

# 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:**

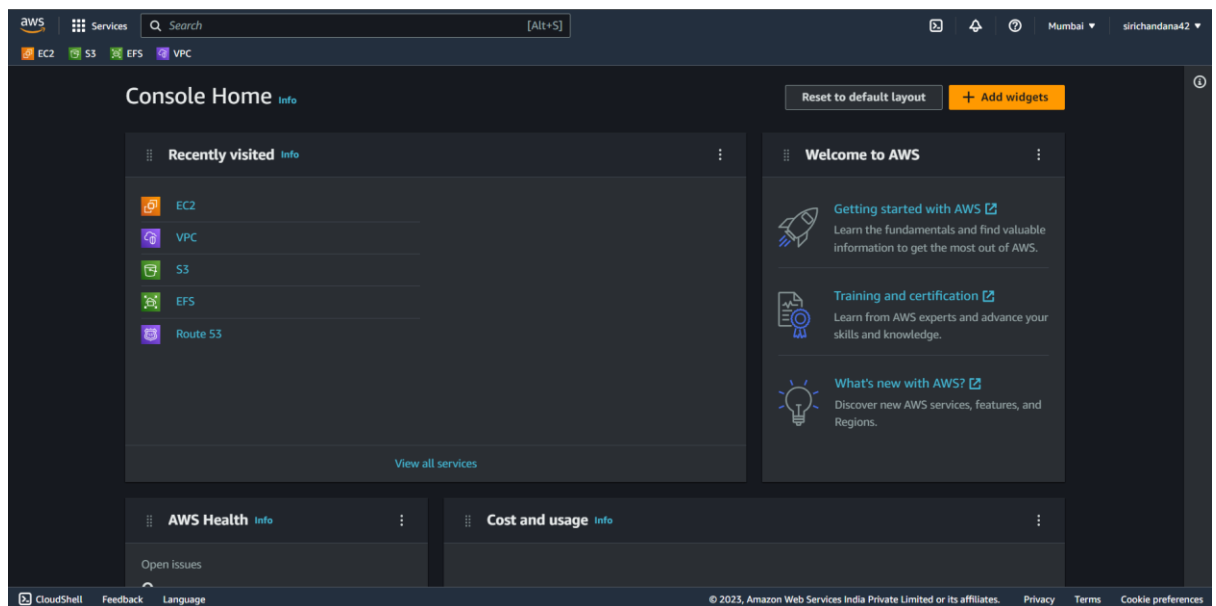
- A NAT Instance is a regular EC2 instance that is deployed in a public subnet And configured to perform NAT.
- Source and destination check should be disabled whenever we create an NAT using instance

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.

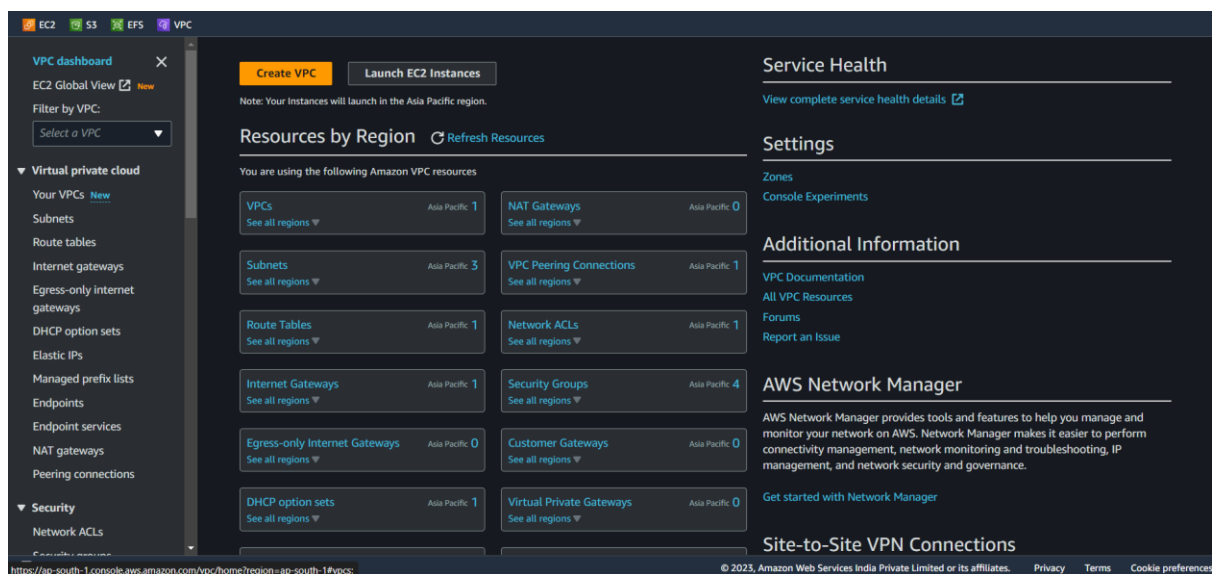
## **Network Access Control List**

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.

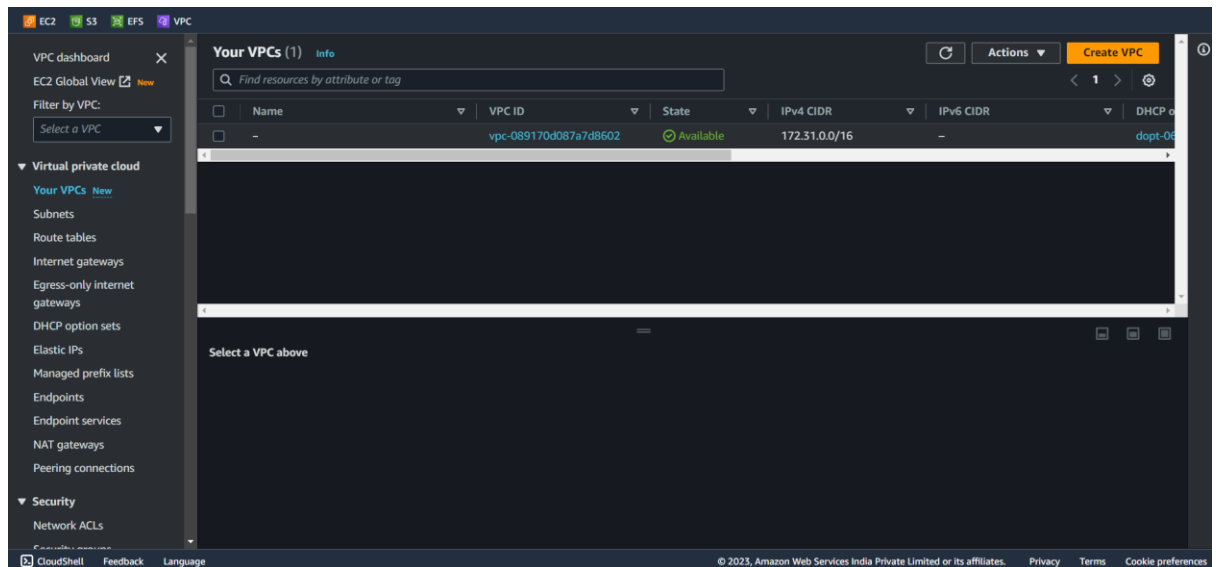
1. First Log in to your AWS free tier account and open your AWS management console and click on services and **select VPC**



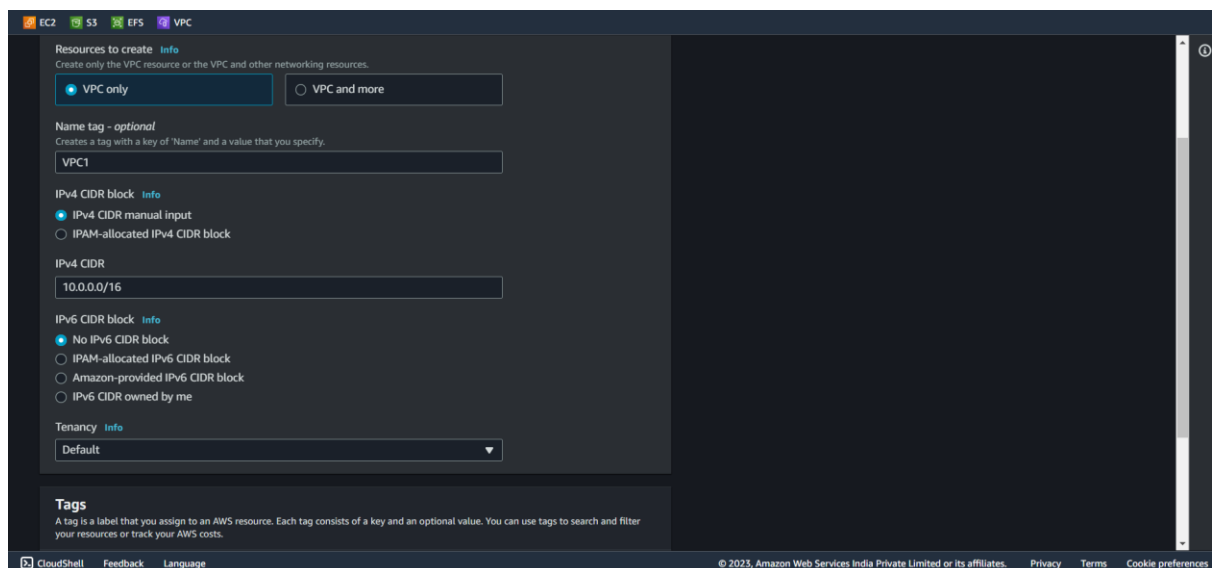
2. Now you will be redirected to VPC dashboard then click on your VPCs to **create a custom** virtual private cloud



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

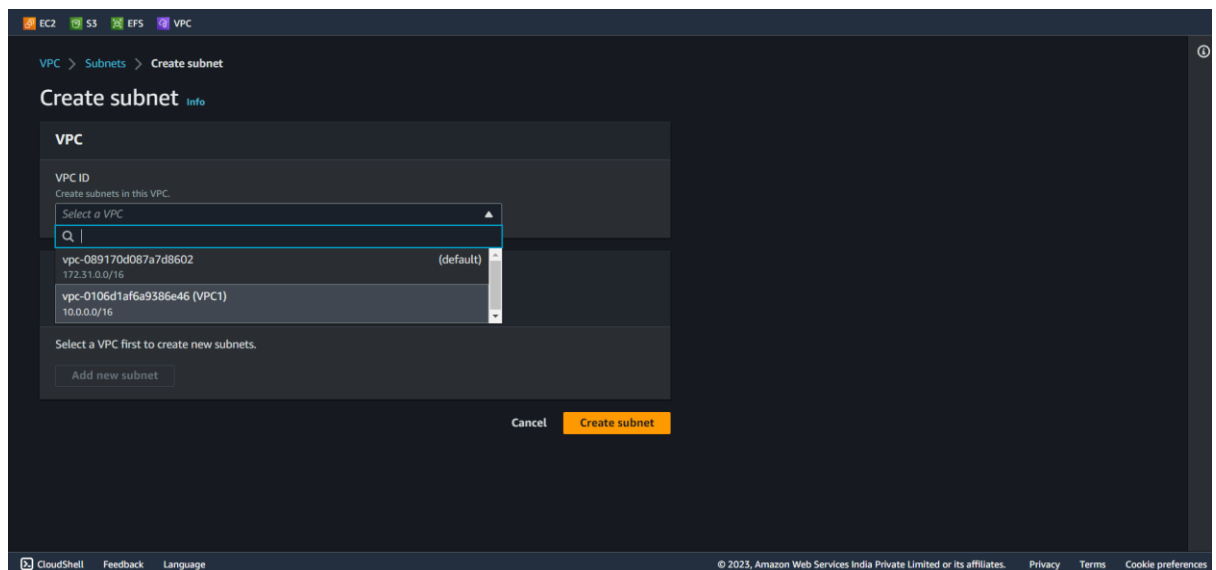


- Now set a **name** for your VPC and assign a **valid CIDR** and click on create VPC.

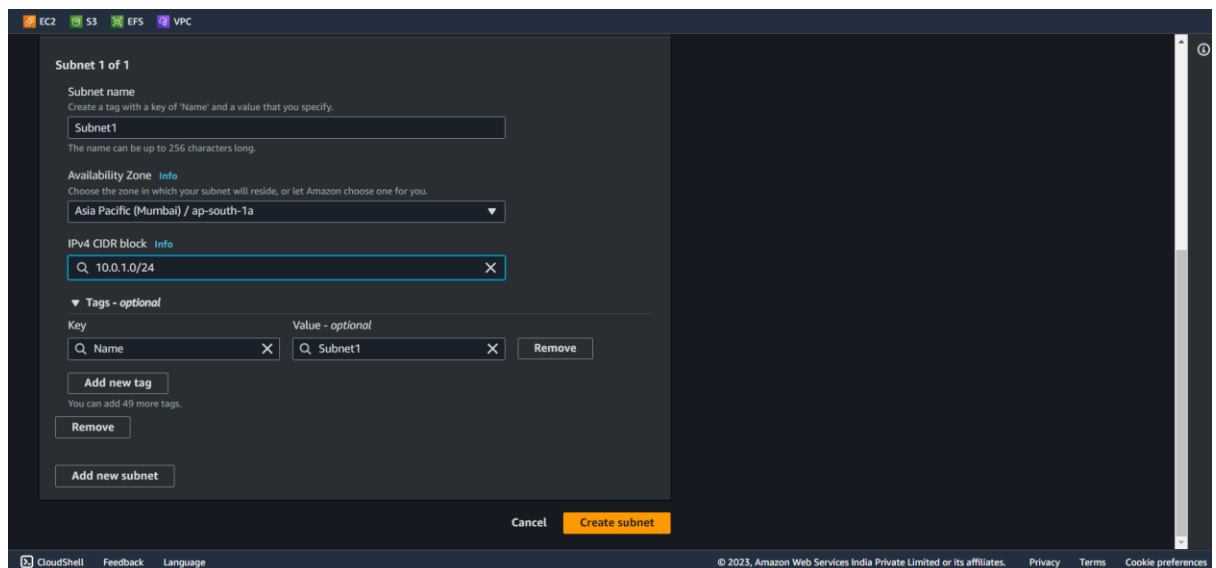


**Classless Inter-Domain Routing (CIDR)** notation is commonly used to represent subnets. It combines the network IP address and the subnet mask, represented as a slash followed by the number of network bits. For example, a subnet with a CIDR notation of /24 means that the first 24 bits of the IP address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



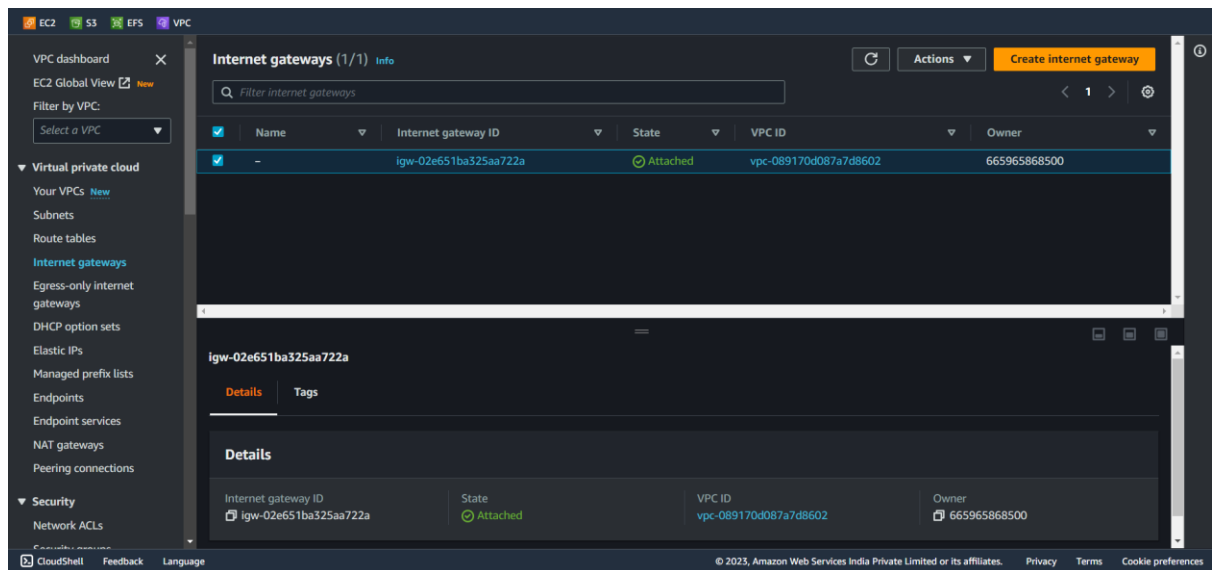
6. Give the subnet name. Select the availability zone in which we want to create a subnet, give the CIDR of the subnet within the CIDR of VPC.



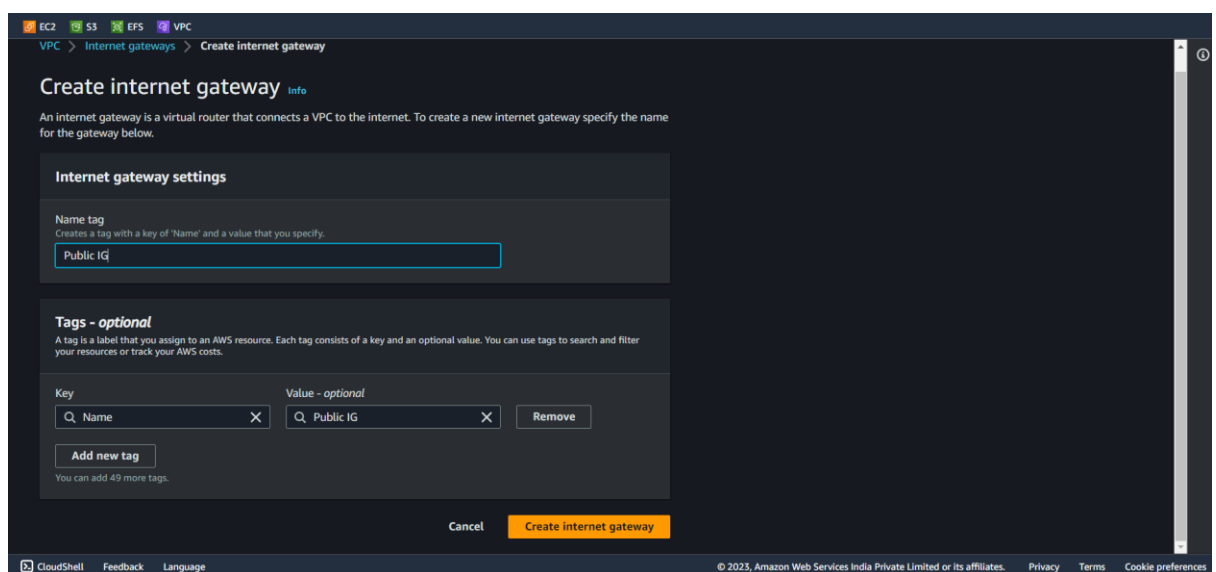
Similarly create another subnet with CIDR **10.0.2.0/24** so that 2 subnets will be created in same VPC.

Rename them as Public and private for your convenience.

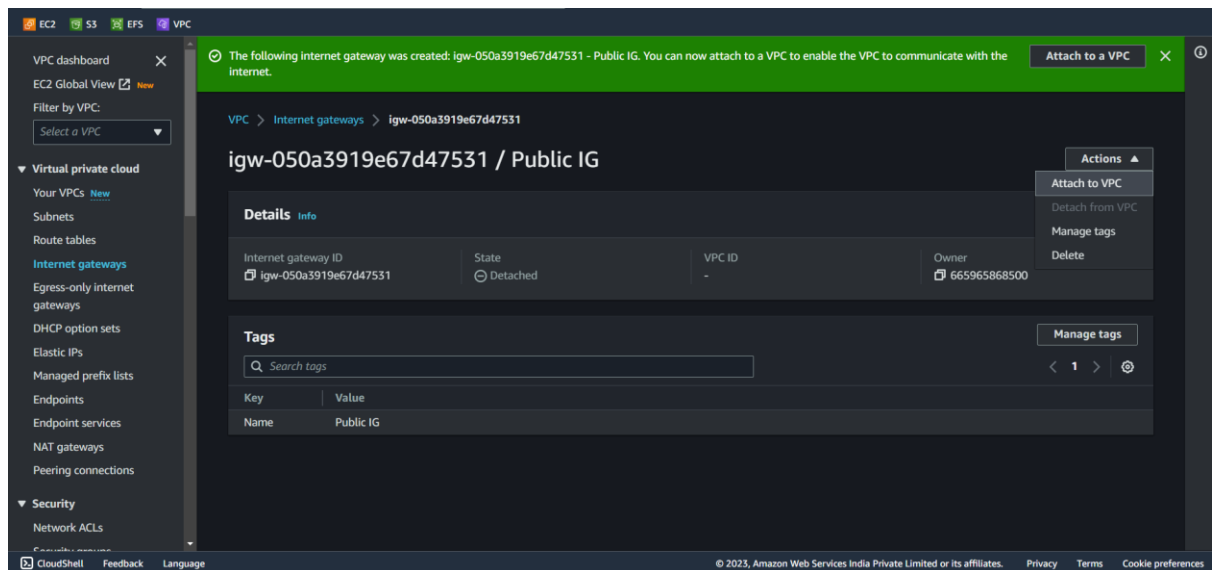
- Now for internet access for your public subnet create an **Internet gateway**. For that go to internet gateways and click on create Internet Gateway.



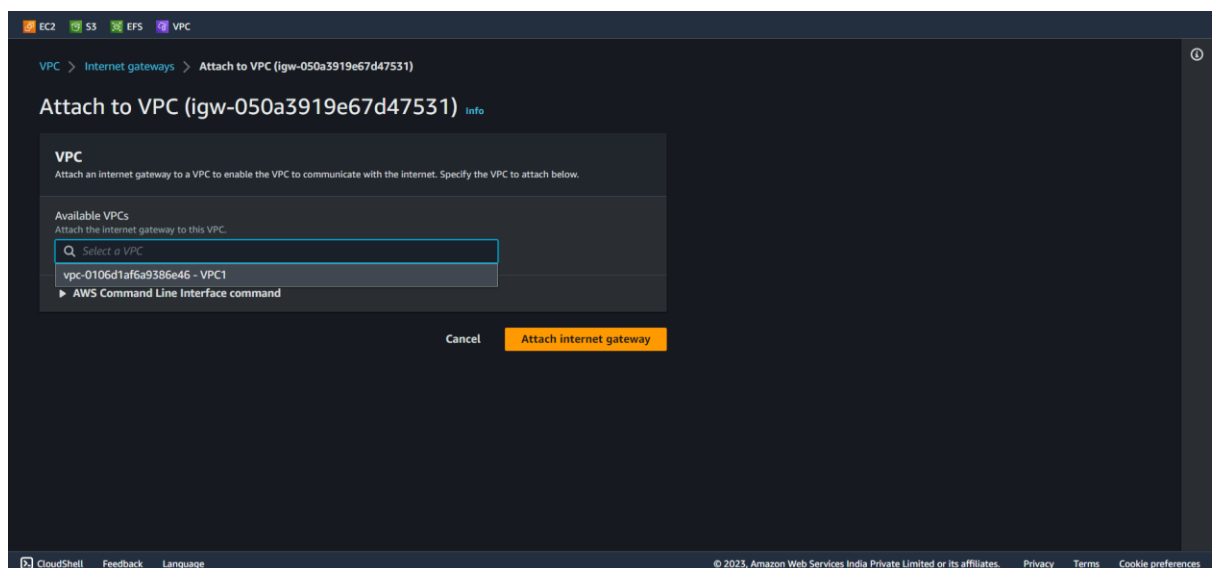
- Now name your Internet gateway and click on create gateway.



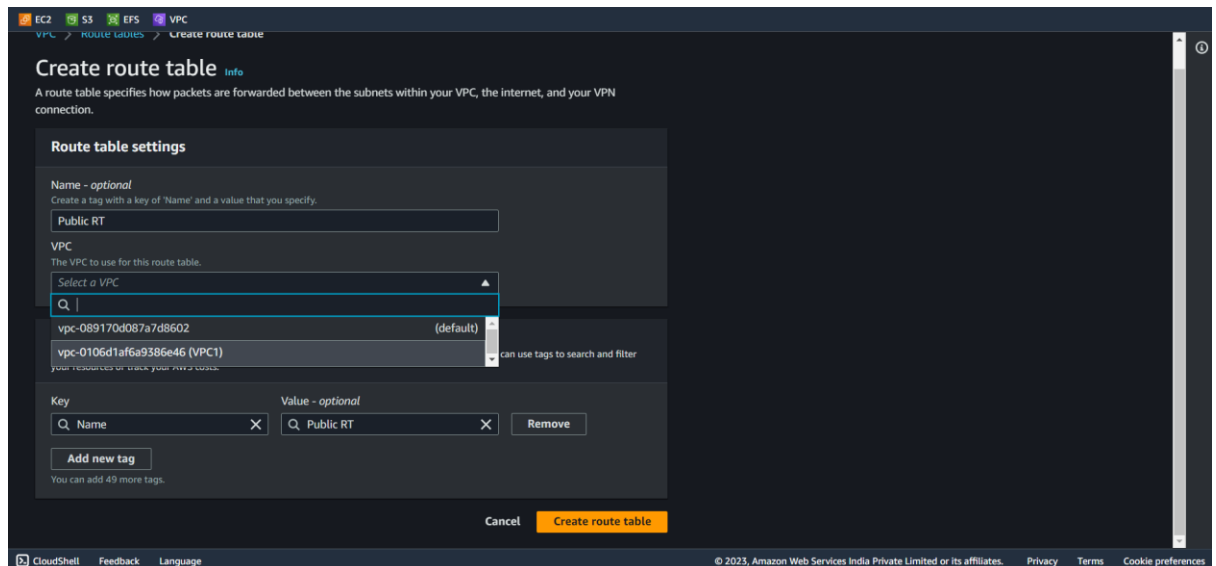
9. Now select the VPC and click on actions and click on attach to VPC to **attach the internet gateway** to the custom VPC.



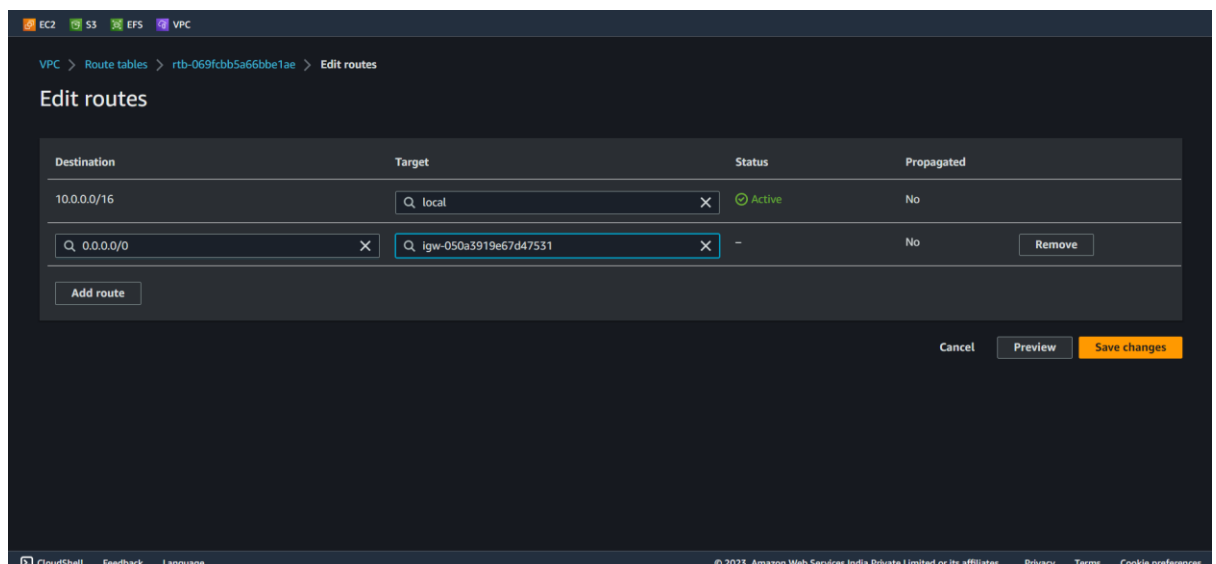
10. Now select the custom VPC from the available VPCs and attach the IG to the VPC



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.

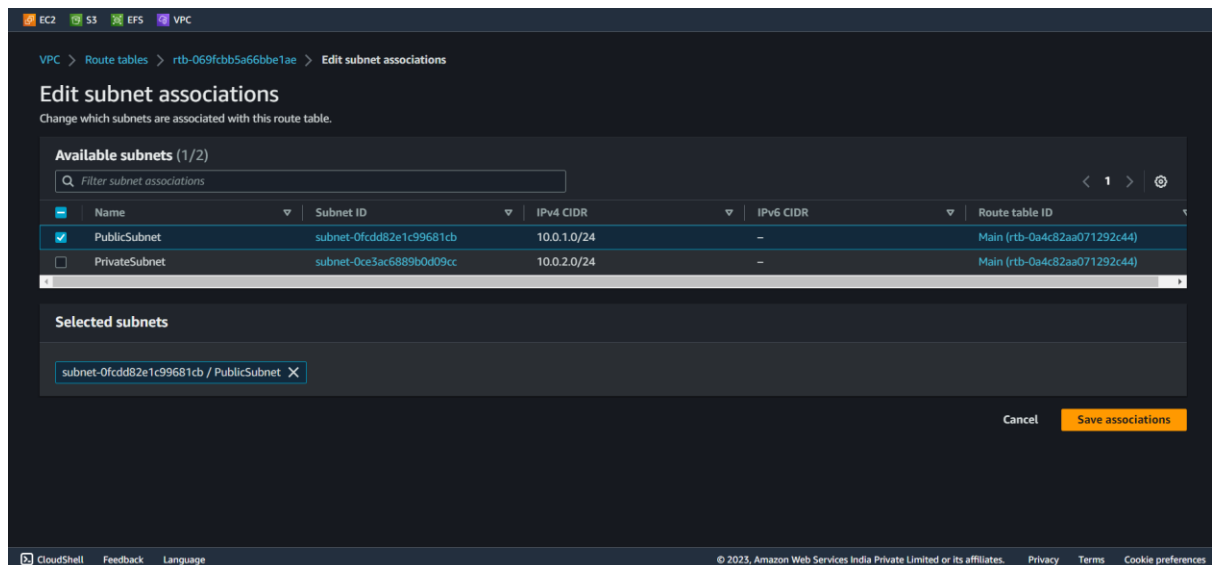
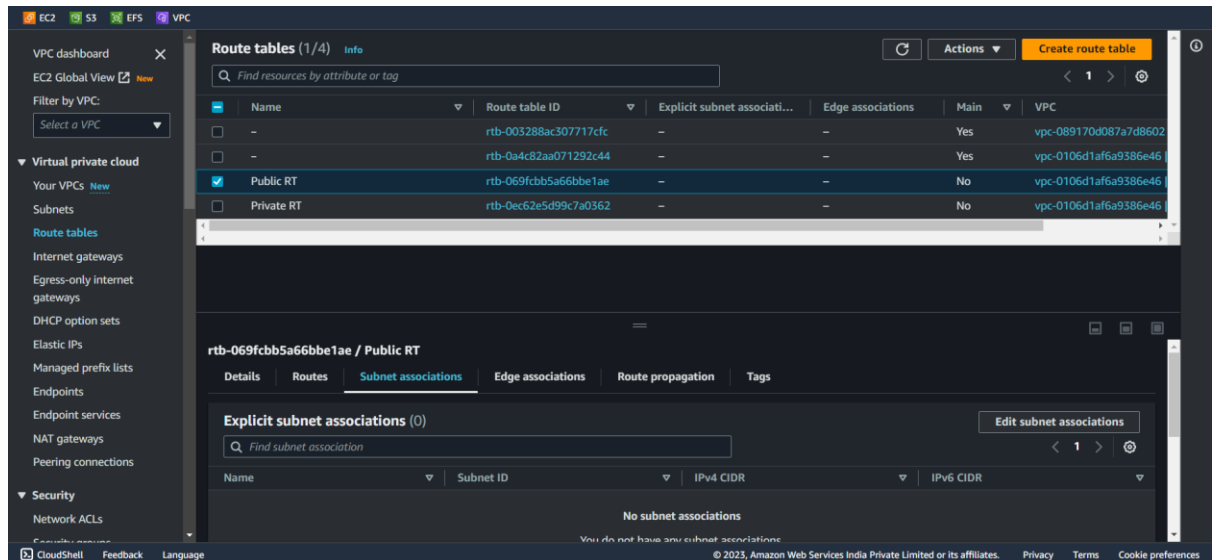


12. Now edit the route settings and add Internet gateway as a route to it and click on save changes.



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.

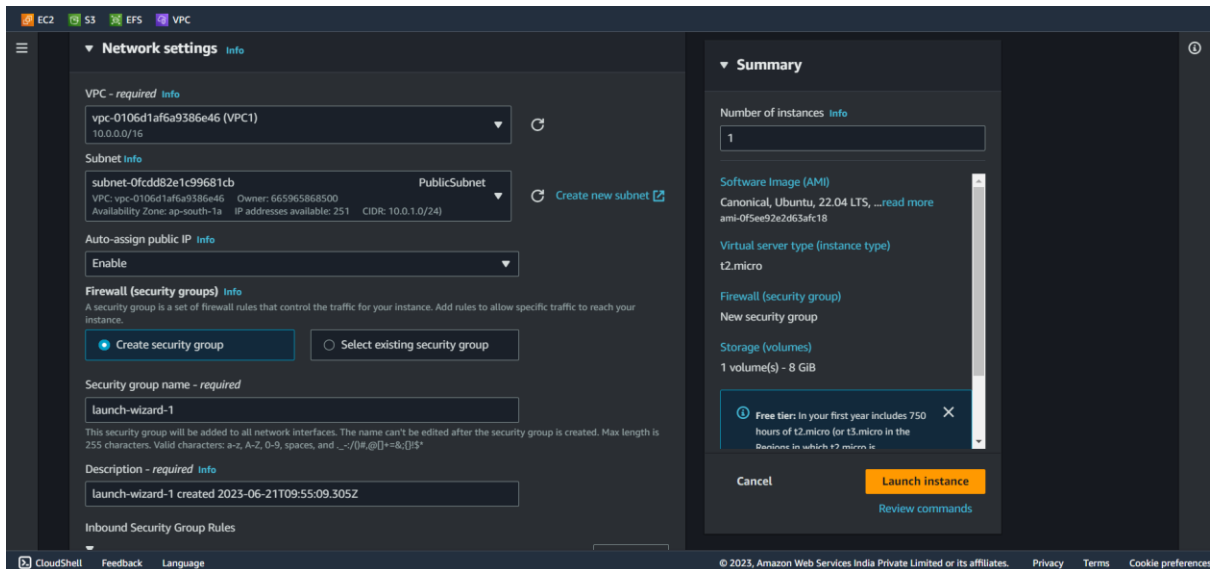


Now your VPC has been completely set up now create 2 instances in two different subnets in your custom VPC.

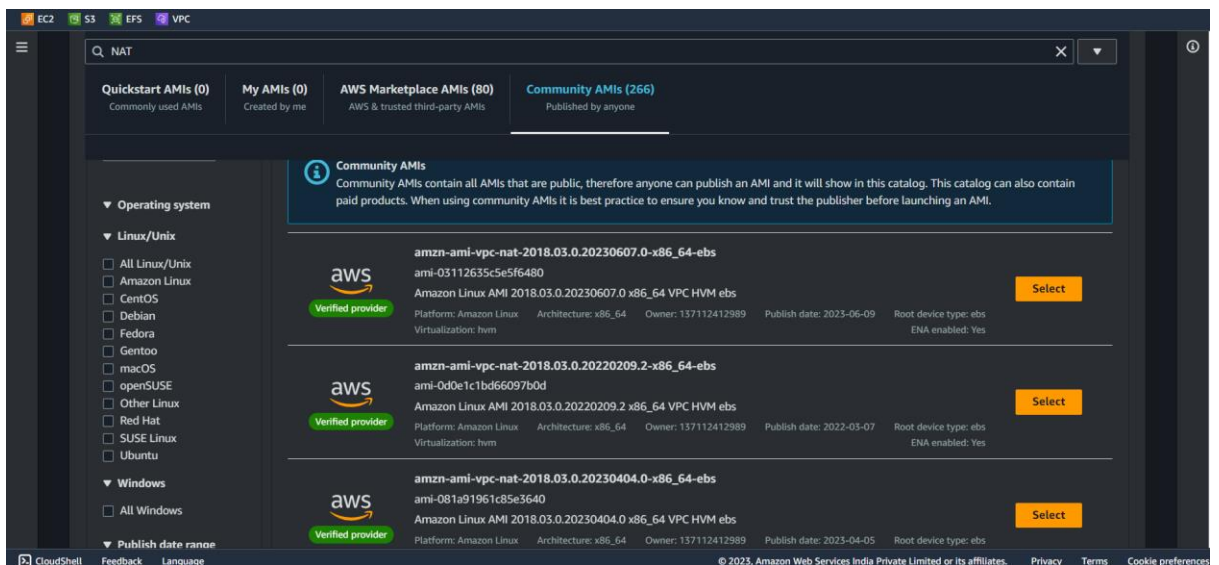


## Creating Instances in two different subnets

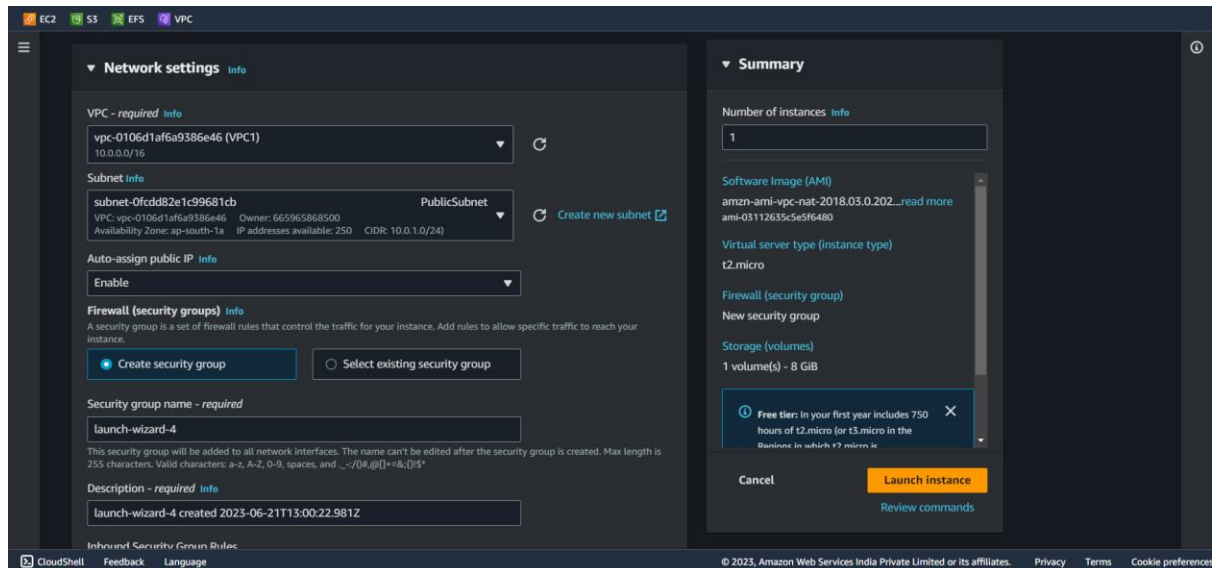
1. While creating ensure that your network settings are on Custom VPC and subnet in a public subnet for Public instance and enable **auto assign public IP** and Private Subnet for private instance.



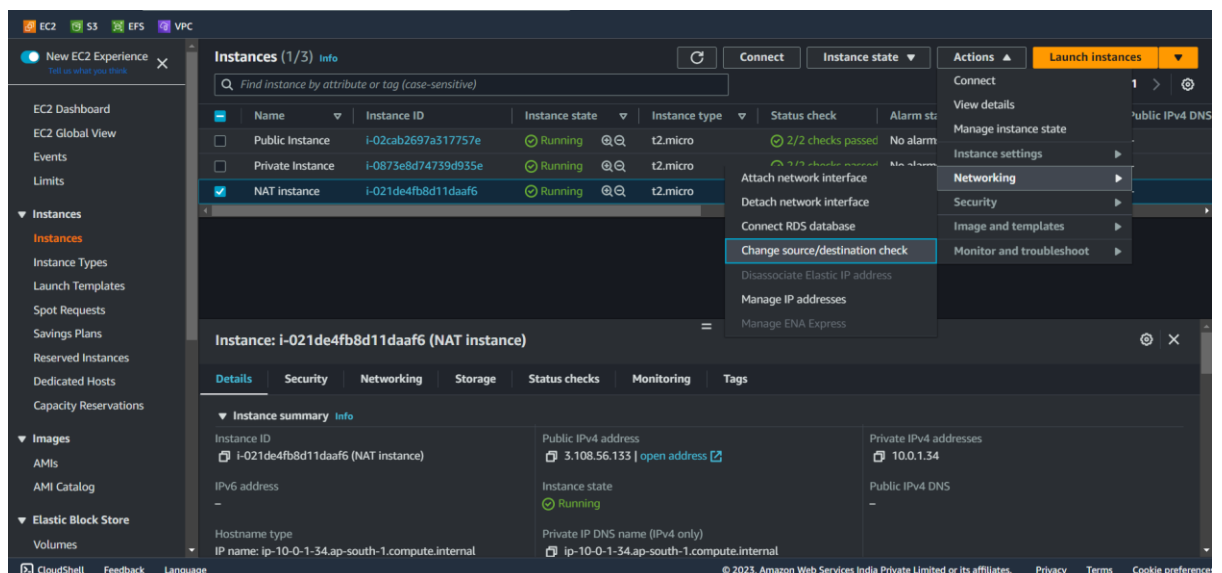
2. Create a NAT instance by selecting AMI containing NAT in the community AMIs



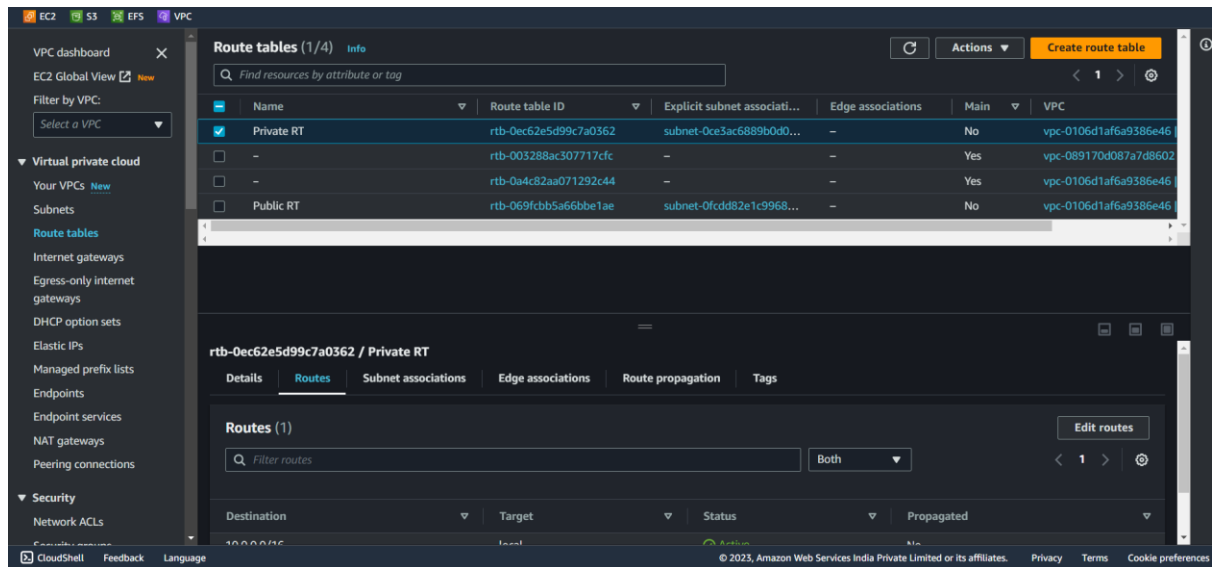
3. Since NAT requires internet connection to work it is placed in Public subnet



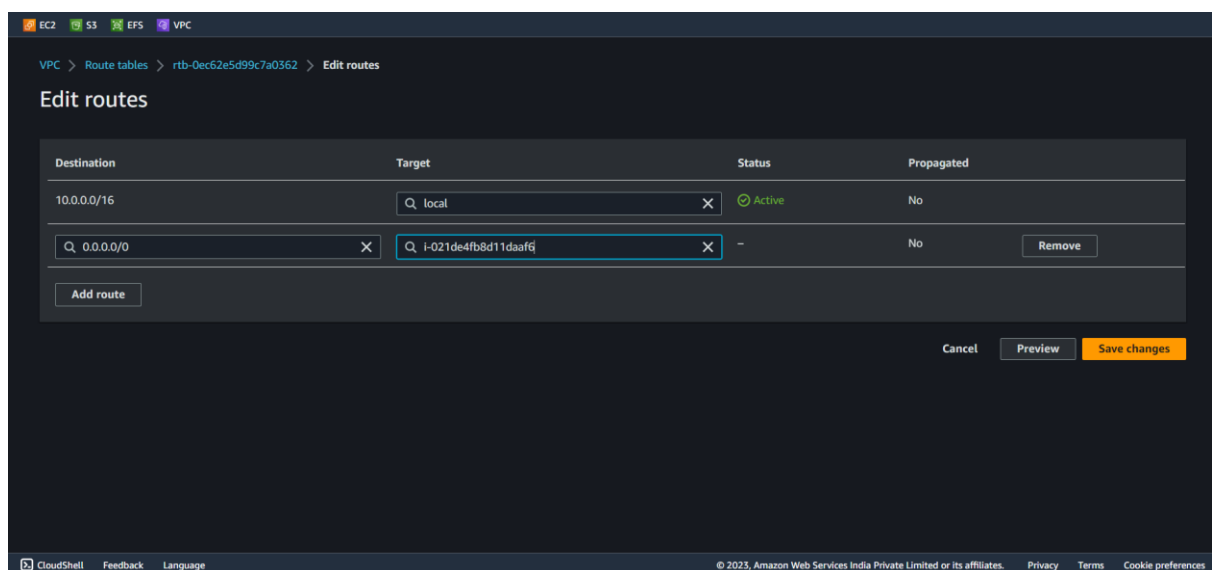
4. Now select the instance and stop the source and destination check for the NAT instance



- Now add NAT instance as a route in private routes



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



- Now firstly connect to public instance using GIT Bash using SSH

```
SIRI CHANDANA GUNTUR@DESKTOP-CRV2VQO MINGW64 ~/Desktop
$ chmod 400 siri.pem

SIRI CHANDANA GUNTUR@DESKTOP-CRV2VQO MINGW64 ~/Desktop
$ ssh -i siri.pem ubuntu@43.205.203.38
The authenticity of host '43.205.203.38 (43.205.203.38)' can't be established.
```

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

```
ubuntu@ip-10-0-1-25:~$ ping google.com
PING google.com (216.58.203.46) 56(84) bytes of data:
64 bytes from hkg12s10-in-f46.1e100.net (216.58.203.46): icmp_seq=1 ttl=51 time=1.64 ms
64 bytes from hkg12s10-in-f46.1e100.net (216.58.203.46): icmp_seq=2 ttl=51 time=1.68 ms
64 bytes from bom12s05-in-f14.1e100.net (216.58.203.46): icmp_seq=3 ttl=51 time=1.69 ms
64 bytes from hkg12s10-in-f14.1e100.net (216.58.203.46): icmp_seq=4 ttl=51 time=1.66 ms
64 bytes from hkg12s10-in-f14.1e100.net (216.58.203.46): icmp_seq=5 ttl=51 time=1.69 ms
```

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

```
ubuntu@ip-10-0-1-25:~$ sudo su
root@ip-10-0-1-25:/home/ubuntu# chmod 777 /opt
root@ip-10-0-1-25:/home/ubuntu# exit
exit
ubuntu@ip-10-0-1-25:~$ exit
logout
Connection to 43.205.203.38 closed.

SIRI CHANDANA GUNTUR@DESKTOP-CRV2VQO MINGW64 ~/Desktop
$ scp -i siri.pem ./siri.pem ubuntu@43.205.203.38:/opt
siri.pem
```

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

```
ubuntu@ip-10-0-1-25:~$ cd /
ubuntu@ip-10-0-1-25:/ $ ls
bin boot dev etc home lib lib32 lib64 libx32 lost+found media mnt opt proc root run sbin snap srv sys tmp usr var
ubuntu@ip-10-0-1-25:/ $ cd opt
ubuntu@ip-10-0-1-25:/opt$ ls
siri.pem
ubuntu@ip-10-0-1-25:/opt$ chmod 400 siri.pem
ubuntu@ip-10-0-1-25:/opt$ ssh -i siri.pem ubuntu@10.0.2.171
The authenticity of host '10.0.2.171 (10.0.2.171)' can't be established.
```

## 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

The screenshot shows the AWS Management Console for EC2 instances. The left sidebar contains navigation links for EC2 Dashboard, EC2 Global View, Events, Limits, Instances, Instance Types, Launch Templates, Spot Requests, Savings Plans, Reserved Instances, Dedicated Hosts, Capacity Reservations, Images, AMIs, AMI Catalog, Elastic Block Store, and Volumes. The main content area displays the 'Instances' table with 3 instances. The 'Actions' dropdown menu is open, showing options like Stop, Reboot, Hibernate, and Terminate. The 'Terminate' option is highlighted. Below the table, there is a 'Monitoring' section with various charts and status checks.

Name	Instance ID	Instance state	Instance type	Status	Availability Zone	Public IPv4 DNS
Public Instance	i-02cab2697a317757e	Running	t2.micro	2/2	ap-south-1a	-
Private Instance	i-0873e8d74739d935e	Running	t2.micro	2/2	ap-south-1a	-
NAT Instance	i-021de4fb8d11daaf6	Running	t2.micro	2/2	ap-south-1a	-

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

The screenshot shows the AWS Management Console interface for the VPC console. On the left, there is a navigation menu with categories like Virtual private cloud, Security, and DNS firewall. The main area displays 'Your VPCs (1/2)' with a table listing VPCs. The first VPC, 'VPC1', is selected. An 'Actions' dropdown menu is open, showing options like 'Create default VPC', 'Create flow log', 'Edit VPC settings', 'Edit CIDRs', 'Manage middlebox routes', 'Manage tags', and 'Delete VPC'. Below the table, the details for 'vpc-0106d1af6a9386e46 / VPC1' are shown, including tabs for Details, Resource map, CIDRs, Flow logs, and Tags. The 'Details' tab is active, showing a grid of information: VPC ID, State (Available), DNS hostnames (Disabled), DNS resolution (Enabled), Tenancy (Default), DHCP option set, Main route table, and Main network ACL.

Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR
-	vpc-089170d087a7d8602	Available	172.31.0.0/16	-
VPC1	vpc-0106d1af6a9386e46	Available	10.0.0.0/16	-

vpc-0106d1af6a9386e46 / VPC1			
Details			
VPC ID	State	DNS hostnames	DNS resolution
vpc-0106d1af6a9386e46	Available	Disabled	Enabled
Tenancy	DHCP option set	Main route table	Main network ACL
Default	dopt-063aeb521863b07af	rtb-0a4c82aa071292c44	acl-0e661984532f26c33