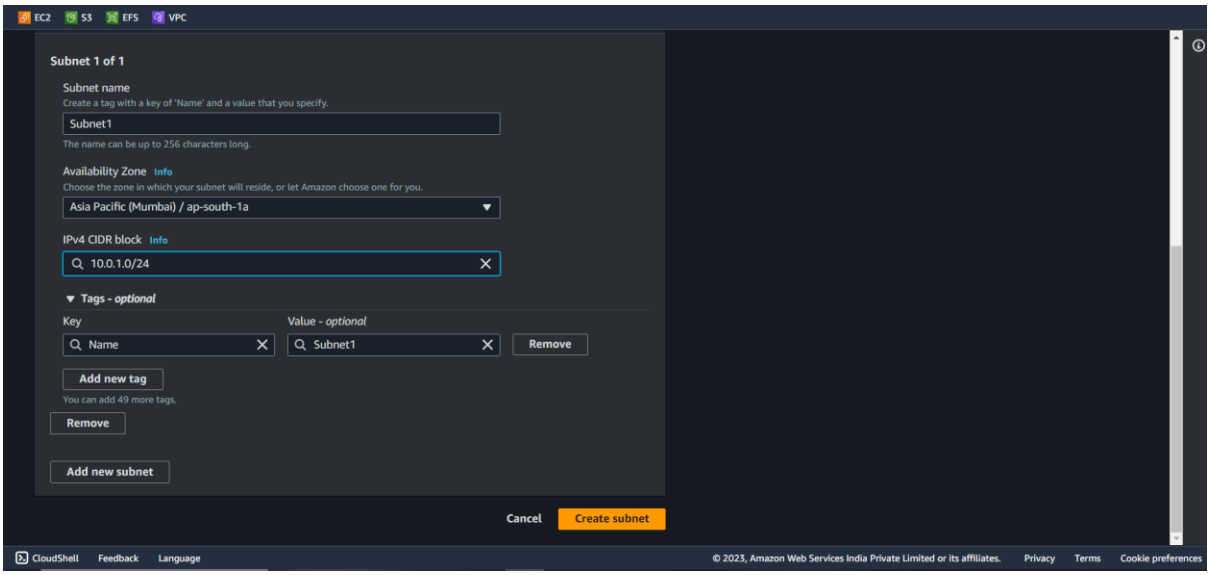



**Classless Inter-Domain Routing** (CIDR) notation is commonly used to represent subnets. It combines the network IP address and the subnet mask, represented as a slash followed by the number of network bits. For example, a subnet with a CIDR notation of /24 means that the first 24 bits of the IP address represent the network, while the remaining 8 bits represent the host portion. AWS allows from **/16 to /28** only

5. Now go to subnets and click on **create subnet** and create 2 subnets in custom VPC



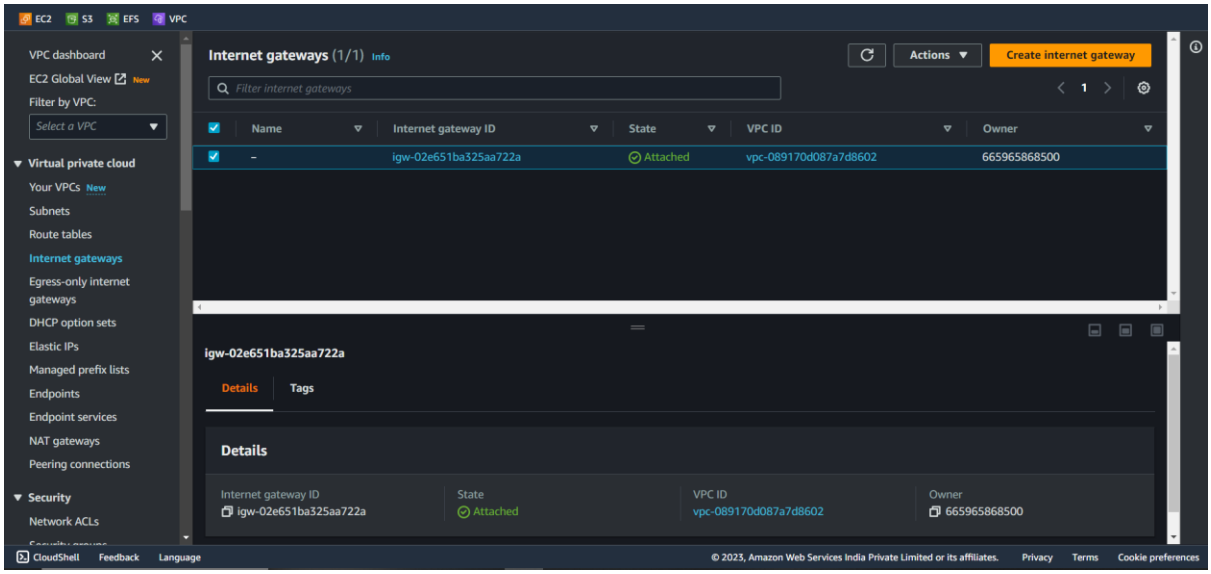

6. Give the subnet name. Select the availability zone in which we want to create a subnet, give the CIDR of the subnet within the CIDR of VPC.



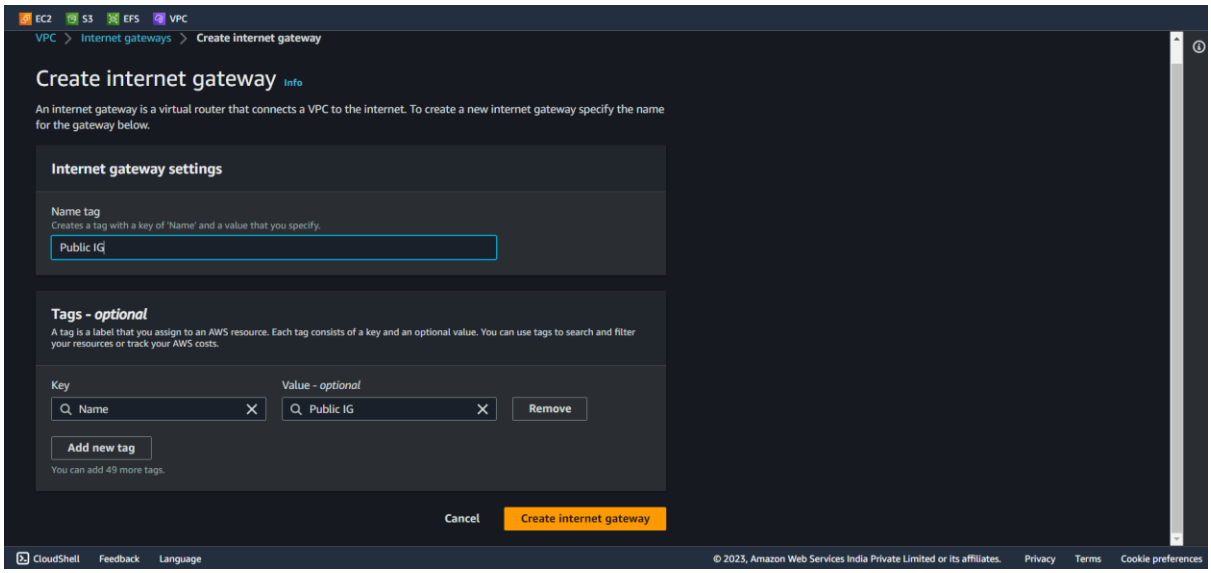

Similarly create another subnet with CIDR **10.0.2.0/24** so that 2 subnets will be created in same VPC.

Rename them as Public and private for your convenience.

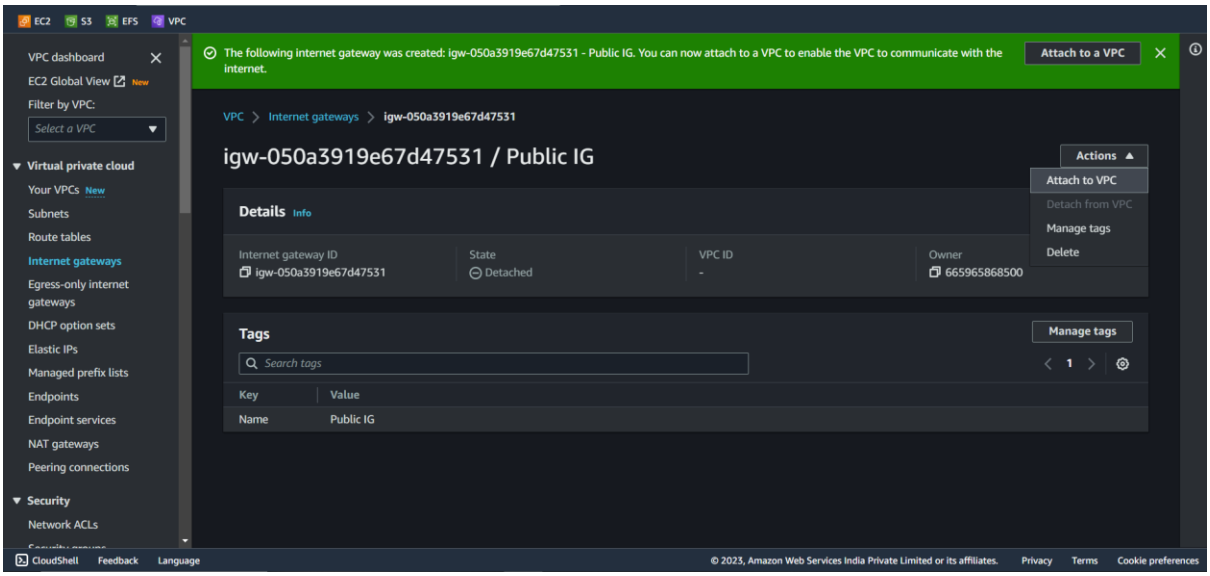
7. Now for internet access for your public subnet create an **Internet gateway**. For that go to internet gateways and click on create Internet Gateway.



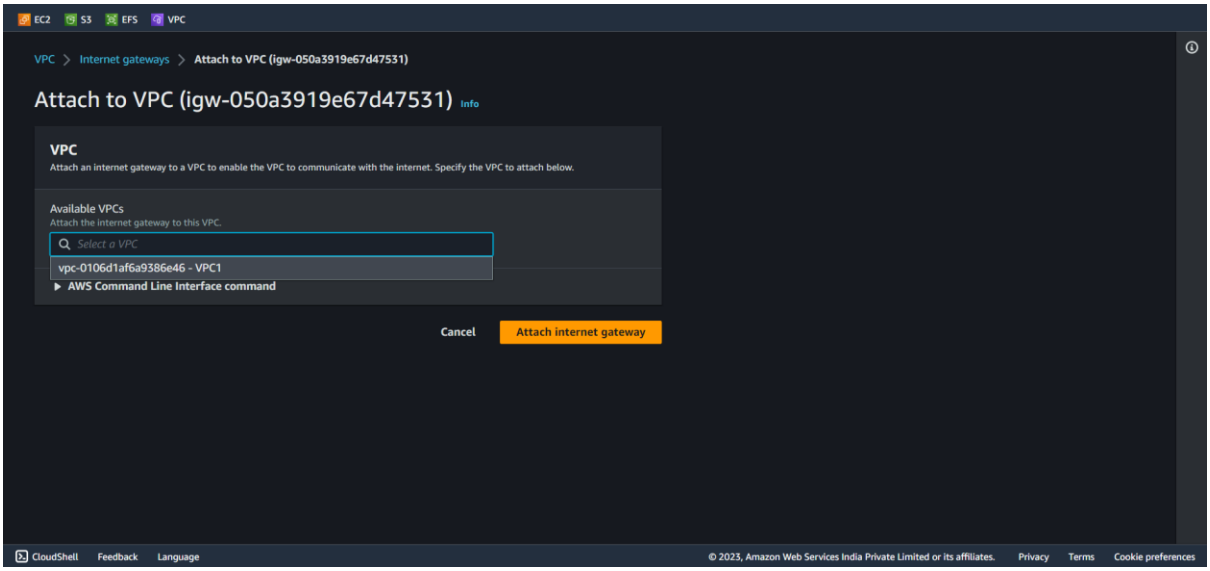

8. Now name your Internet gateway and click on create gateway.



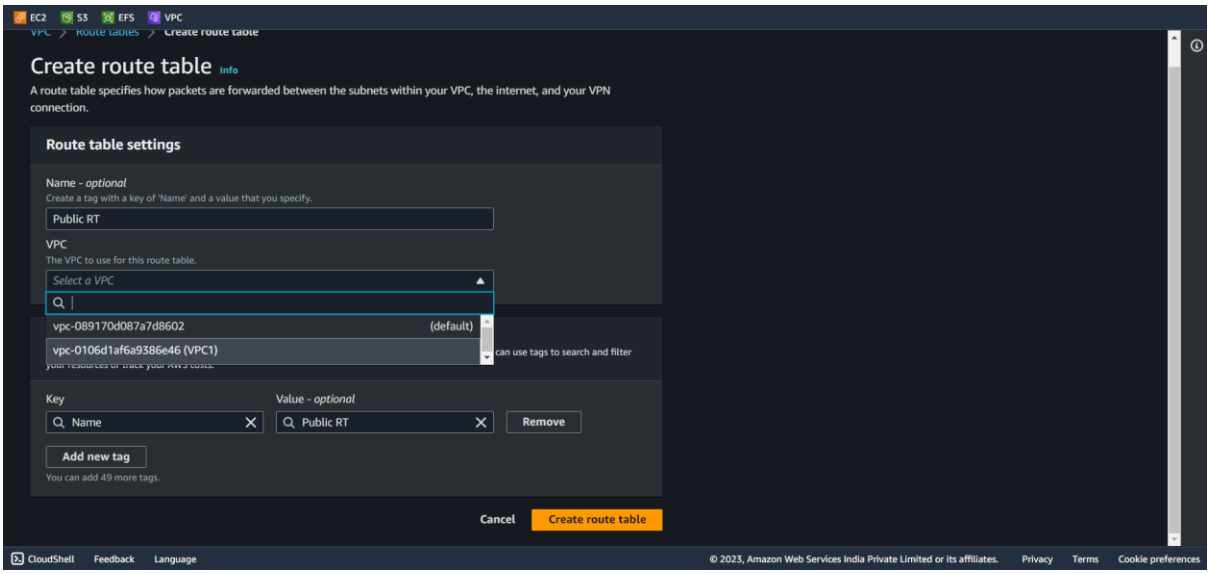
9. Now select the VPC and click on actions and click on attach to VPC to **attach the internet gateway** to the custom VPC.



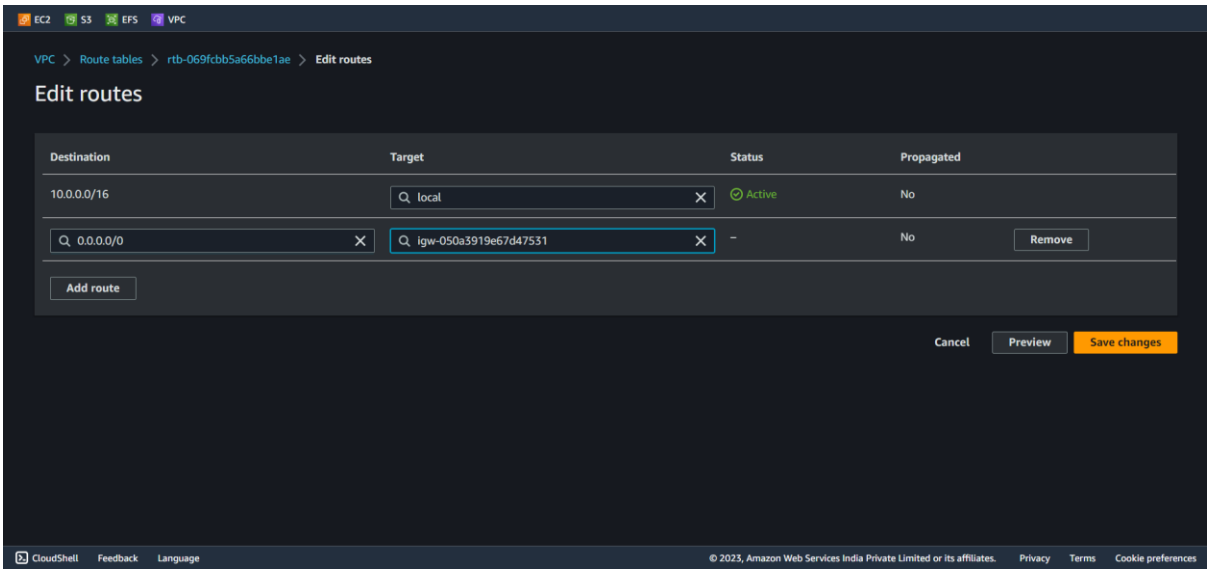

10. Now select the custom VPC from the available VPCs and attach the IG to the VPC



11. Now to create **route tables** for both public and private subnets click on Route tables and click on create route table name the RT and select the VPC and click on create route table.

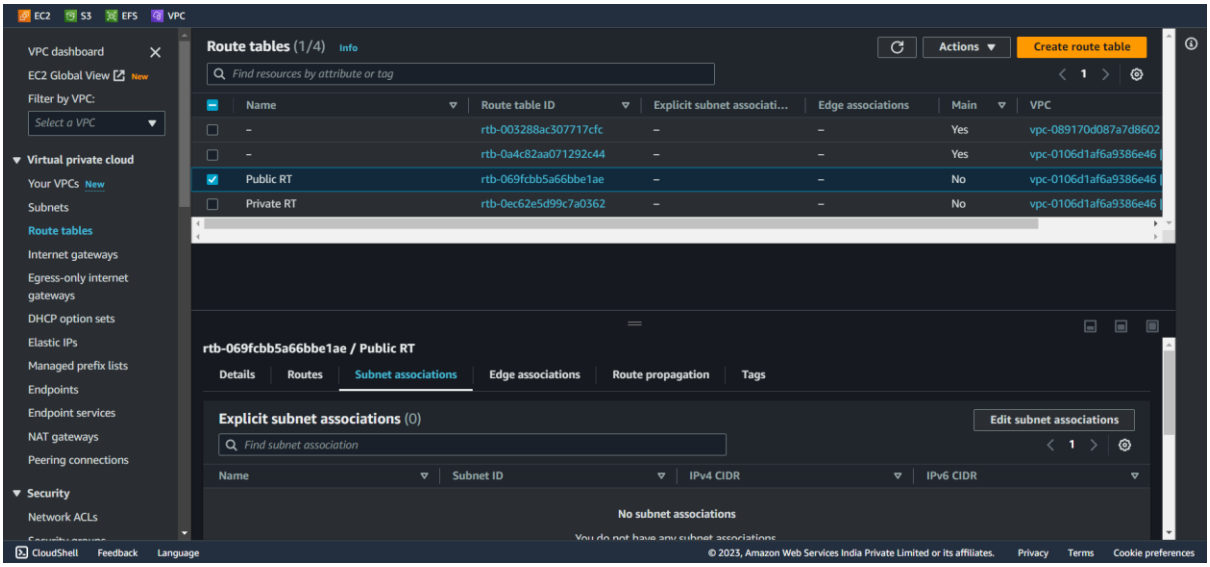


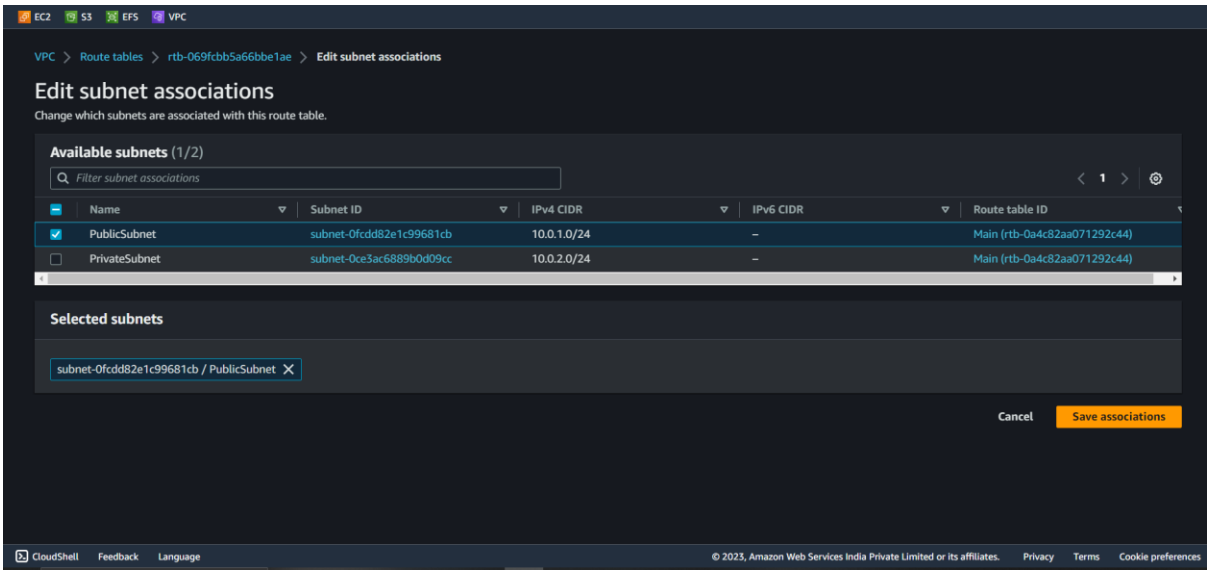

12. Now edit the route settings and add Internet gateway as a route to it and click on save changes.




Similarly create another route table but don't add IG as private subnet shouldn't have access to the internet

13. Now select the route table and select subnet associations, click on edit subnet associations and associate the public subnet to public and private subnet to private RT.

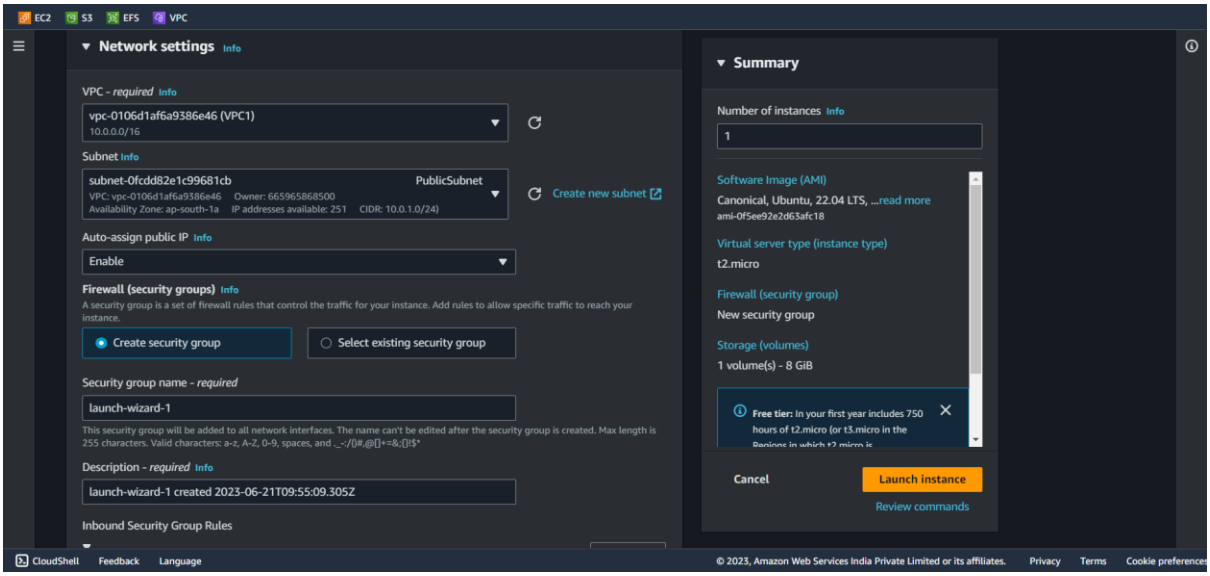


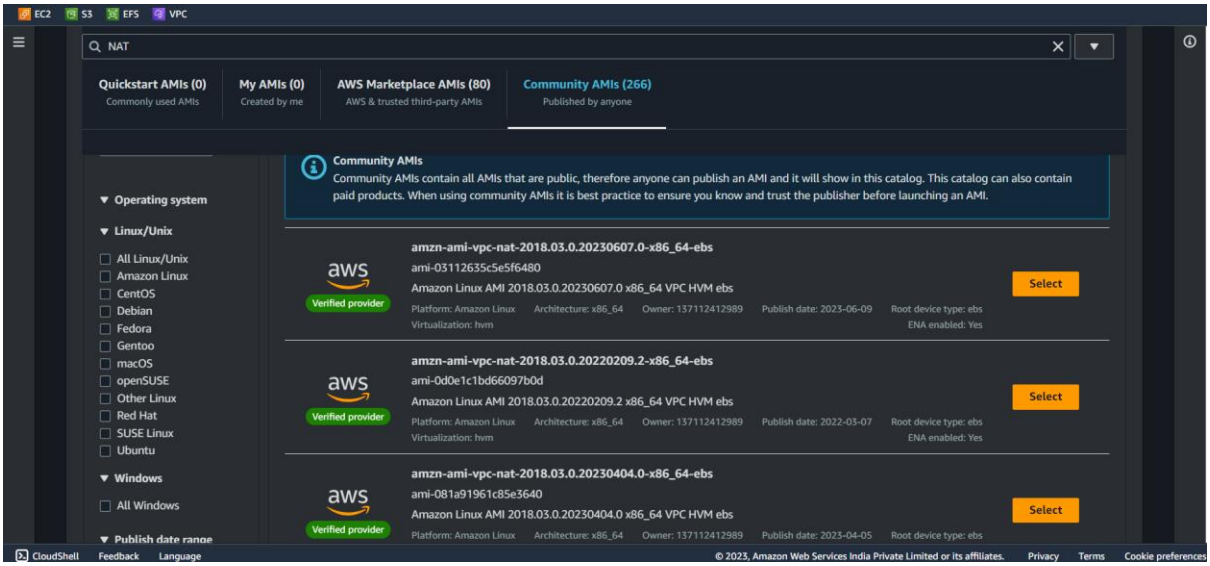

Now your VPC has been completely set up now create 2 instances in two different subnets in your custom VPC.

## Creating Instances in two different subnets

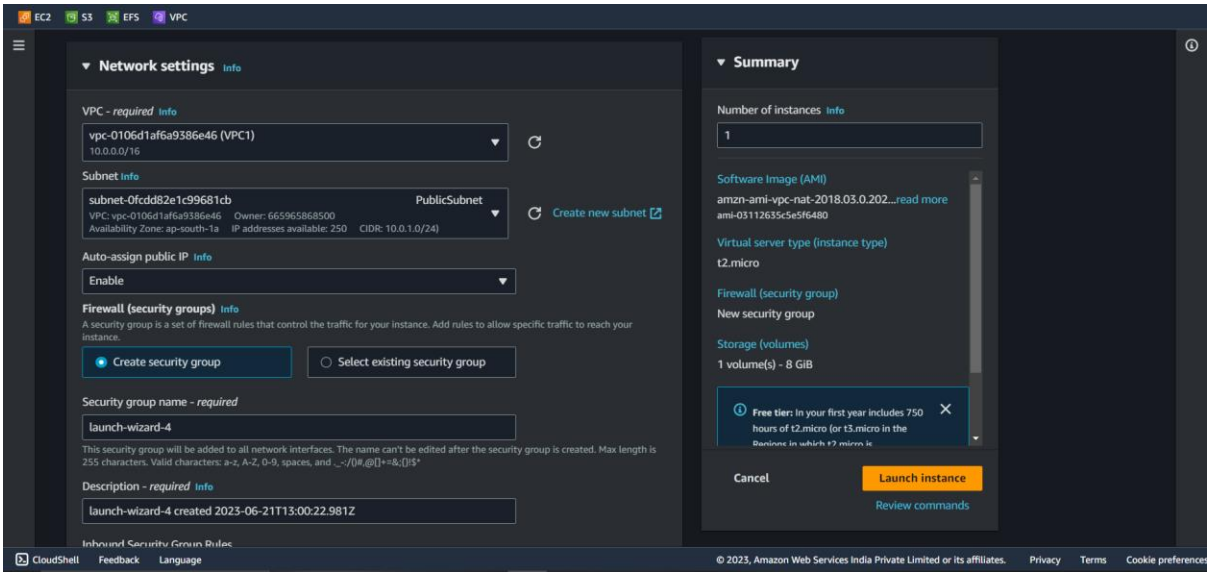
1. While creating ensure that your network settings are on Custom VPC and subnet in a public subnet for Public instance and enable **auto assign public IP** and Private Subnet for private instance.



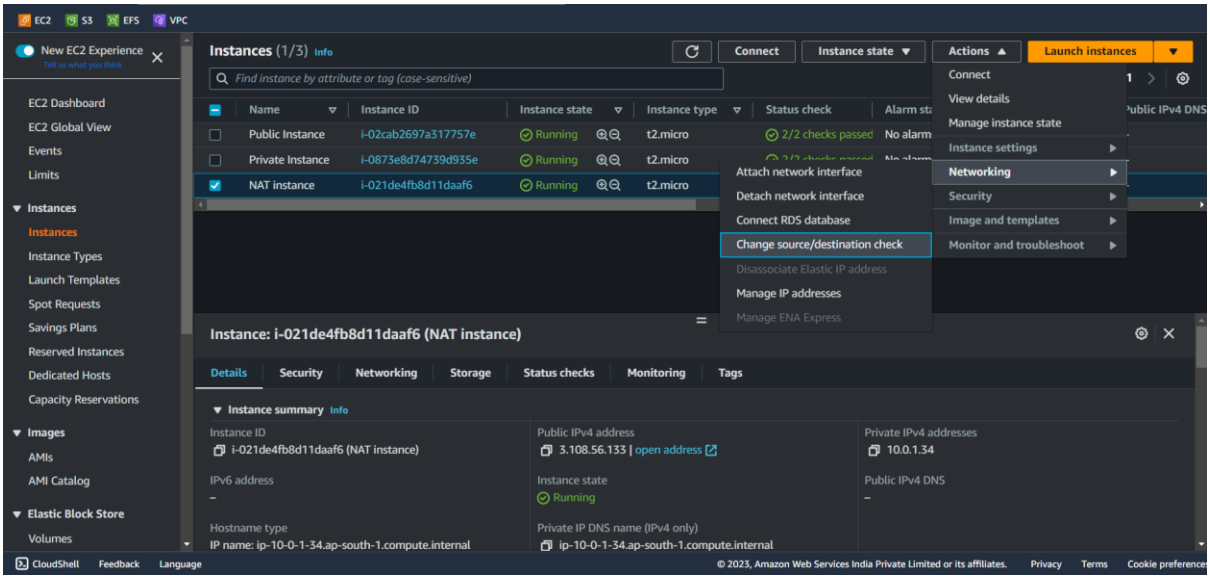

2. Create a NAT instance by selecting AMI containing NAT in the community AMIs



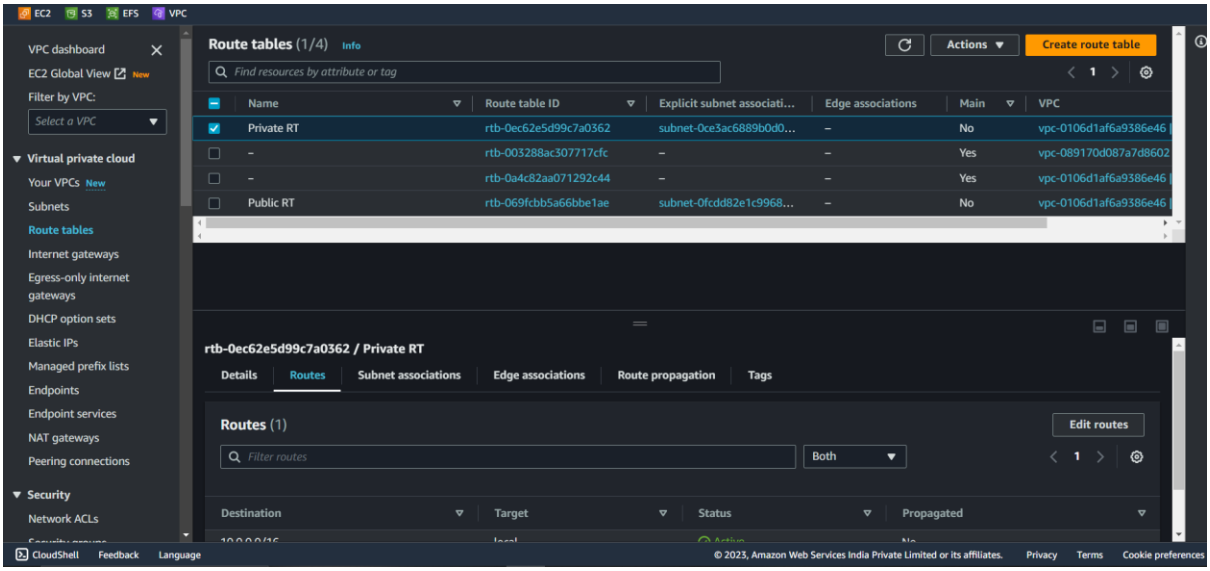
3. Since NAT requires internet connection to work it is placed in Public subnet



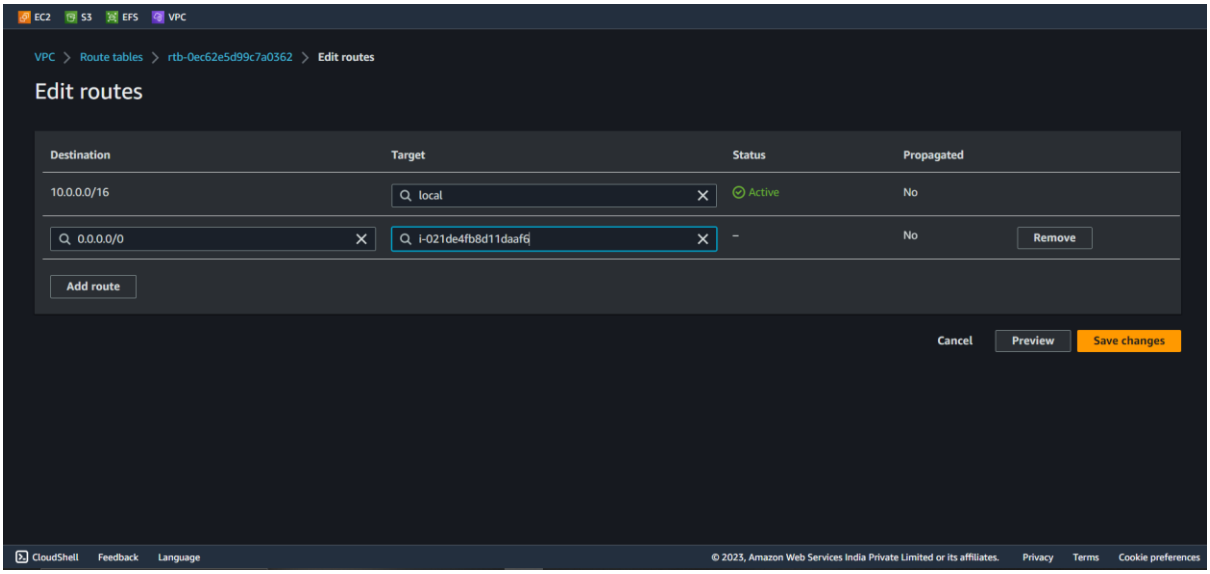

4. Now select the instance and stop the source and destination check for the NAT instance



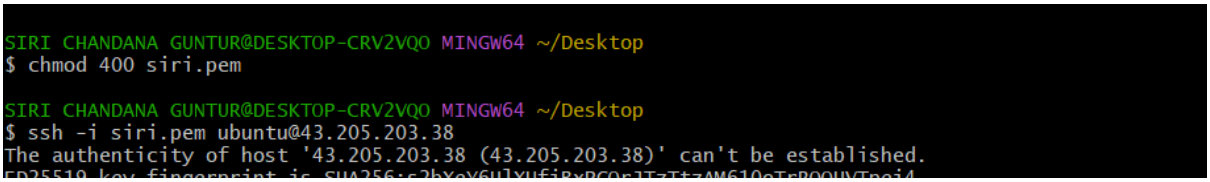
5. Now add NAT instance as a route in private routes



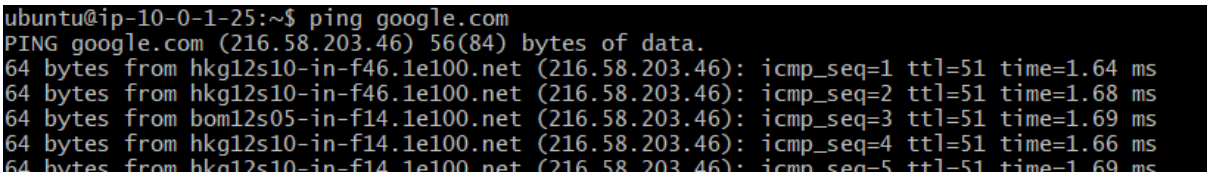

6. Add CIDR 0.0.0.0/0 as destination to NAT instance in route table.



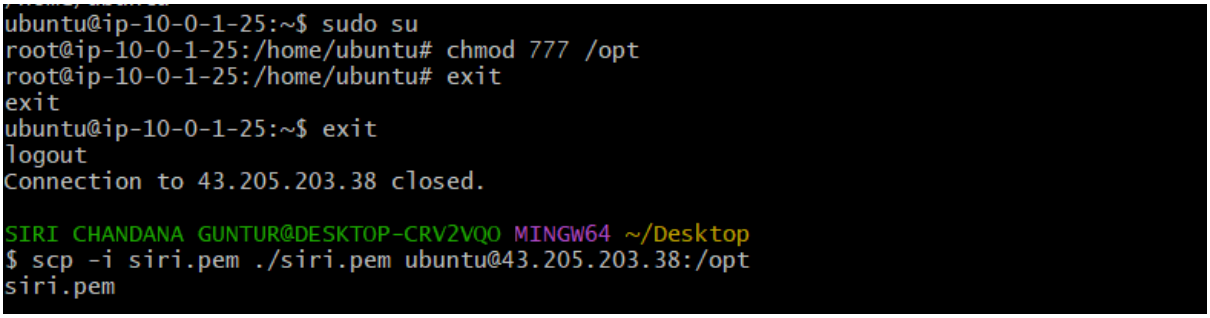
7. Now firstly connect to public instance using GIT Bash using SSH




Now try to ping any website for ex Google.com to verify internet connectivity.




Now enable rwx permissions to a directory in public instance and copy the key pair file onto public instance to connect to Private instance.



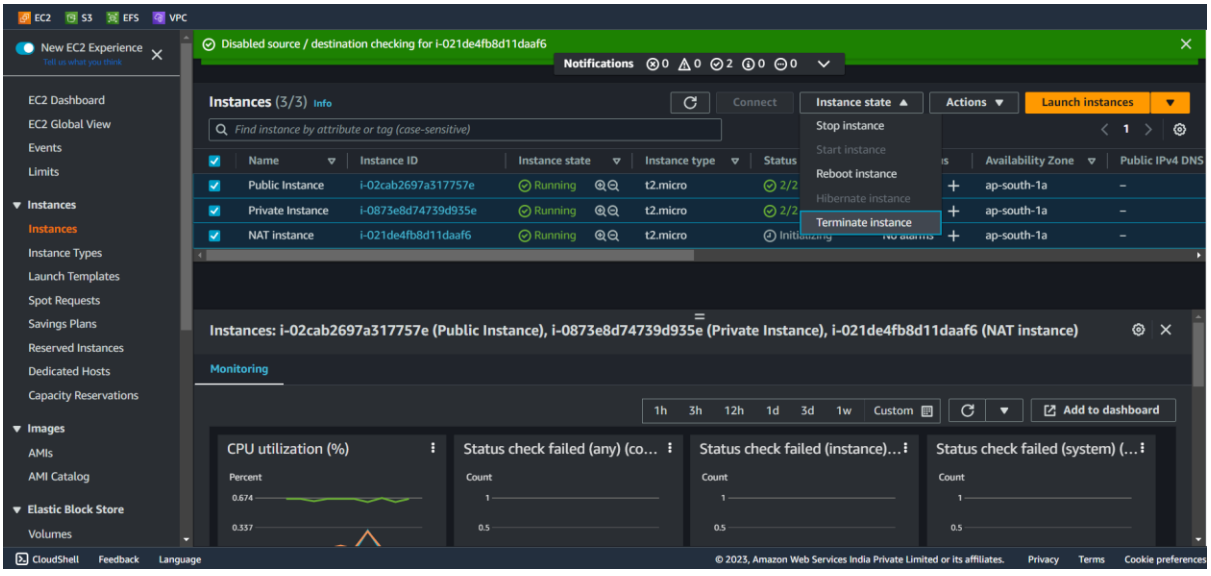

8. Now connect back to public instance and connect to private instance from /opt directory since it has private key file

9. Now try to ping google.com from private internet

```
ubuntu@ip-10-0-1-25:~$ cd /opt
ubuntu@ip-10-0-1-25:/opt$ ssh -i siri.pem ubuntu@10.0.2.171
Welcome to Ubuntu 22.04.2 LTS (GNU/Linux 5.19.0-1025-aws x86_64)

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

  System information as of Wed Jun 21 13:40:03 UTC 2023

  System load:  0.0               Processes:             96
  Usage of /:   20.8% of 7.57GB   Users logged in:       0
  Memory usage: 23%               IPv4 address for eth0: 10.0.2.171
  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


The list of available updates is more than a week old.
To check for new updates run: sudo apt update
Failed to connect to https://changelogs.ubuntu.com/meta-release-lts. Check your Internet connection or proxy settings


Last login: Wed Jun 21 10:29:04 2023 from 10.0.1.25
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-10-0-2-171:~$ ping google.com
PING google.com (172.217.166.78) 56(84) bytes of data.
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=1 ttl=50 time=1.75 ms
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=2 ttl=50 time=1.77 ms
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=3 ttl=50 time=1.85 ms
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=4 ttl=50 time=2.57 ms
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=5 ttl=50 time=2.03 ms
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=6 ttl=50 time=1.86 ms
64 bytes from bom05s15-in-f14.1e100.net (172.217.166.78): icmp_seq=7 ttl=50 time=1.78 ms
```

## Cleaning up workspace

1. Terminate all the EC2 instances



2. Delete the VPC so that all the components regarding the VPC will be deleted.