AWS – Design & VPC

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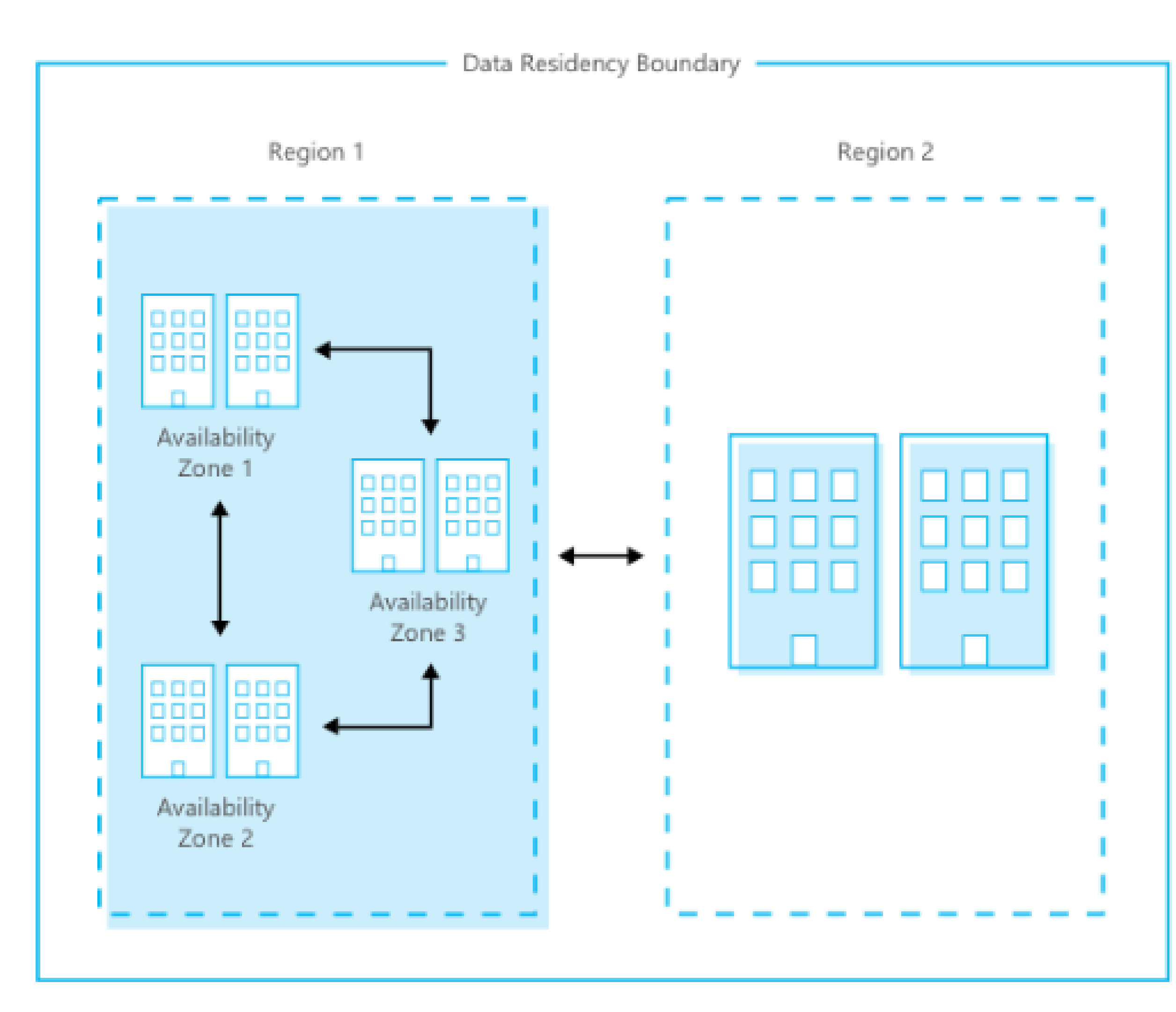
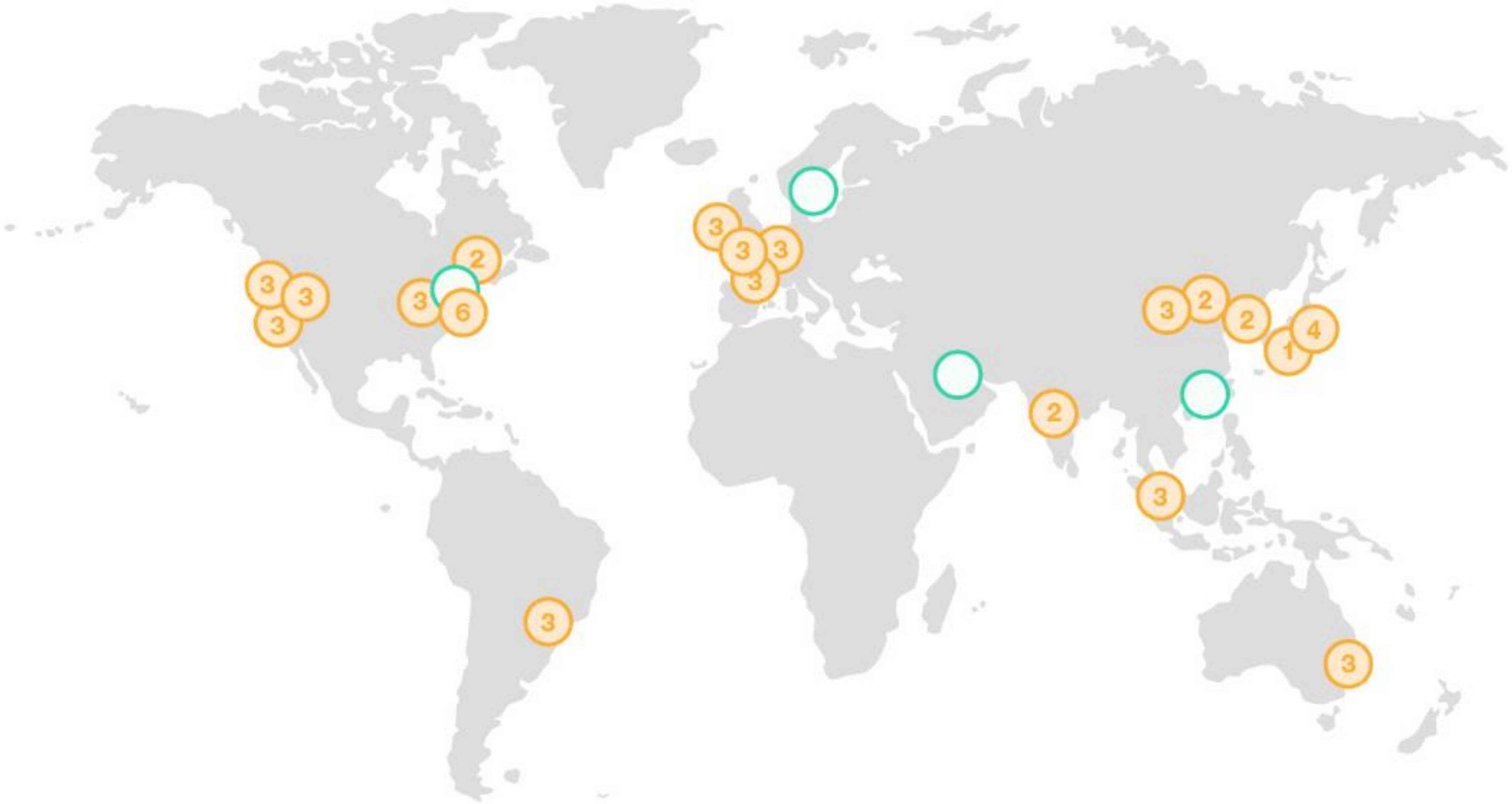
Concepts of Region and Availability Zone

- AWS has 18 regions , out of which 3 are China Regions, which are not accessible.
- Each region has min of 2 Datacenter's (Availability Zone) and max of 6 AZ.
- Each datacenter(Availability Zone) are interconnected with HIGH BANDWIDTH (BACKHOLE LINK, more than 1000Gbps)
- Each Region is also connected with other region. (The speed might be less when compared to above).
- REGION IS NOT EQUAL TO COUNTRY



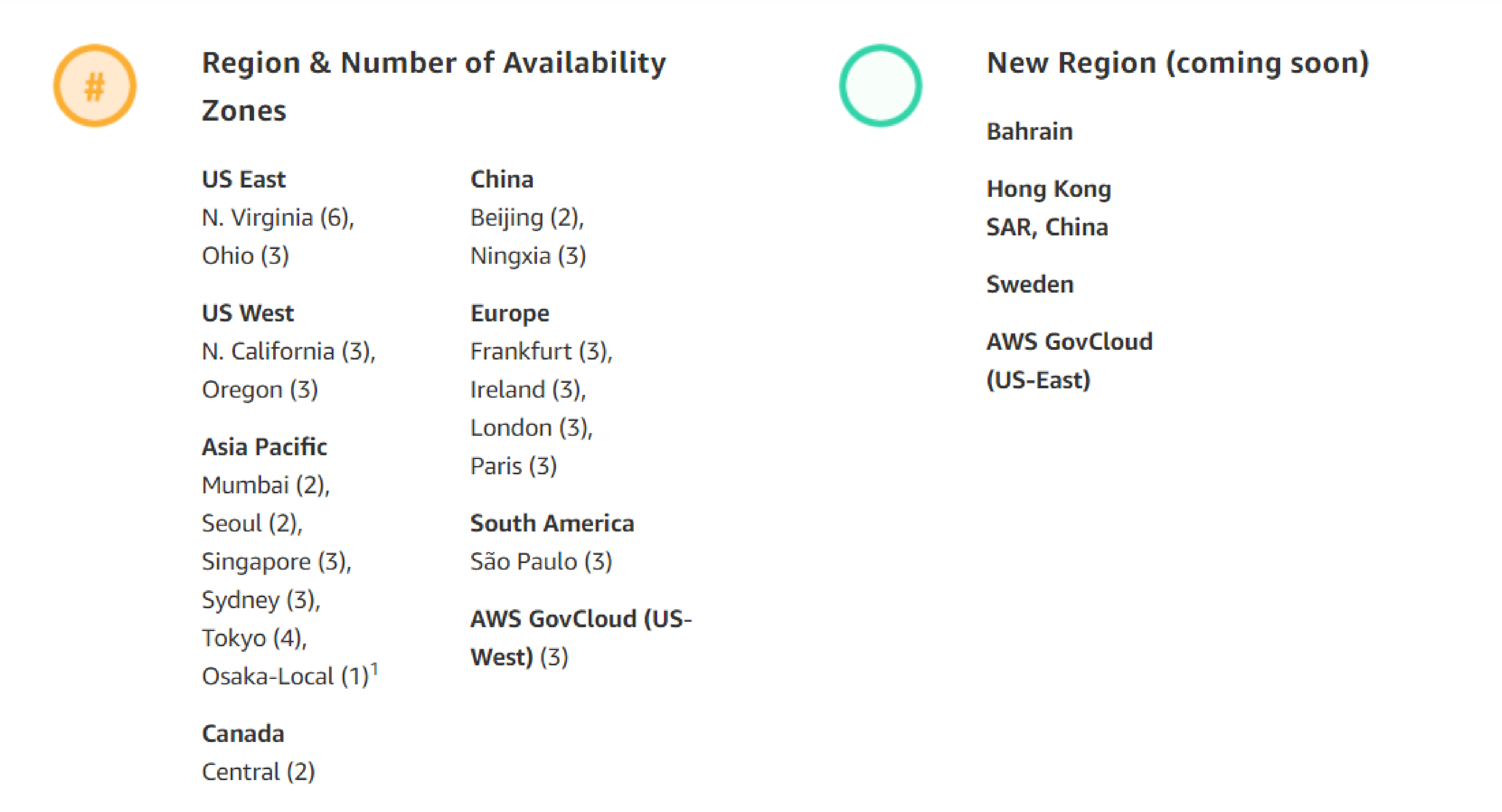
Global Infrastructure



(#) Region & Number of Availability Zones

○ New Region (coming soon)

List of Region and AZ count



Region & Number of Availability Zones

US East
N. Virginia (6),
Ohio (3)

US West
N. California (3),
Oregon (3)

Asia Pacific
Mumbai (2),
Seoul (2),
Singapore (3),
Sydney (3),
Tokyo (4),
Osaka-Local (1)[1]

Canada
Central (2)

China
Beijing (2),
Ningxia (3)

Europe
Frankfurt (3),
Ireland (3),
London (3),
Paris (3)

South America
São Paulo (3)

AWS GovCloud (US-West) (3)

New Region (coming soon)

Bahrain

Hong Kong SAR, China

Sweden

AWS GovCloud (US-East)

Creation of VPC (Basic networking)

- Basic Four Steps to create an basic Network platform for your Virtual Datacenter.
  - **Create a VPC**
  - Create Subnet
  - Create Internet Gateway
  - Modify/update Routing Table.

Concepts VPC

- VPC is the Base for all the connectivity's inside your Virtual Datacenter on AWS.
- VPC is part of one region only.
- By Default 2 different VPC’s **DOES not** talk to each other
- All the Network’s Within the same VPC can talk to each other.
- An Subnet can be part of “1” VPC only with assigned to “1” AZ only.

Step1 : Creation of VPC

- By default in an account, all the Regions has an Default VPC created by AWS With **“172.31.0.0/16”**
- Also default “Subnets” are created for these VPC’s in the Regions, eg:-- **“172.31.0.0/20”**
- We should be creating VPC with “**IPV4 Private IP**” ranges only.

Private IPV4

Class A – 10.0.0.0 to 10.255.255.255

Class B – 172.16.0.0 to 172.31.255.255

Class C – 192.168.0.0 to 192.168.255.255

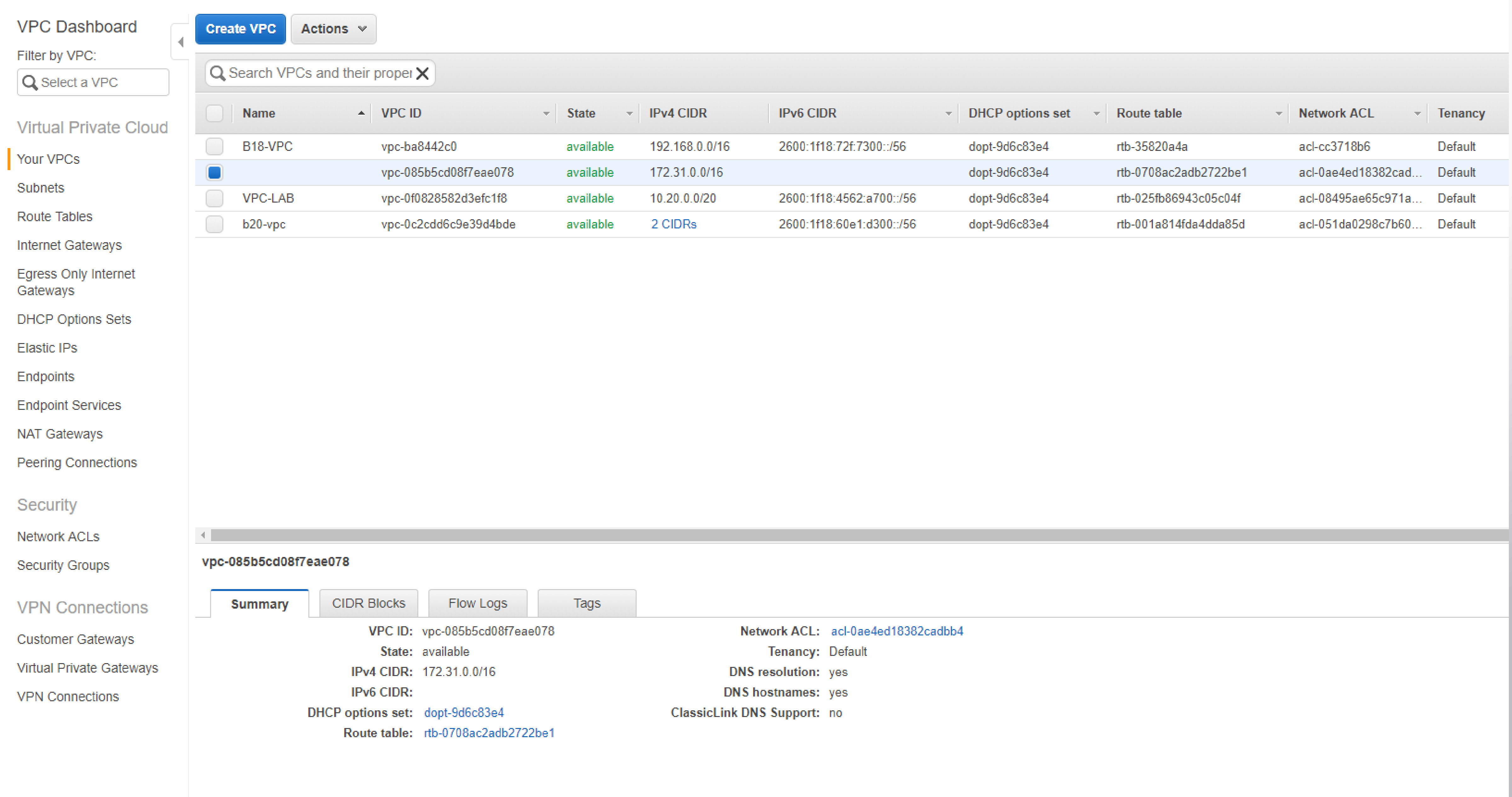
- Select a VALID NETWORK FOR VPC CIDR

After Creation of VPC

- An VPC ID is created.
- IPv6 public address block is assigned by AWS to your VPC (**if enabled**)
  - By default the public network would be **“/56” Network**.
- Default DHCP option Set gets assigned.
  - DNS Resolution is by default “yes”. This helps all the VM’s In the VPC to resolve any “Name” to “ip address”.
  - DNS Hostname is by default “No”. Change it to “yes”, this helps to provide an public DNS hostname to your VM’s.
- Default Routing Table gets created.
- Default Network ACL gets created. → By default all the Traffic Inbound and Outbound are **ALLOWED.**

Note:-- NACL – Network Access Control List

We can add “Main Network” to the same VPC.



	Name	VPC ID	State	IPv4 CIDR	IPv6 CIDR	DHCP options set	Route table	Network ACL	Tenancy
□	B18-VPC	vpc-ba8442c0	available	192.168.0.0/16	2600:1f18:72f:7300::/56	dopt-9d6c83e4	rtb-35820a4a	acl-cc3718b6	Default
■		vpc-085b5cd08f7eae078	available	172.31.0.0/16		dopt-9d6c83e4	rtb-0708ac2adb2722be1	acl-0ae4ed18382cad...	Default
□	VPC-LAB	vpc-0f0828582d3efc1f8	available	10.20.0.0/20	2600:1f18:4562:a700::/56	dopt-9d6c83e4	rtb-025fb86943c05c04f	acl-08495ae65c971a...	Default
□	b20-vpc	vpc-0c2cdd6c9e39d4bde	available	2 CIDRs	2600:1f18:60e1:d300::/56	dopt-9d6c83e4	rtb-001a814fda4dda85d	acl-051da0298c7b60...	Default

vpc-085b5cd08f7eae078

VPC ID:	vpc-085b5cd08f7eae078	Network ACL:	acl-0ae4ed18382cadbb4
State:	available	Tenancy:	Default
IPv4 CIDR:	172.31.0.0/16	DNS resolution:	yes
IPv6 CIDR:		DNS hostnames:	yes
DHCP options set:	dopt-9d6c83e4	ClassicLink DNS Support:	no
Route table:	rtb-0708ac2adb2722be1		

Limitations of VPC

- Cannot create a VPC only on **IPV6.**

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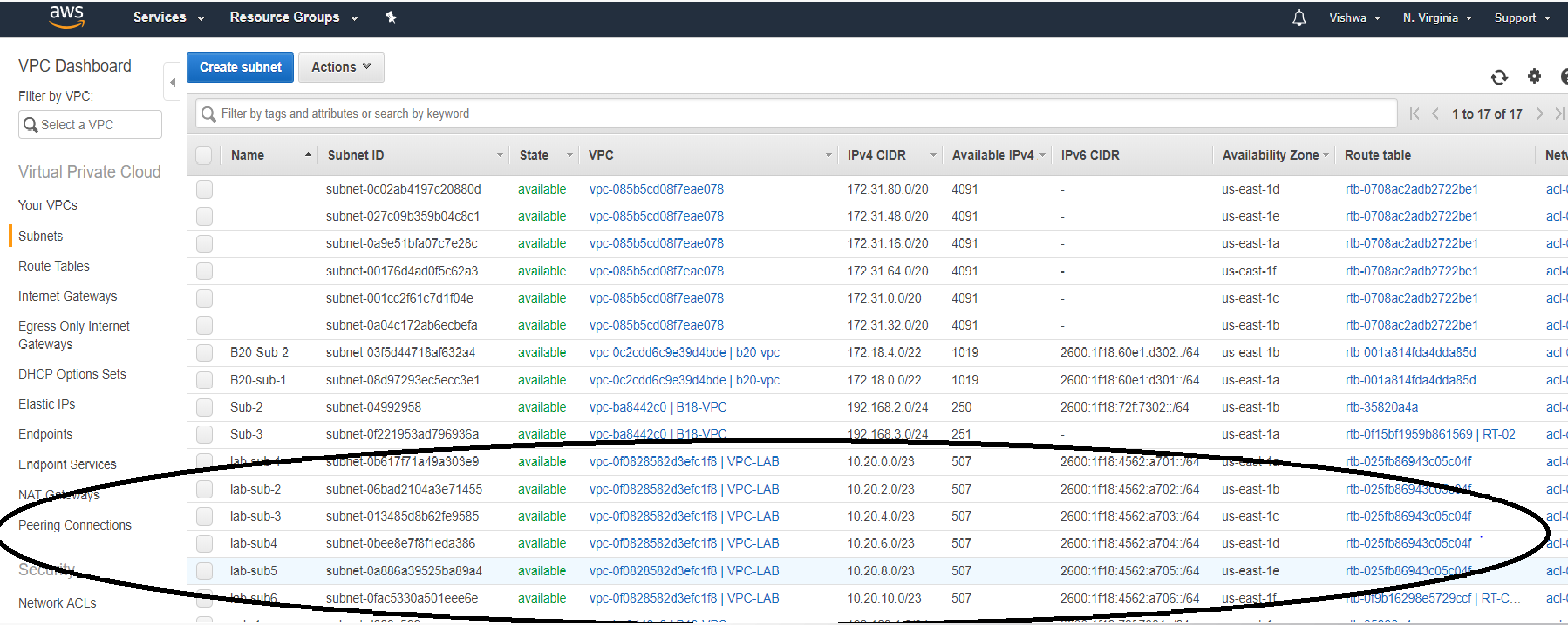
Step2: Creation of Subnet

- After manual Subnetting of the VPC CIDR, we would be creating the Subnets.
- Select the Appropriate “VPC”
- Assign the “CIDR” for the Subnet. (Means the Subnetwork)
- Assign the Availability Zone (Datacenter)
  - Eg: -- “Us-east-1” refers to N.Virginia and “a” to “f” refers to the Datacenters available in that Region.
  - **SUBNET CANNOT BE CHANGED TO A DIFFERENT AVAILABILITY ZONE AFTER CREATION OF IT.**
- Allocated IPv6 from the given ::/64 Network.

After Creation of Subnets

- Subnet ID is created.
- if IPv6 was enabled, each Subnet get “**/64**” subnet network from the main Network assigned in the VPC.
- Each subnet has **“5”** Ip’s blocked for AWS usage.
  - The **First IP** is the **Network ID**, eg:-- **172.30.1.0/24**
  - The **Second IP** is the **First usable IP** also called as **Default Gateway** for the subnet: **172.30.1.1/24**
  - The **Last IP** is the Broadcast, eg:-- **172.30.1.255/24**
  - There are **2 more IP’s** , that are used internally by the **“Virtual Router”** for Failover.

Note: -- VPC’s one of the function is “Virtual Router”



□	Name	Subnet ID	State	VPC	IPv4 CIDR	Available IPv4	IPv6 CIDR	Availability Zone	Route table	Netw
□		subnet-0c02ab4197c20880d	available	vpc-085b5cd08f7eae078	172.31.80.0/20	4091	-	us-east-1d	rtb-0708ac2adb2722be1	acl-
□		subnet-027c09b359b04c8c1	available	vpc-085b5cd08f7eae078	172.31.48.0/20	4091	-	us-east-1e	rtb-0708ac2adb2722be1	acl-
□		subnet-0a9e51bfa07c7e28c	available	vpc-085b5cd08f7eae078	172.31.16.0/20	4091	-	us-east-1a	rtb-0708ac2adb2722be1	acl-
□		subnet-00176d4ad0f5c62a3	available	vpc-085b5cd08f7eae078	172.31.64.0/20	4091	-	us-east-1f	rtb-0708ac2adb2722be1	acl-
□		subnet-001cc2f61c7d1f04e	available	vpc-085b5cd08f7eae078	172.31.0.0/20	4091	-	us-east-1c	rtb-0708ac2adb2722be1	acl-
□		subnet-0a04c172ab6ecbefa	available	vpc-085b5cd08f7eae078	172.31.32.0/20	4091	-	us-east-1b	rtb-0708ac2adb2722be1	acl-
□	B20-Sub-2	subnet-03f5d44718af632a4	available	vpc-0c2cdd6c9e39d4bde | b20-vpc	172.18.4.0/22	1019	2600:1f18:60e1:d302::/64	us-east-1b	rtb-001a814fda4dda85d	acl-
□	B20-sub-1	subnet-08d97293ec5ecc3e1	available	vpc-0c2cdd6c9e39d4bde | b20-vpc	172.18.0.0/22	1019	2600:1f18:60e1:d301::/64	us-east-1a	rtb-001a814fda4dda85d	acl-
□	Sub-2	subnet-04992958	available	vpc-ba8442c0 | B18-VPC	192.168.2.0/24	250	2600:1f18:72f:7302::/64	us-east-1b	rtb-35820a4a	acl-
□	Sub-3	subnet-0f221953ad796936a	available	vpc-ba8442c0 | B18-VPC	192.168.3.0/24	251	-	us-east-1a	rtb-0f15bf1959b861569 | RT-02	acl-
□	lab-sub-1	subnet-0b617f71a49a303e9	available	vpc-0f0828582d3efc1f8 | VPC-LAB	10.20.0.0/23	507	2600:1f18:4562:a701::/64	us-east-1a	rtb-025fb86943c05c04f	acl-
□	lab-sub-2	subnet-06bad2104a3e71455	available	vpc-0f0828582d3efc1f8 | VPC-LAB	10.20.2.0/23	507	2600:1f18:4562:a702::/64	us-east-1b	rtb-025fb86943c05c04f	acl-
□	lab-sub-3	subnet-013485d8b62fe9585	available	vpc-0f0828582d3efc1f8 | VPC-LAB	10.20.4.0/23	507	2600:1f18:4562:a703::/64	us-east-1c	rtb-025fb86943c05c04f	acl-
□	lab-sub4	subnet-0bee8e7f8f1eda386	available	vpc-0f0828582d3efc1f8 | VPC-LAB	10.20.6.0/23	507	2600:1f18:4562:a704::/64	us-east-1d	rtb-025fb86943c05c04f	acl-
□	lab-sub5	subnet-0a886a39525ba89a4	available	vpc-0f0828582d3efc1f8 | VPC-LAB	10.20.8.0/23	507	2600:1f18:4562:a705::/64	us-east-1e	rtb-025fb86943c05c04f	acl-
□	lab-sub6	subnet-0fac5330a501eee6e	available	vpc-0f0828582d3efc1f8 | VPC-LAB	10.20.10.0/23	507	2600:1f18:4562:a706::/64	us-east-1f	rtb-0f9b16298e5729ccf | RT-C...	acl-

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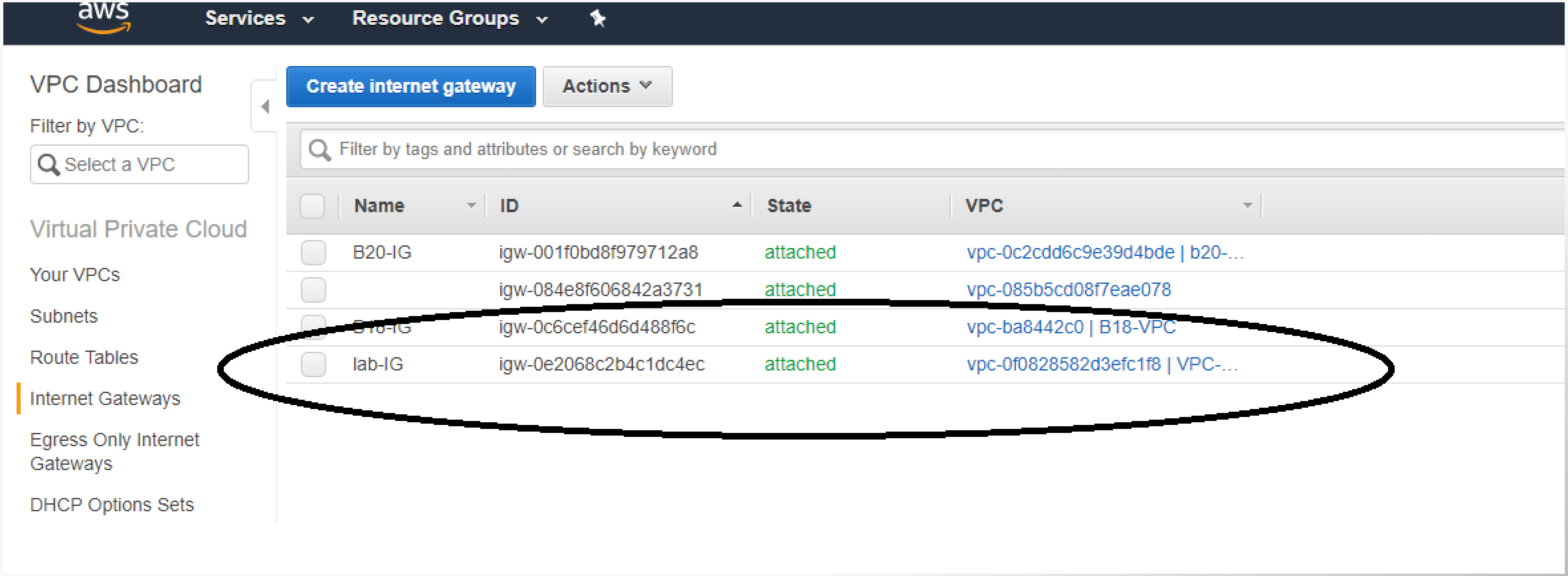
  - **Create Internet Gateway**
  - Modify/update Routing Table.

Step3: Creation of Internet Gateway

- Internet Gateway is created to intimate VPC that it would have internet connection
- Its just an Interface that gets created on the VPC
- After creating the Internet Gateway, we would need to Attach it to an VPC.

- Note:-- ONE VPC CAN HAVE ONLY ONE INTERNET GATEWAY



Name	ID	State	VPC
B20-IG	igw-001f0bd8f979712a8	attached	vpc-0c2cdd6c9e39d4bde | b20-...
	igw-084e8f606842a3731	attached	vpc-085b5cd08f7eae078
B18-IG	igw-0c6cef46d6d488f6c	attached	vpc-ba8442c0 | B18-VPC
lab-IG	igw-0e2068c2b4c1dc4ec	attached	vpc-0f0828582d3efc1f8 | VPC-...

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Step4: Modify the Route Table

- Properties of the Routing Table
  - All the Subnets are by default part of the Default Routing Table for that VPC.
  - By default, all the Private Network and the IPv6 Public Network assigned by AWS is part of the Routing table
  - By Default, there is **NO route for the Internet Traffic.**
  - Custom Route Table does not have any Subnets Associated to it by **DEFAULT.**

- We need to manually add the route for Internet Traffic.
  - For IPv4 **“0.0.0.0/0”** is added for allowing all Traffic towards Internet (Bi-Directional)
  - For IPv6 **“::/0”** is added for allowing all Traffic towards Internet (Bi-Directional)

How did the 0.0.0.0/0 come?

192.168.1.0/24

- first 3 octet are fixed and 4th octet can take any value.

172.18.0.0/16

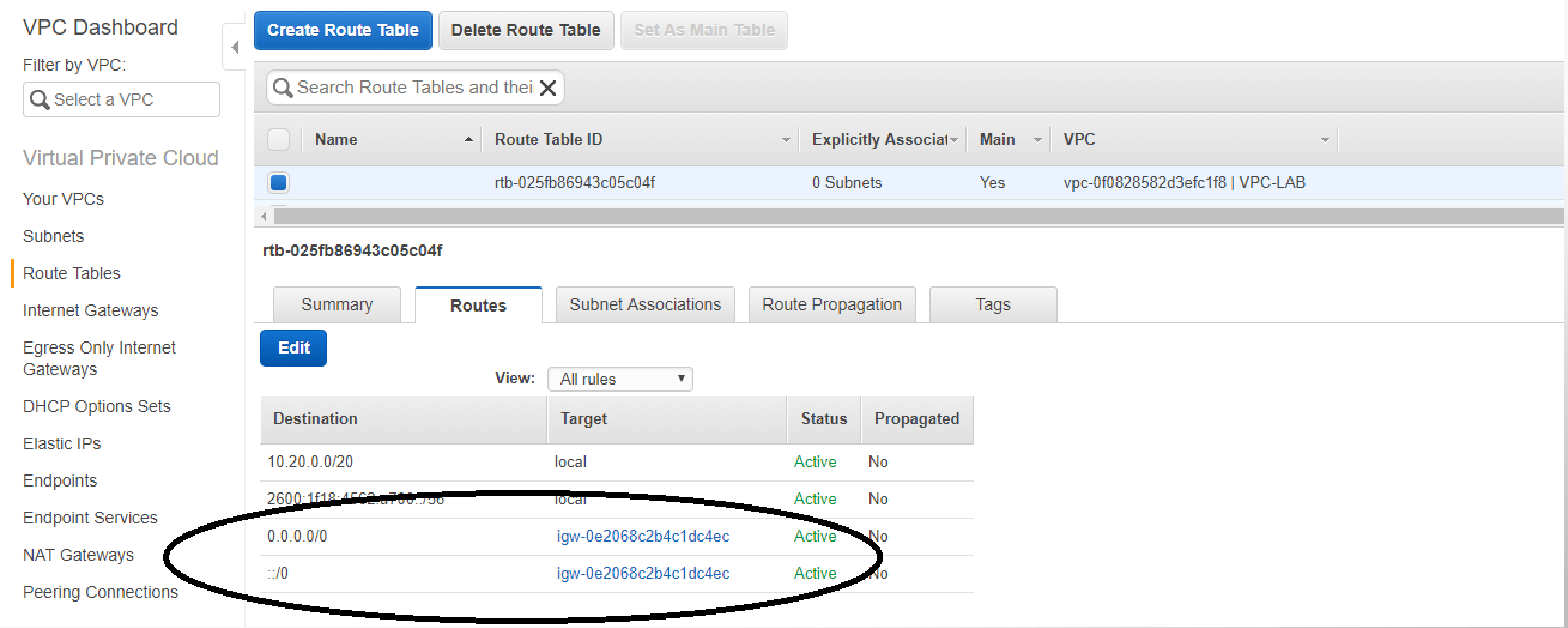
- first 2 octet are fixed and next 2 octet can take any value.

10.0.0.0/8

- first octet is fixed and next 3 octet can take any value.

0.0.0.0/0

- All the octet can take any value – ALL TRAFFIC – DEFAULT ROUTE



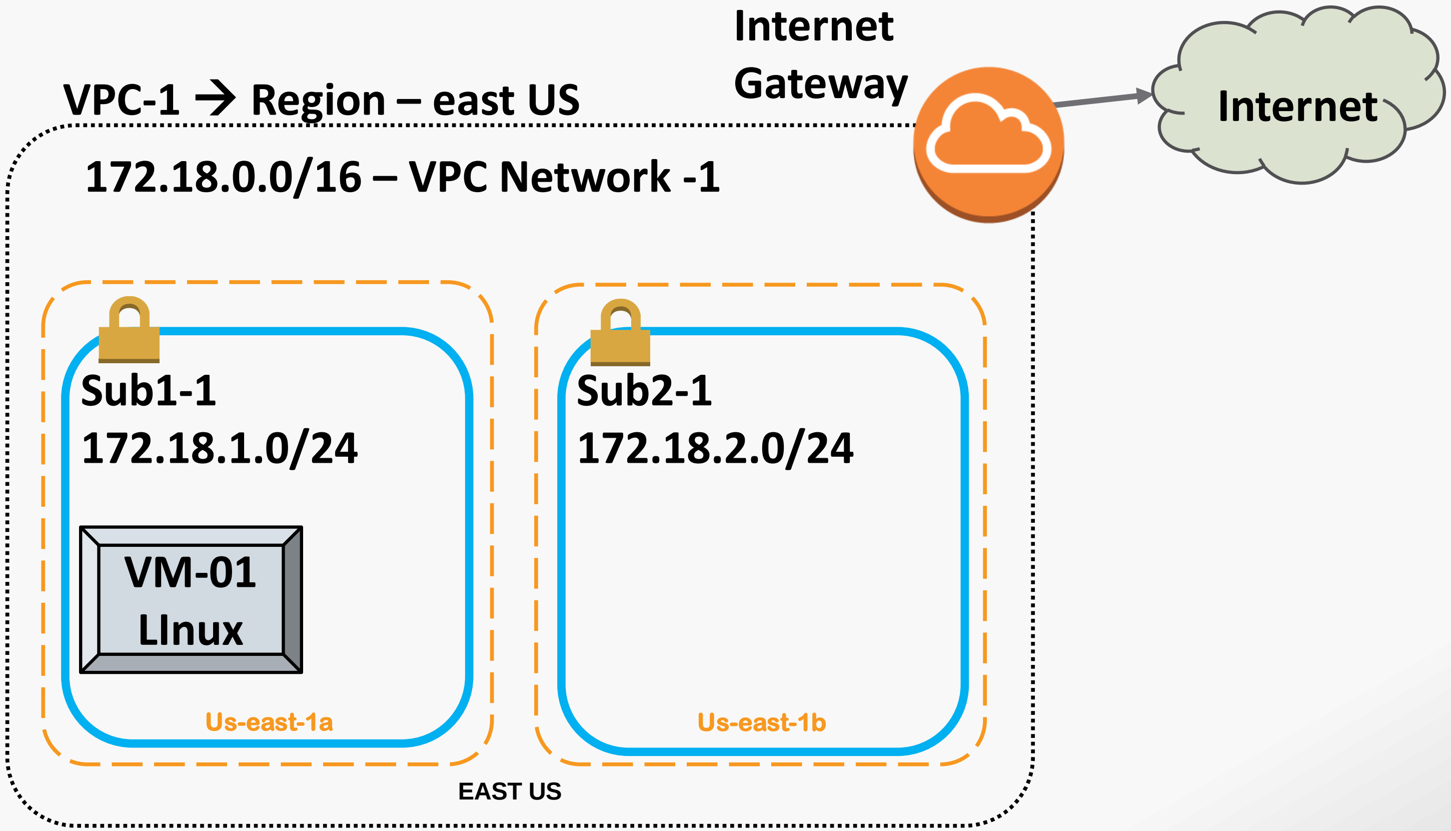
□	Name	Route Table ID	Explicitly Associat	Main	VPC
■		rtb-025fb86943c05c04f	0 Subnets	Yes	vpc-0f0828582d3efc1f8 | VPC-LAB

rtb-025fb86943c05c04f

View: All rules

Destination	Target	Status	Propagated
10.20.0.0/20	local	Active	No
2600:1f18:4562:a700::/56	local	Active	No
0.0.0.0/0	igw-0e2068c2b4c1dc4ec	Active	No
::/0	igw-0e2068c2b4c1dc4ec	Active	No

VPC – Demo – Setup - Details

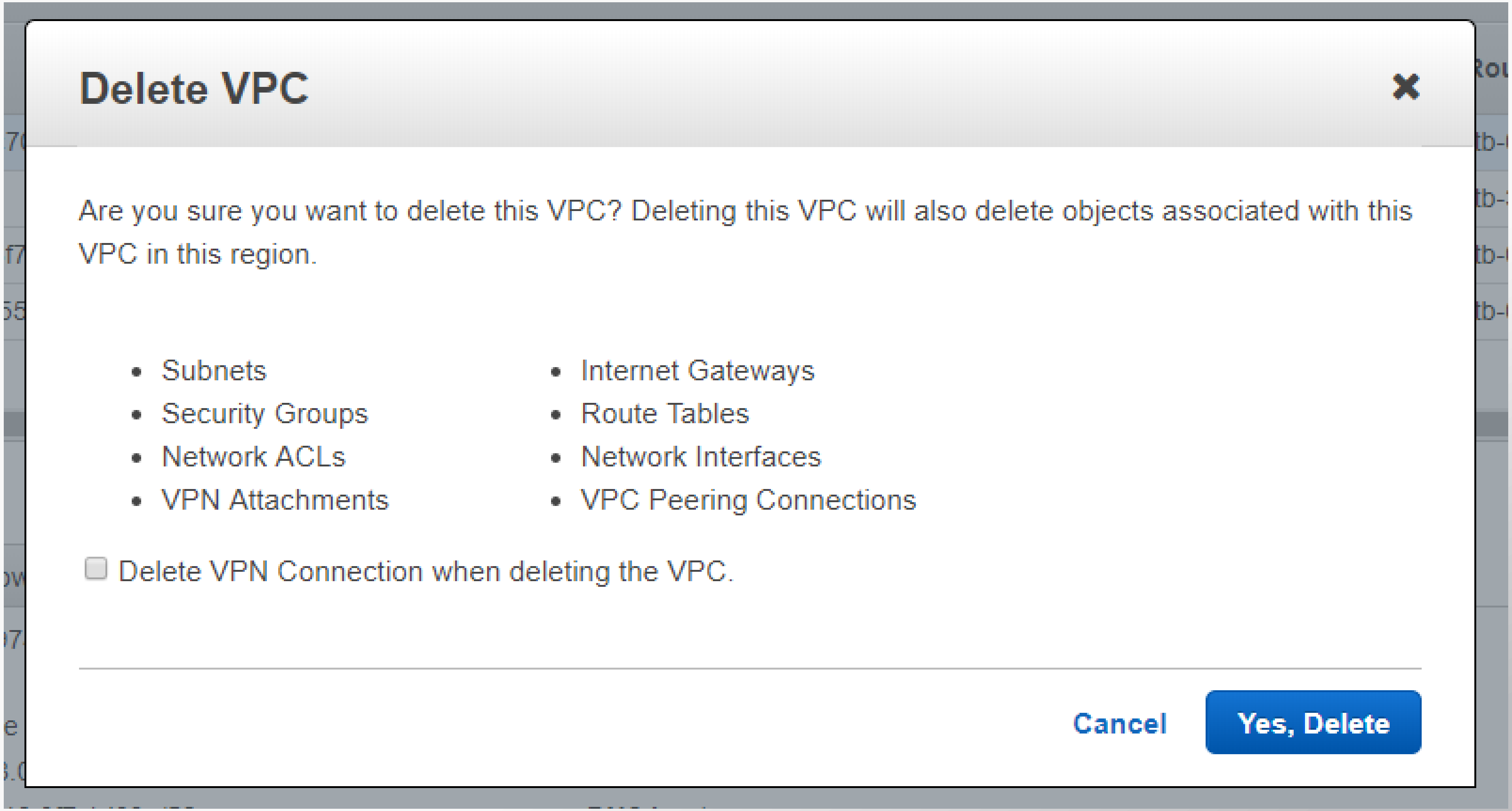


Add routing entry on VPC-1 routing table
0.0.0.0/0 – Internet Gateway
::/0 – Internet Gateway

Hurrey….

NOW CREATE AN BASIC VIRTUAL MACHINE(EC2) AND YOU ARE DONE WITH THE VM ON THE CLOUD WITH INTERNET ACCESS.

Deleting VPC



Delete VPC

Are you sure you want to delete this VPC? Deleting this VPC will also delete objects associated with this VPC in this region.

- Subnets
- Security Groups
- Network ACLs
- VPN Attachments
- Internet Gateways
- Route Tables
- Network Interfaces
- VPC Peering Connections

☐ Delete VPN Connection when deleting the VPC.

Troubleshooting VPC

Basic Troubleshooting steps if the EC2 instance is not getting connected.

- Check Weather “Internet gateway” is created an assigned to “Routing Table”.
- If custom Route table created, weather “Subnet’s” are associated to the new Routing table.
- Weather “PORTS” are allowed in the security group for “inbound” and “outbound”.

- https://aws.amazon.com/premiumsupport/knowledge-center/troubleshoot-vpc-route-table/