

# Experiment 04 - Cloud Computing

December 14, 2022

## Aim

To understand networking components (VPC, Internet Gateway, Subnet and Route Tables) in AWS Cloud and implement Peering connection between VPC of two different regions.

## Theory

- **VPC** : A virtual private cloud is an on-demand configurable pool of shared resources allocated within a public cloud environment, providing a certain level of isolation between the different organizations using the resources.
- **Subnet** : A subnetwork or subnet is a logical subdivision of an IP network. The practice of dividing a network into two or more networks is called subnetting.
- **Route Table** : A routing table, or routing information base, is a data table stored in a router or a network host that lists the routes to particular network destinations, and in some cases, metrics associated with those routes.
- **Internet Gateway** : An internet gateway is a horizontally scaled, redundant, and highly available VPC component that allows communication between your VPC and the internet. It supports IPv4 and IPv6 traffic. It does not cause availability risks or bandwidth constraints on your network traffic.
- **VPC Peering** : A VPC peering connection is a networking connection between two VPCs that enables you to route traffic between them using private IPv4 addresses or IPv6 addresses. Instances in either VPC can communicate with each other as if they are within the same network. The VPCs can be in different Regions (also known as an inter-Region VPC peering connection).

## Results

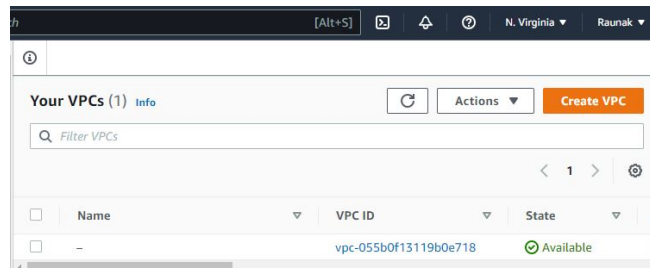


Figure 1: Start by creating a VPC in VPC section of AWS

**VPC settings**

Resources to create [Info](#)  
 Create only the VPC resource or the VPC and other networking resources.

☒ VPC only ☐ VPC and more

Name tag - *optional*  
 Creates a tag with a key of 'Name' and a value that you specify.

genericVPC

IPv4 CIDR block [Info](#)  
☒ IPv4 CIDR manual input ☐ IPAM-allocated IPv4 CIDR block

IPv4 CIDR  
 10.0.0.0/16

IPv6 CIDR block [Info](#)  
☒ No IPv6 CIDR block ☐ IPAM-allocated IPv6 CIDR block  
☐ Amazon-provided IPv6 CIDR block ☐ IPv6 CIDR owned by me

Tenancy [Info](#)  
 Default

Figure 2: Name the VPC and select the CIDR as 10.0.0.0/16

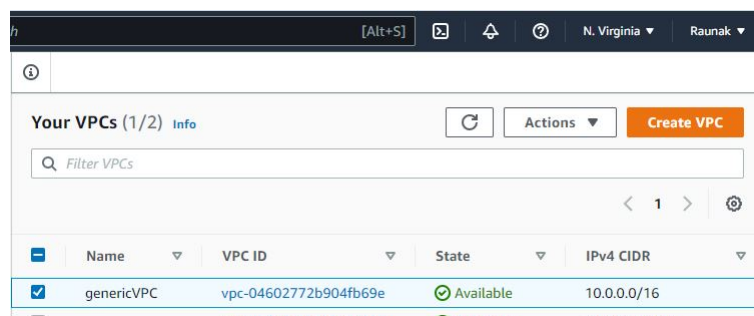


Figure 3: Successful creation of VPC under the name of genericVPC



Figure 4: Select the create subnet option from Subnets situated in VPC section

**VPC**

VPC ID  
Create subnets in this VPC.  
vpc-04602772b904fb69e (genericVPC)

**Associated VPC CIDRs**

IPv4 CIDRs  
10.0.0.0/16

---

**Subnet settings**  
Specify the CIDR blocks and Availability Zone for the subnet.

**Subnet 1 of 1**

Subnet name  
Create a tag with a key of 'Name' and a value that you specify.  
my-subnet-01  
The name can be up to 256 characters long.

Availability Zone [Info](#)  
Choose the zone in which your subnet will reside, or let Amazon choose one for you.  
No preference

IPv4 CIDR block [Info](#)  
10.0.0.0/24

▼ Tags - optional  
No tags associated with the resource.

Figure 5: Select the created VPC and give CIDR block as 10.0.0.0/24

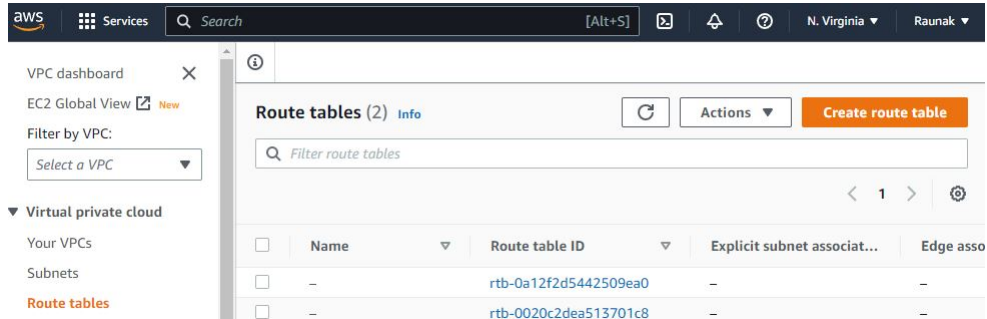


Figure 6: Go to Route Tables section from VPC main section and create a route table

## Create route table [Info](#)

A route table specifies how packets are forwarded between the subnets within your VPC, the internet, and your VPN connection.

### Route table settings

**Name - optional**  
Create a tag with a key of 'Name' and a value that you specify.

**VPC**  
The VPC to use for this route table.

Figure 7: Name the route table and select the VPC that was created

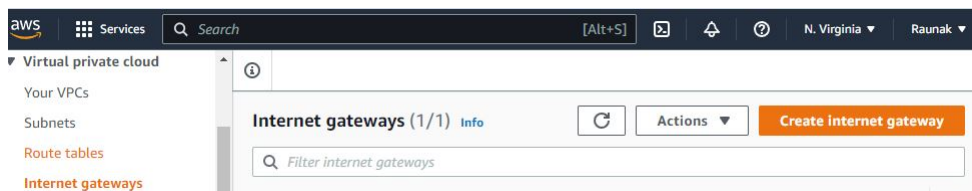


Figure 8: Create an Internet Gateway from section of internet gateway under the VPC main section

### Create internet gateway Info

An internet gateway is a virtual router that connects a VPC to the internet. To create a new internet gateway specify the name for the gateway below.

**Internet gateway settings**

Name tag  
Creates a tag with a key of 'Name' and a value that you specify.

Figure 9: Name the internet gateway whatever you wish

**Internet gateways (1/2) Info**
↻
Actions ▴
Create internet gateway

	Name	Internet gateway ID	State	VPC
<input type="checkbox"/>	-	igw-03cc0945b98ff3a1b	Attached	vpc-
<input checked="" type="checkbox"/>	genericInternetGateway	igw-048b6651e6a6faca4	Detached	-

View details  
**Attach to VPC**  
Detach from VPC  
Manage tags  
Delete internet gateway

Figure 10: Attach the created internet gateway to VPC

### Attach to VPC (igw-048b6651e6a6faca4) Info

**VPC**  
Attach an internet gateway to a VPC to enable the VPC to communicate with the internet. Specify the VPC to attach below.

Available VPCs  
Attach the internet gateway to this VPC.

vpc-04602772b904fb69e - genericVPC

► AWS Command Line Interface command

Cancel
Attach internet gateway

Figure 11: Select the genericVPC which was created earlier and attach for completing the process

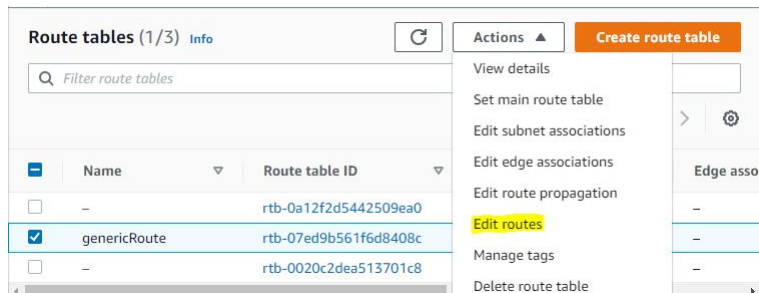


Figure 12: Edit the created route from route table section

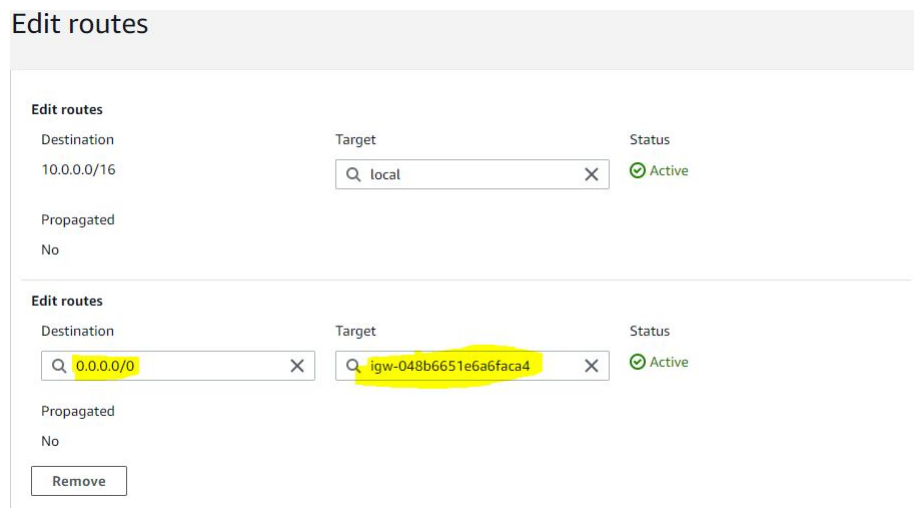


Figure 13: Add the internet gateway that was created after attaching to VPC

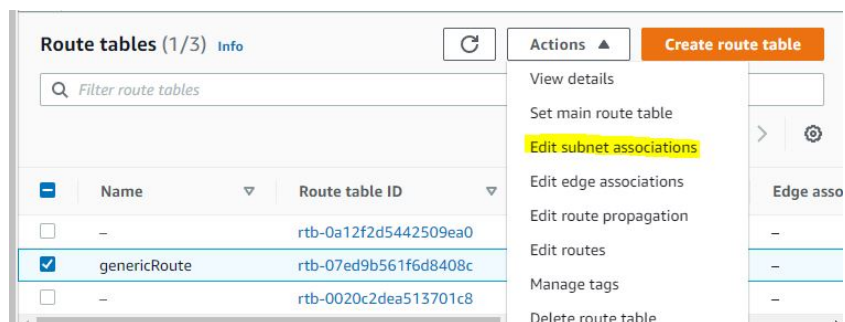


Figure 14: Edit the subnet associations of the created route

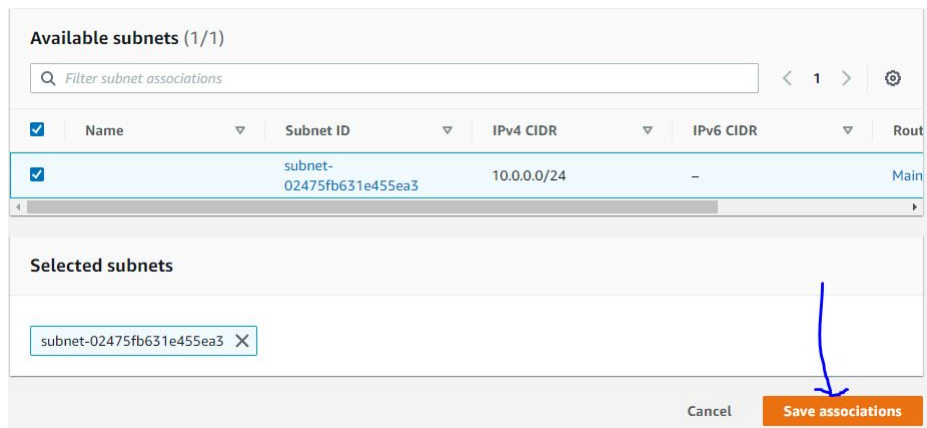


Figure 15: After selecting the created subnet save the association

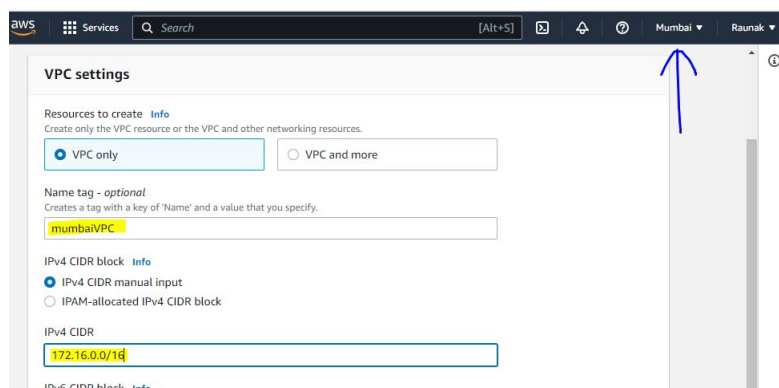


Figure 16: Create another VPC in different region and name it along with CIDR of 172.16.0.0/16 . The region that I used for this experiment is Mumbai Asia

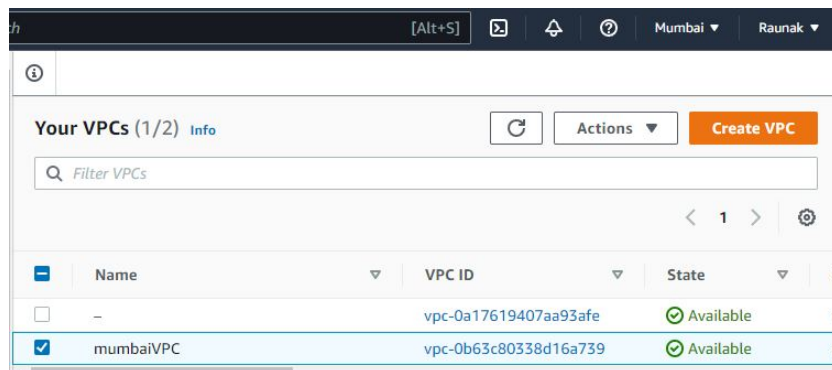


Figure 17: Successful creation of VPC in another region

**VPC**

VPC ID  
Create subnets in this VPC:  
vpc-0b63c80338d16a739 (mumbaiVPC)

Associated VPC CIDRs  
IPv4 CIDRs  
172.16.0.0/16

---

**Subnet settings**  
Specify the CIDR blocks and Availability Zone for the subnet.

**Subnet 1 of 1**

Subnet name  
Create a tag with a key of 'Name' and a value that you specify.  
mumbaiSubnet  
The name can be up to 256 characters long.

Availability Zone [Info](#)  
Choose the zone in which your subnet will reside, or let Amazon choose one for you.  
No preference

IPv4 CIDR block [Info](#)  
172.16.0.0/24

Tags - optional

Figure 18: Create a subnet similarly for another region VPC and give the CIDR block as 172.16.0.0/24. The selected VPC should be VPC from same region as Mumbai is for my experiment

**Create internet gateway** [Info](#)

An internet gateway is a virtual router that connects a VPC to the internet. To create a new internet gateway specify the name for the gateway below.

**Internet gateway settings**

Name tag  
Creates a tag with a key of 'Name' and a value that you specify.  
mumbaiInternetGateway

**Tags - optional**  
A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key	Value - optional	
Name	mumbaiInternetGateway	Remove

[Add new tag](#)  
You can add 49 more tags.

[Cancel](#) [Create internet gateway](#)

Figure 19: Create an internet gateway similarly in respective region



**Attach to VPC (igw-0c3b3e48619b7acfd)** [Info](#)

**VPC**  
Attach an internet gateway to a VPC to enable the VPC to communicate with the internet. Specify the VPC to attach below.

Available VPCs  
Attach the internet gateway to this VPC.

► AWS Command Line Interface command

Cancel **Attach internet gateway**

Figure 20: Attach the internet gateway to VPC created in same region

**Route table settings**

**Name - optional**  
Create a tag with a key of 'Name' and a value that you specify.

**VPC**  
The VPC to use for this route table.

Figure 21: Route the table with its creation and attaching to respective region VPC

**Edit routes**

Destination	Target	Status
<input type="text" value="0.0.0.0/0"/>	<input type="text" value="igw-0c3b3e48619b7acfd"/>	-

Propagated  
No

Cancel  **Save changes**

Figure 22: Add the internet gateway to designation route table of respective region

### Edit subnet associations

Change which subnets are associated with this route table.

**Available subnets (1/1)**

<input checked="" type="checkbox"/>	Name	Subnet ID	IPv4 CIDR	IPv6 CIDR	Route
<input checked="" type="checkbox"/>	mumbaiSubnet	subnet-089a8402d99fd2cc4	172.16.0.0/24	-	Main

**Selected subnets**

subnet-089a8402d99fd2cc4 / mumbaiSubnet
 ✕

Cancel
Save associations

Figure 23: Associate the respective region subnet for the route table

Services

Search

[Alt+S]

N. Virginia

Raunak

**Name and tags**

Add additional tags

Figure 24: Create an Instance in first region

**Network settings**

**VPC - required**

**Subnet**

Create new subnet

**Auto-assign public IP**

Figure 25: Select the VPC and subnet created earlier in Network settings. Also enable the auto-assign public IP

**Inbound security groups rules**

▼ Security group rule 1 (TCP, 22, 0.0.0.0/0) Remove

Type <a href="#">Info</a>	Protocol <a href="#">Info</a>	Port range <a href="#">Info</a>
ssh	TCP	22
Source type <a href="#">Info</a>	Source <a href="#">Info</a>	Description - optional <a href="#">Info</a>
Anywhere	<input type="text" value="0.0.0.0/0"/> <input type="button" value="X"/>	e.g. SSH for admin desktop

▼ Security group rule 2 (TCP, 3389, 0.0.0.0/0) Remove

Type <a href="#">Info</a>	Protocol <a href="#">Info</a>	Port range <a href="#">Info</a>
rdp	TCP	3389
Source type <a href="#">Info</a>	Source <a href="#">Info</a>	Description - optional <a href="#">Info</a>
Anywhere	<input type="text" value="0.0.0.0/0"/> <input type="button" value="X"/>	e.g. SSH for admin desktop

▼ Security group rule 3 (ICMP, All, 0.0.0.0/0) Remove

Type <a href="#">Info</a>	Protocol <a href="#">Info</a>	Port range <a href="#">Info</a>
All ICMP - IPv4	ICMP	All
Source type <a href="#">Info</a>	Source <a href="#">Info</a>	Description - optional <a href="#">Info</a>
Anywhere	<input type="text" value="0.0.0.0/0"/> <input type="button" value="X"/>	e.g. SSH for admin desktop

Figure 26: Add security groups for SSH, RDP, ICMP with *Anywhere* as a source type

Services  [Alt+S] Mumbai ▼ Raunak ▼

**Name and tags** [Info](#)

Name

genericInstanceMumbai Add additional tags

Figure 27: Create one more instance in new region where another VPC was created

▼ **Network settings** [Info](#)

VPC - *required* [Info](#)

vpc-0b63c80338d16a739 (mumbaiVPC) 172.16.0.0/16

Subnet [Info](#)

subnet-089a8402d99fd2cc4 mumbaiSubnet  
 VPC: vpc-0b63c80338d16a739 Owner: 303164066091 Availability Zone: ap-south-1a  
 IP addresses available: 251 CIDR: 172.16.0.0/24

Auto-assign public IP [Info](#)

Enable

Figure 28: Provide the network settings with created region VPC and subnet along with enabling the auto-assign public IP feature

**Inbound security groups rules**

▼ Security group rule 1 (TCP, 22, 0.0.0.0/0) [Remove](#)

Type [Info](#) Protocol [Info](#) Port range [Info](#)

ssh TCP 22

Source type [Info](#) Source [Info](#) Description - optional [Info](#)

Anywhere Add CIDR, prefix list or security 0.0.0.0/0 X e.g. SSH for admin desktop

▼ Security group rule 2 (TCP, 3389, 0.0.0.0/0) [Remove](#)

Type [Info](#) Protocol [Info](#) Port range [Info](#)

rdp TCP 3389

Source type [Info](#) Source [Info](#) Description - optional [Info](#)

Anywhere Add CIDR, prefix list or security 0.0.0.0/0 X e.g. SSH for admin desktop

▼ Security group rule 3 (ICMP, All, 0.0.0.0/0) [Remove](#)

Type [Info](#) Protocol [Info](#) Port range [Info](#)

All ICMP All

Source type [Info](#) Source [Info](#) Description - optional [Info](#)

Anywhere Add CIDR, prefix list or security 0.0.0.0/0 X e.g. SSH for admin desktop

Figure 29: Provide the security groups for SSH, RDP and ICMP with *Anywhere* as the source type

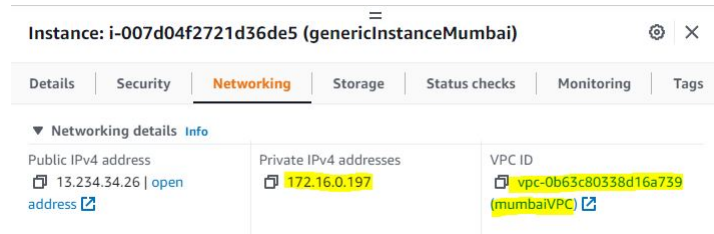


Figure 30: Copy the private IP and VPC ID for the instance

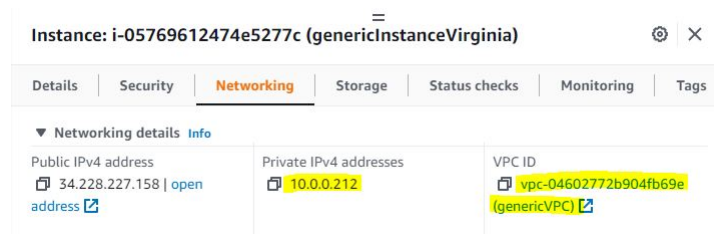


Figure 31: Copy the private IP and VPC ID for the instance of other region too

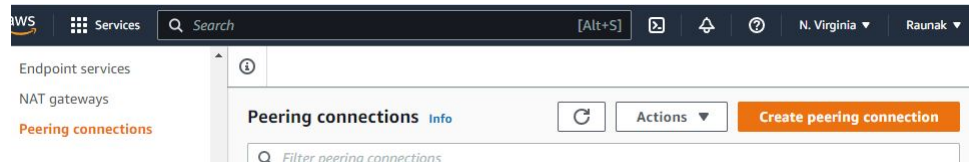


Figure 32: Select peering connections service and create a peering connection

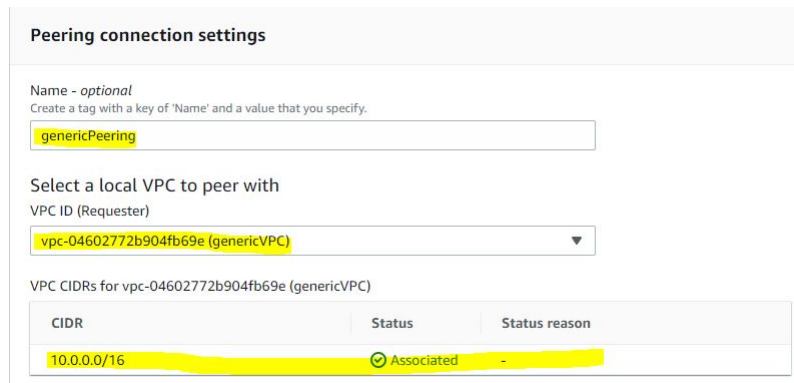


Figure 33: Mention the name of peering along with the VPC ID of the region in which the peering connection is made. In my case the copied Virginia VPC ID will be pasted because the peering connection is being made in Virginia itself

Region

☐ This Region (us-east-1)

☒ Another Region

Asia Pacific (Mumbai) (ap-south-1) ▼

VPC ID (Accepter)

vpc-0b63c80338d16a739

**Tags**

A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

Key Value - optional

Q Name X Q genericPeering X Remove

Add new tag

You can add 49 more tags.

Cancel Create peering connection

Figure 34: Mention the copied VPC of other region. In this example I created peering in Virginia and connecting it to Mumbai. So use the VPC ID of Mumbai region Instance

ch [Alt+S] Mumbai Raunak

Peering connections (1/1) Info

Filter peering connections

Actions

- View details
- Accept request
- Reject request
- Edit DNS settings
- Manage tags
- Delete peering connection

Create peering connection

< 1 > ⚙

Name	Peering connection ID	Requester VPC
-	pcx-0eef857727554b524	pc-04602772b904fb69e

Figure 35: Head to another region and accept the peering connection request

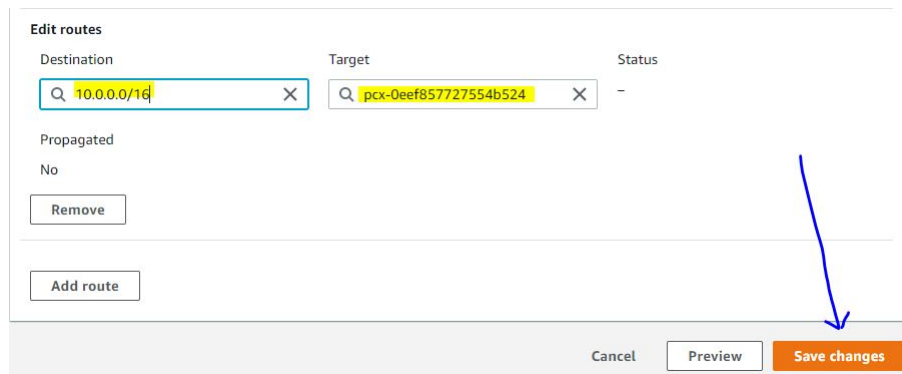


Figure 36: Edit the routes for peering connection in route table of respective region

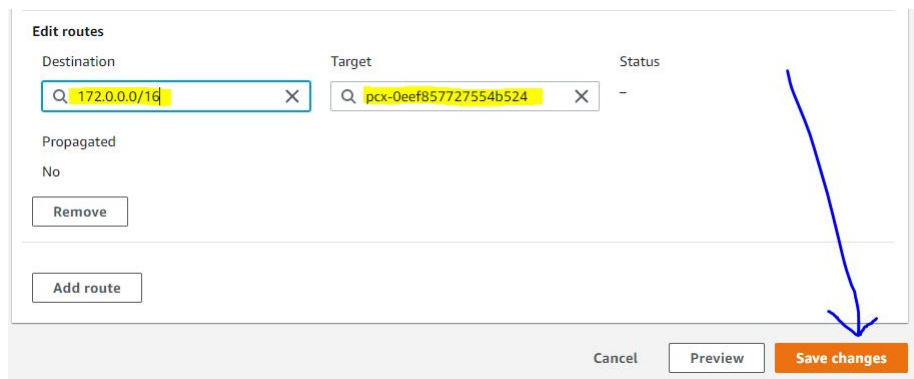


Figure 37: Edit the routes for peering connection in route table of respective region

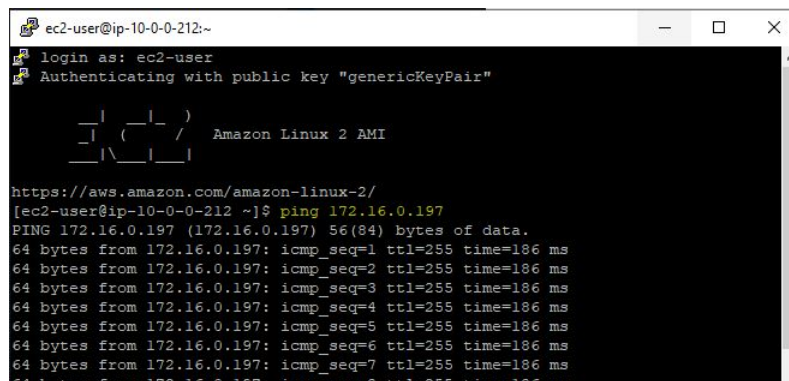
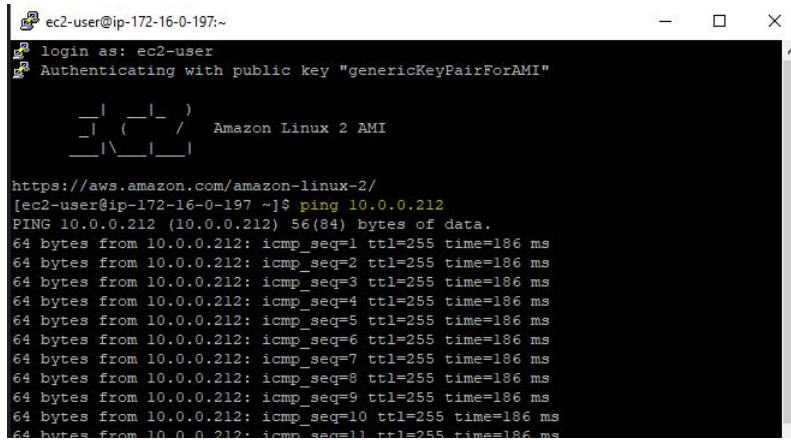
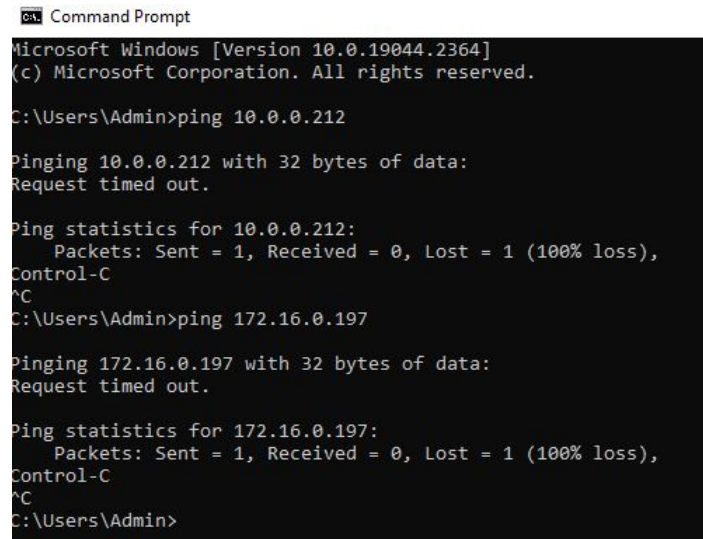


Figure 38: Connect the instance and ping the other instance

A terminal window titled 'ec2-user@ip-172-16-0-197:~'. It shows the user logging in as 'ec2-user' and authenticating with a public key. The terminal displays the 'Amazon Linux 2 AMI' logo. Below the logo, the user runs 'ping 10.0.0.212'. The output shows 11 successful ping requests, each with 64 bytes of data, a TTL of 255, and a time of 186 ms.

```
ec2-user@ip-172-16-0-197:~  
login as: ec2-user  
Authenticating with public key "genericKeyPairForAMI"  
  
  _| _| _| )  
  _| ( _| /  
  _| \ _| _|  
      Amazon Linux 2 AMI  
  
https://aws.amazon.com/amazon-linux-2/  
[ec2-user@ip-172-16-0-197 ~]$ ping 10.0.0.212  
PING 10.0.0.212 (10.0.0.212) 56(84) bytes of data:  
64 bytes from 10.0.0.212: icmp_seq=1 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=2 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=3 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=4 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=5 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=6 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=7 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=8 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=9 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=10 ttl=255 time=186 ms  
64 bytes from 10.0.0.212: icmp_seq=11 ttl=255 time=186 ms
```

Figure 39: Connect the instance and ping the other instance

A Windows Command Prompt window titled 'Command Prompt'. It shows the user attempting to ping 10.0.0.212 and 172.16.0.197. Both attempts result in 'Request timed out' and '100% loss' statistics.

```
Microsoft Windows [Version 10.0.19044.2364]  
(c) Microsoft Corporation. All rights reserved.  
  
C:\Users\Admin>ping 10.0.0.212  
  
Pinging 10.0.0.212 with 32 bytes of data:  
Request timed out.  
  
Ping statistics for 10.0.0.212:  
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),  
Control-C  
^C  
C:\Users\Admin>ping 172.16.0.197  
  
Pinging 172.16.0.197 with 32 bytes of data:  
Request timed out.  
  
Ping statistics for 172.16.0.197:  
    Packets: Sent = 1, Received = 0, Lost = 1 (100% loss),  
Control-C  
^C  
C:\Users\Admin>
```

Figure 40: To prove the connection is laid over a private network I even try pinging it through personalized system which in turns to be effectively working



## Conclusion

This experiment is successful demonstration of creating 2 VPC in different regions along with instances and try to establish a private connection between the two. The premise of experiment touches upon many networking concepts engulfed in the cloud ecosystem that provides an implementation inclination through the prowess of AWS flawlessly. The concepts covered which were shown as services were Subnet, Route Tables, Internet Gateway and Peering Connections respectively. The execution of successful experiment was done and result section does suffice it in a seamless manner.