AWS Academy Cloud Foundations

Module 5: Networking and Content Delivery

Module overview

Topics

- Networking basics
- Amazon VPC
- VPC networking
- VPC security
- Amazon Route 53
- Amazon CloudFront

Activities

- Label a network diagram
- Design a basic VPC architecture

Demo

- VPC demonstration

Lab

- Build your VPC and launch a web server

Knowledge check

Module objectives

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After completing this module, you should be able to:

- Recognize the basics of networking
- Describe virtual networking in the cloud with Amazon VPC
- Label a network diagram
- Design a basic VPC architecture
- Indicate the steps to build a VPC
- Identify security groups
- Create your own VPC and add additional components to it to produce a customized network
- Identify the fundamentals of Amazon Route 53
- Recognize the benefits of Amazon CloudFront

Module 5: Networking and Content Delivery

Section 1: Networking basics

Networks

Number System

Protocol

IP Addressing

Networks

Number System :-

- Decimal
- Roman
- Binary
- Octal
- HexaDecimal

Networks

0 1 2 3 4 5 6 7 8 9 A B C D E F - Hexadecimal

0 1 - Binary

0	10	100
1	11	101
		110
		111

0	0	10	10	20	20	90	
1	1	11	11	21	21	91	100
2	2	12	12	2	12	92	101
3	3	13	13	3	13	93	102
4	4	14	14	4	14	94	103
5	5	15	15	5	15	95	4
6	6	16	16	6	16	96	5
7	7	17	17	7	27	97	6
8		18		8		98	7
9		19		29		99	8
							109

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Conversion of Number from one number system to another

- Decimal to Binary
- Binary to Decimal

Networks

Protocol

Network protocols:

- TCP/IP - DOD
- IPx/SPx - Novell
- AppleTalk - Apple
- NetBIOS - Microsoft
- OSI – ISO

IP addresses

192	.	0	.	2	.	0
↓		↓		↓		↓
11000000		00000000		00000010		00000000

IP addresses

Range of IP Address

RANGE OF IPv4 ADDRESS

Taking example as all 0's and all 1's

0 0 0 0 0 0 0 0 = 0

0 0 0 0 0 0 0 1 = 1

0 0 0 0 0 0 1 0 = 2

0 0 0 0 0 0 1 1 = 3

0 0 0 0 0 1 0 0 = 4

1 1 1 1 1 1 1 1 = 255

Total IP Address Range: 0.0.0.0 to 255.255.255.255

IPv4 and IPv6 addresses

IPv4 (32-bit) address: 192.0.2.0

IPv6 (128-bit) address: 2600:1f18:22ba:8c00:ba86:a05e:a5ba:00FF

IP Address Classification

IP ADDRESS CLASSIFICATION

IP ADDRESS are divided into 5 classes

CLASS A 0 - 127
CLASS B 128 - 191
CLASS C 192 - 223
CLASS D 224 – 239
CLASS E 240 – 255
CLAS A, B, C used in LAN & WAN
CLASS D reserved for multicasting
CLASS E reserved for research & development and for future use

Public IP address And Private IP Address

- Public IP Address

- External (global) reach
- Used for communicating outside your private network, over the internet
- A unique numeric code never reused by other devices
- Found by Googling: "What is my IP address?“
- Assigned and controlled by your internet service provider
- Not free

- Private IP Address

- Internal (local) reach
- Used for communicating within your private network, with other devices in your home or office
- A non-unique numeric code that may be reused by other devices in other private networks
- Found via your device’s internal settings
- Assigned to your specific device within a private network

Public IP address types

Public IPv4 address

- Manually assigned through an Elastic IP address
- Automatically assigned through the auto-assign public IP address settings at the subnet level

Elastic IP address

- Associated with an AWS account
- Can be allocated and remapped anytime
- Additional costs might apply

Private IP address Class

NETWORK AND HOST PORTIONS

IP Address is divided into Network & Host Portion.

CLASS A	N.H.H.H
CLASS B	N.N.H.H
CLASS C	N.N.N.H

Host: specific a device in the network.
Network: set of devices

Private IP address Class

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PRIVATE IP ADDRESS

There are certain addresses in each class of IP address that are reserved for Private Networks. These addresses are called private addresses.

CLASS A

10.0.0.0 to 10.255.255.255 (10.X.X.X)

CLASS B

172.16.0.0 to 172.31.255.255

CLASS C

192.169.0.0 to 192.168.255.255 (192.168.X.X)

Classless Inter-Domain Routing (CIDR)

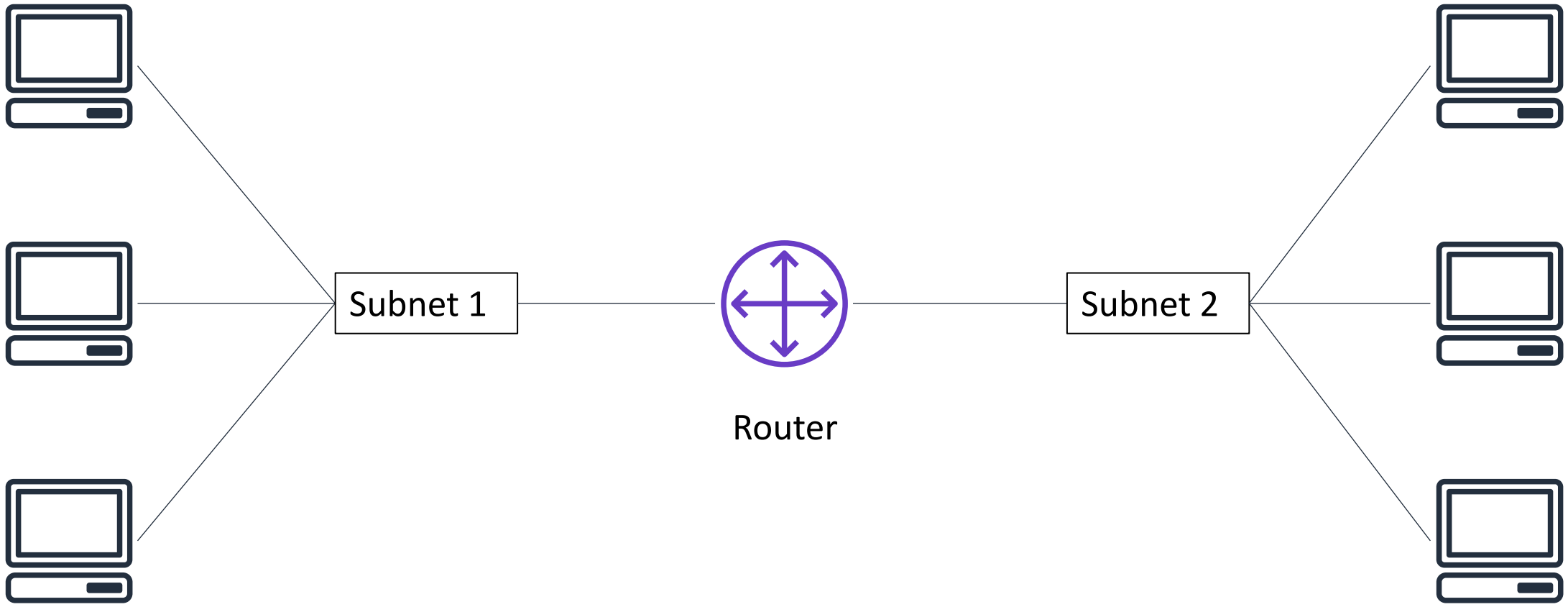
Network identifier (routing prefix) | Host identifier

192 . 0 . 2 . 0 / 24

192	0	2	0
11000000	00000000	00000010	00000000 to 11111111
Fixed	Fixed	Fixed	Flexible

Tells you how many bits are fixed

Networks



Open Systems Interconnection (OSI) model

Layer	Number	Function	Protocol/Address
Application	7	Means for an application to access a computer network	HTTP(S), FTP, DHCP, LDAP
Presentation	6	• Ensures that the application layer can read the data • Encryption	ASCI, ICA
Session	5	Enables orderly exchange of data	NetBIOS, RPC
Transport	4	Provides protocols to support host-to-host communication	TCP, UDP
Network	3	Routing and packet forwarding (routers)	IP
Data link	2	Transfer data in the same LAN network (hubs and switches)	MAC
Physical	1	Transmission and reception of raw bitstreams over a physical medium	Signals (1s and 0s)

Module 5: Networking and Content Delivery

Section 2: Amazon VPC

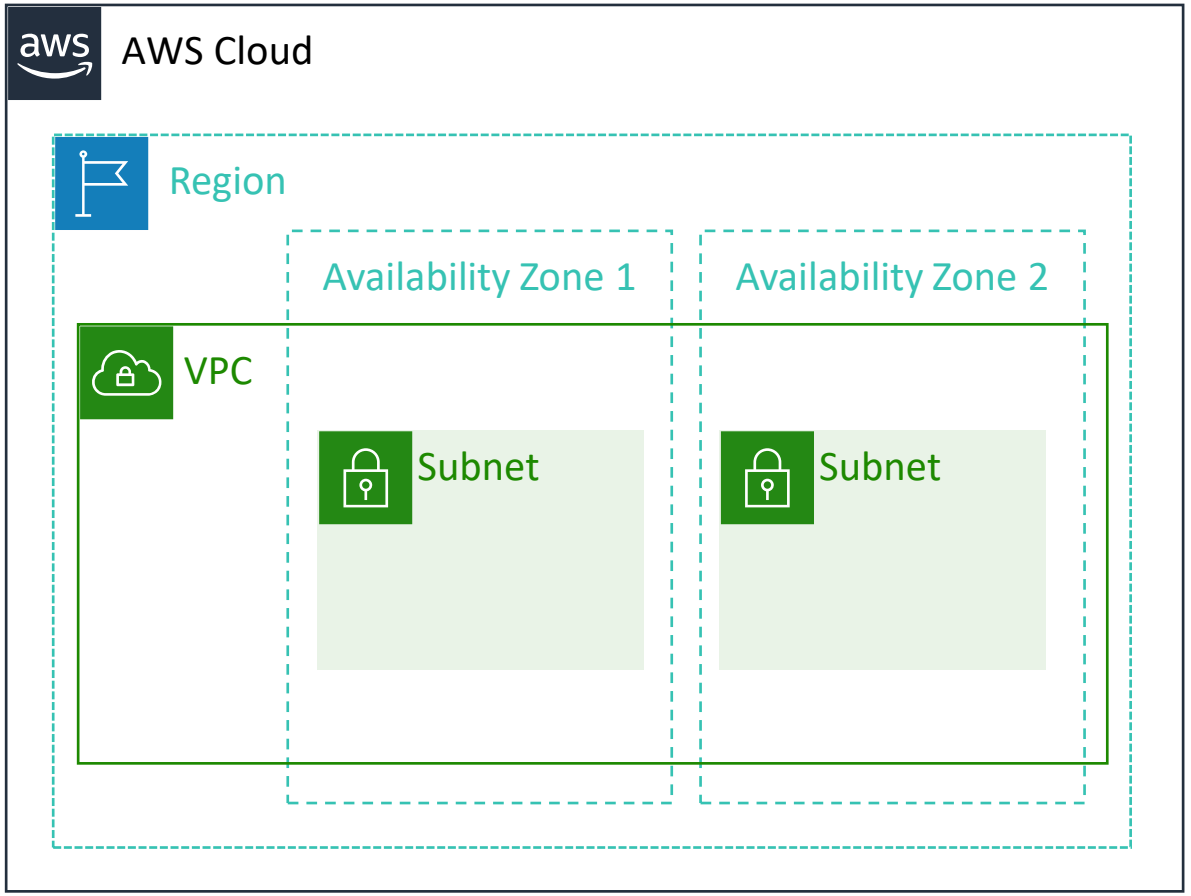
Amazon VPC

Amazon VPC

- Enables you to provision a **logically isolated** section of the AWS Cloud where you can launch AWS resources in a virtual network that you define
- Gives you **control over your virtual networking resources**, including:
  - Selection of IP address range
  - Creation of subnets
  - Configuration of route tables and network gateways
- Enables you to **customize the network configuration** for your VPC
- Enables you to use **multiple layers of security**

VPCs and subnets

- VPCs:
  - **Logically isolated** from other VPCs
  - **Dedicated** to your AWS account
  - Belong to a single **AWS Region** and can span multiple Availability Zones
- Subnets:
  - **Range of IP addresses** that divide a VPC
  - Belong to a single **Availability Zone**
  - Classified as **public** or **private**



IP addressing

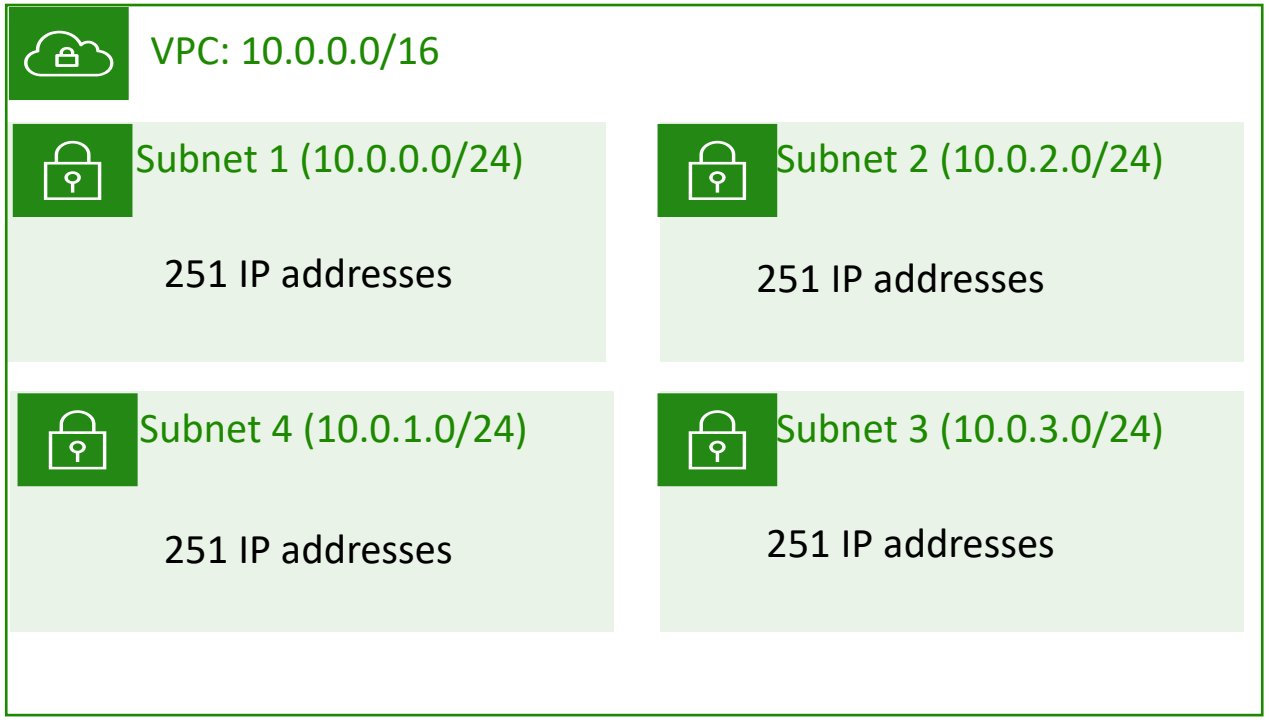
- When you create a VPC, you assign it to an IPv4 **CIDR block** (range of **private** IPv4 addresses).
- You **cannot change the address range** after you create the VPC.
- The **largest** IPv4 CIDR block size is **/16**.
- The **smallest** IPv4 CIDR block size is **/28**.
- IPv6 is also supported (with a different block size limit).
- CIDR blocks of subnets **cannot overlap**.

VPC

x.x.x.x/16 or 65,536 addresses (max)
to
x.x.x.x/28 or 16 addresses (min)

Reserved IP addresses

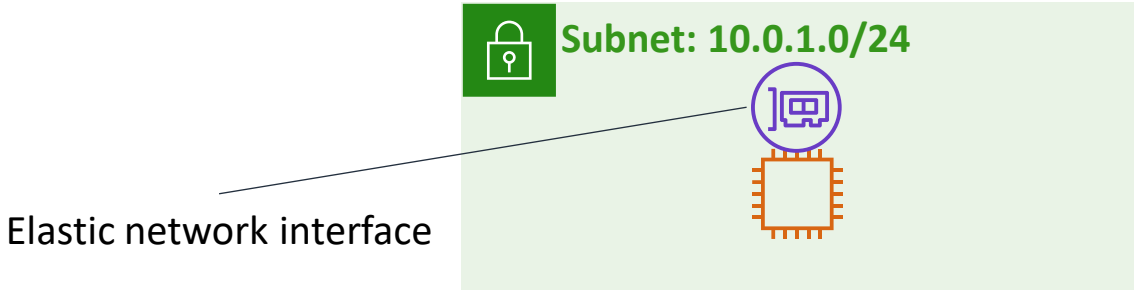
Example: A VPC with an IPv4 CIDR block of 10.0.0.0/16 has 65,536 total IP addresses. The VPC has four equal-sized subnets. Only 251 IP addresses are available for use by each subnet.



IP Addresses for CIDR block 10.0.0.0/24	Reserved for
10.0.0.0	Network address
10.0.0.1	Internal communication
10.0.0.2	Domain Name System (DNS) resolution
10.0.0.3	Future use
10.0.0.255	Network broadcast address

Elastic network interface

- An elastic network interface is a **virtual network interface** that you can:
  - Attach to an instance.
  - Detach from the instance, and attach to another instance to redirect network traffic.
- Its **attributes follow** when it is reattached to a new instance.
- Each instance in your VPC has a **default network interface** that is assigned a private IPv4 address from the IPv4 address range of your VPC.



Route tables and routes

- A **route table** contains a set of rules (or routes) that **you can configure** to direct network traffic from your subnet.
- Each **route** specifies a destination and a target.
- By default, every route table contains a **local route** for communication within the VPC.
- Each **subnet must be associated with a route table** (at most one).

Main (Default) Route Table

Destination	Target
10.0.0.0/16	local

VPC CIDR block

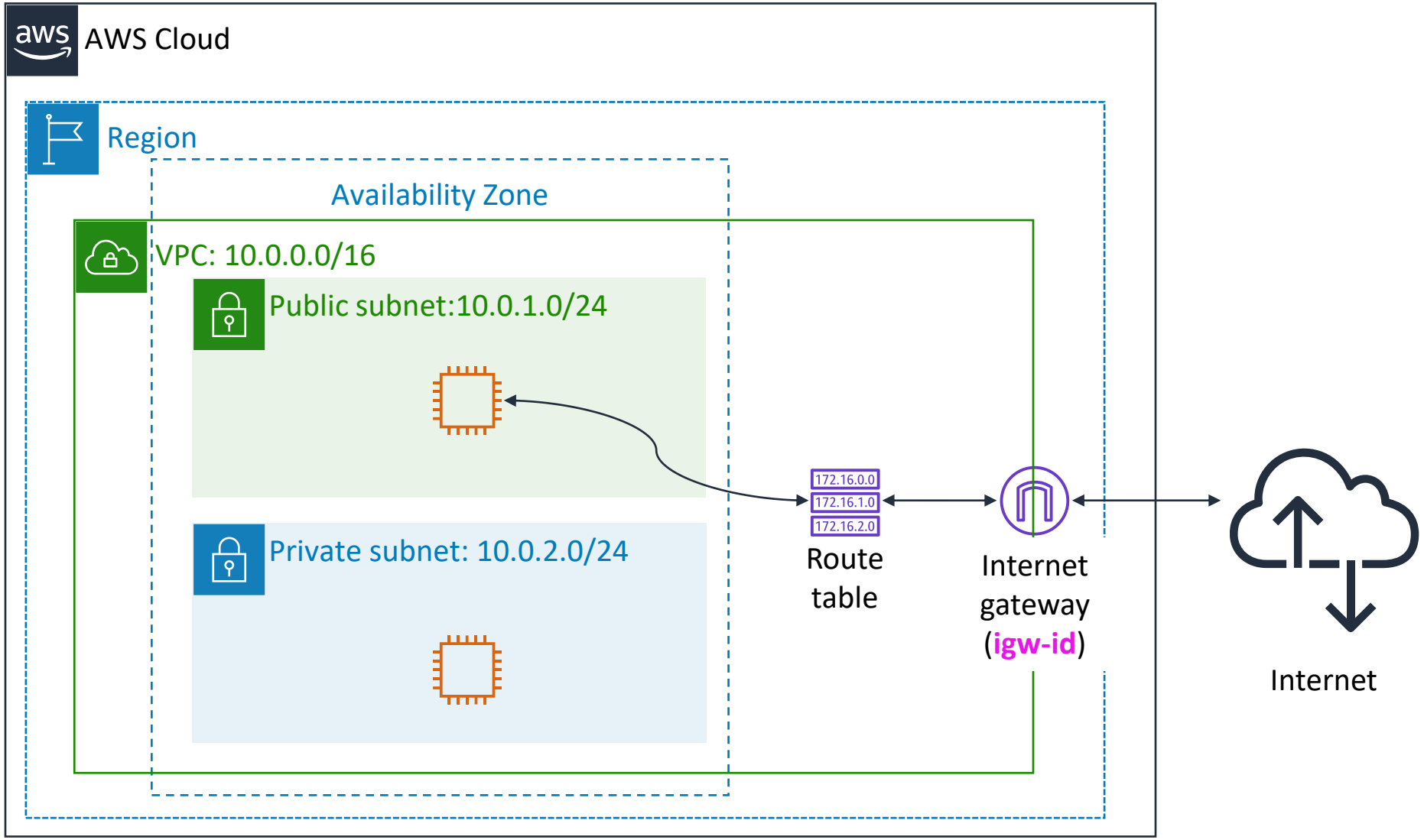
Section 2 key takeaways

- A VPC is a logically isolated section of the AWS Cloud.
- A VPC belongs to one Region and requires a CIDR block.
- A VPC is subdivided into subnets.
- A subnet belongs to one Availability Zone and requires a CIDR block.
- Route tables control traffic for a subnet.
- Route tables have a built-in local route.
- You add additional routes to the table.
- The local route cannot be deleted.

Module 5: Networking and Content Delivery

Section 3: VPC networking

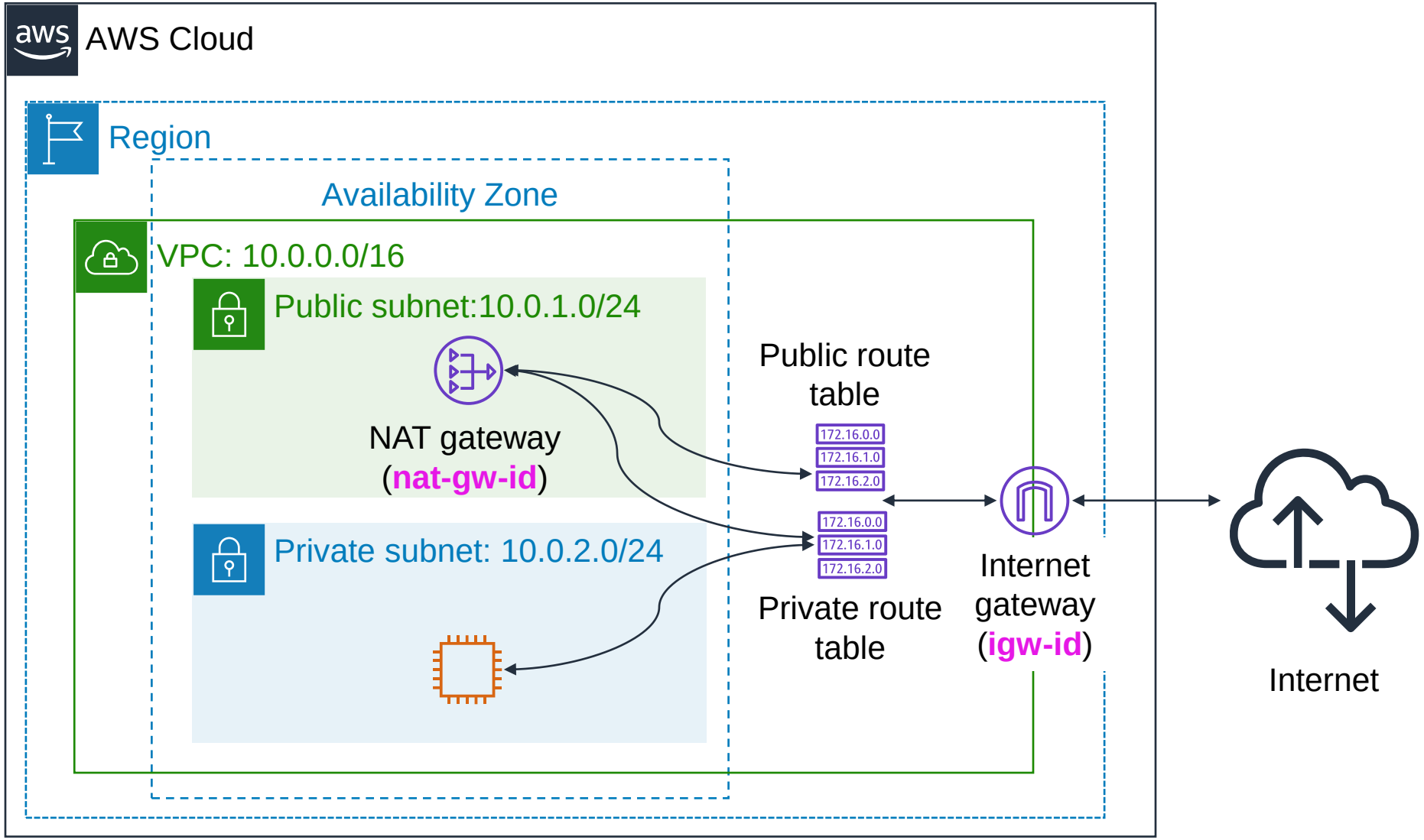
Internet gateway



Public Subnet Route Table

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	igw-id

Network address translation (NAT) gateway



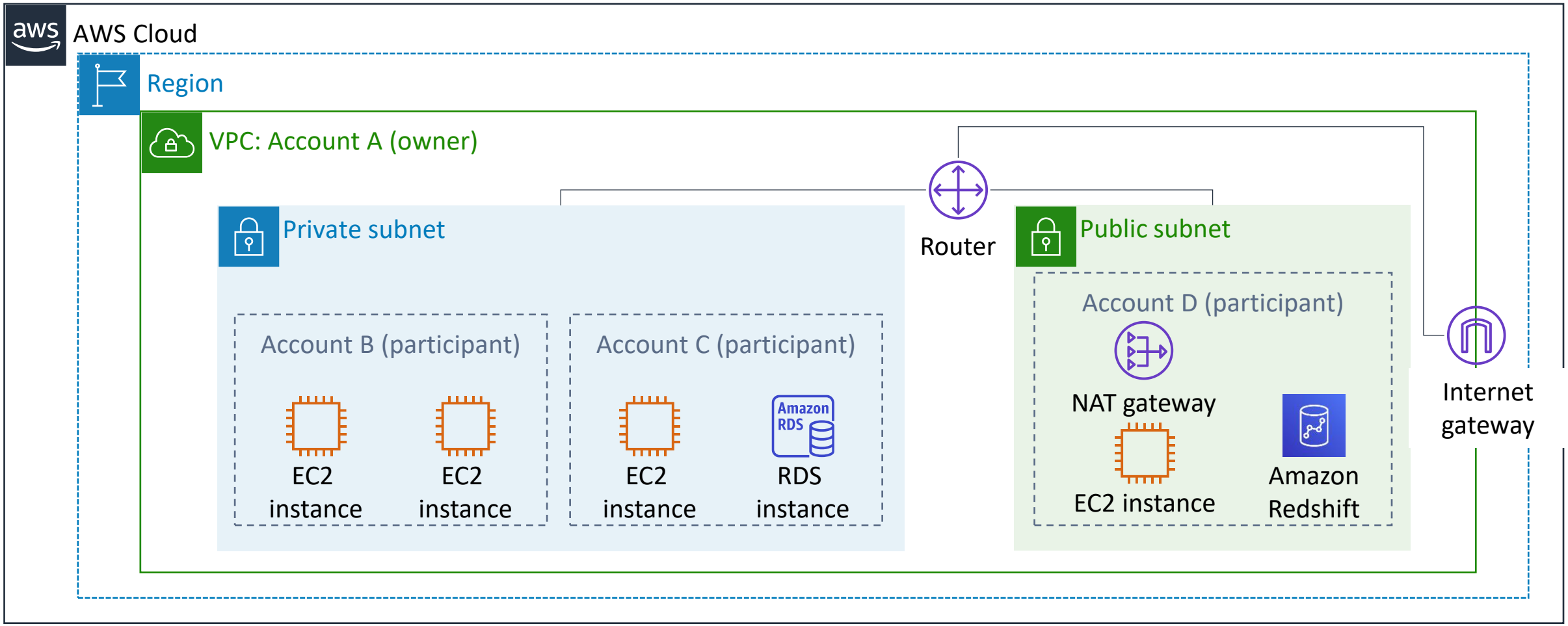
Public Subnet Route Table

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	igw-id

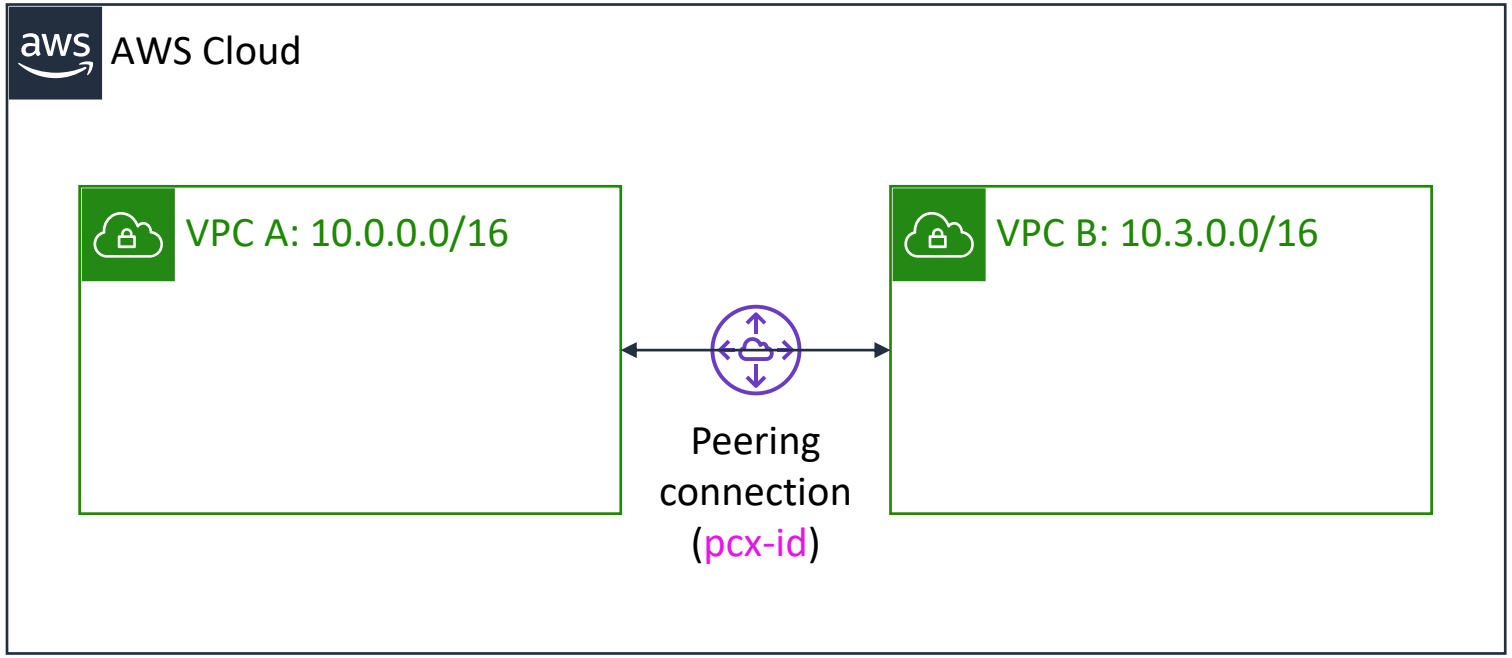
Private Subnet Route Table

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	nat-gw-id

VPC sharing



VPC peering



Route Table for VPC A

Destination	Target
10.0.0.0/16	local
10.3.0.0/16	pcx-id

Route Table for VPC B

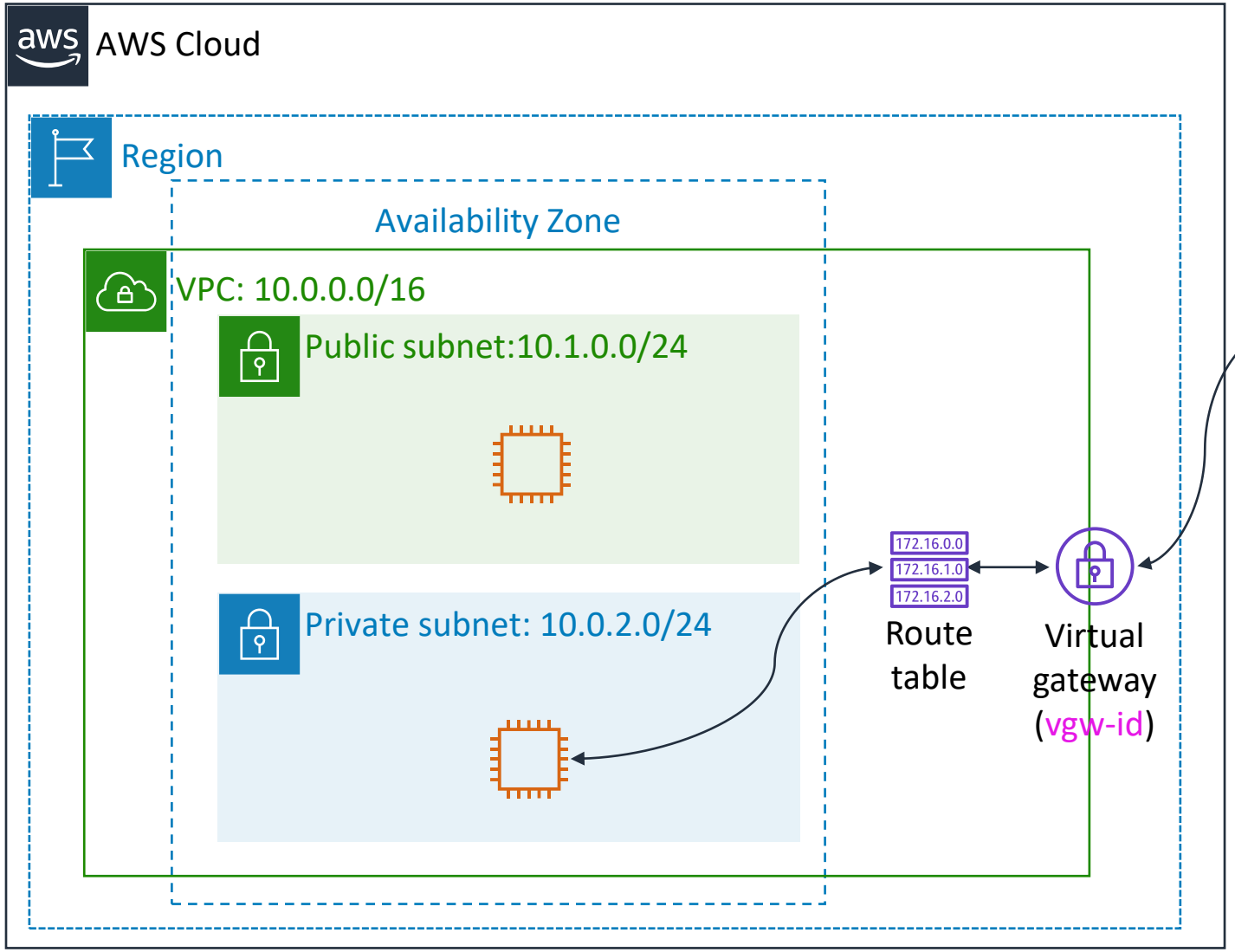
Destination	Target
10.3.0.0/16	local
10.0.0.0/16	pcx-id

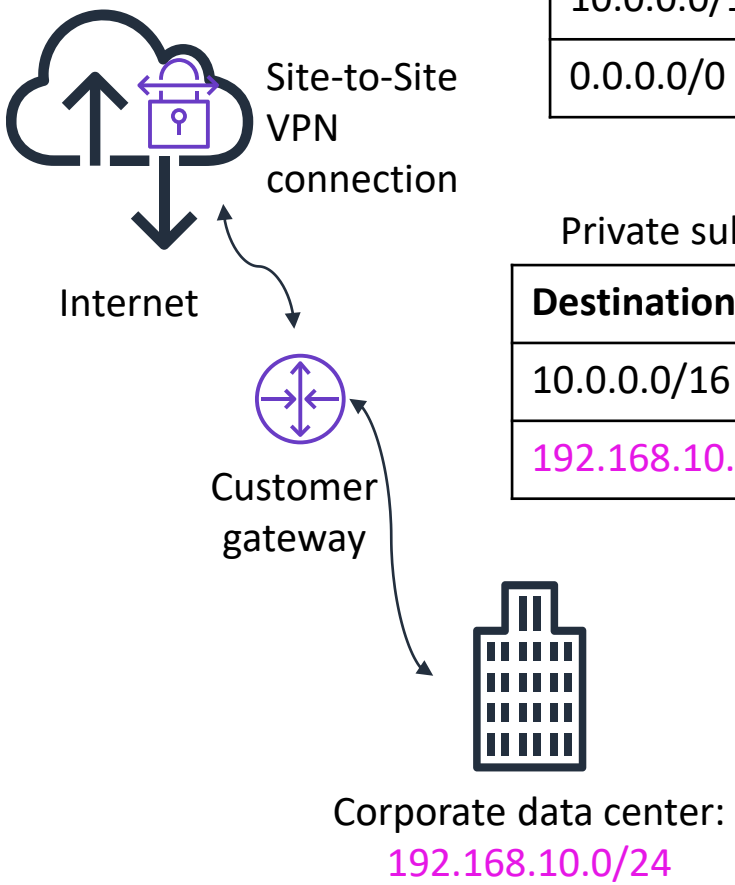
You can connect VPCs in your own AWS account, between AWS accounts, or between AWS Regions.

Restrictions:

- IP spaces cannot overlap.
- Transitive peering is not supported.
- You can only have one peering resource between the same two VPCs.

AWS Site-to-Site VPN





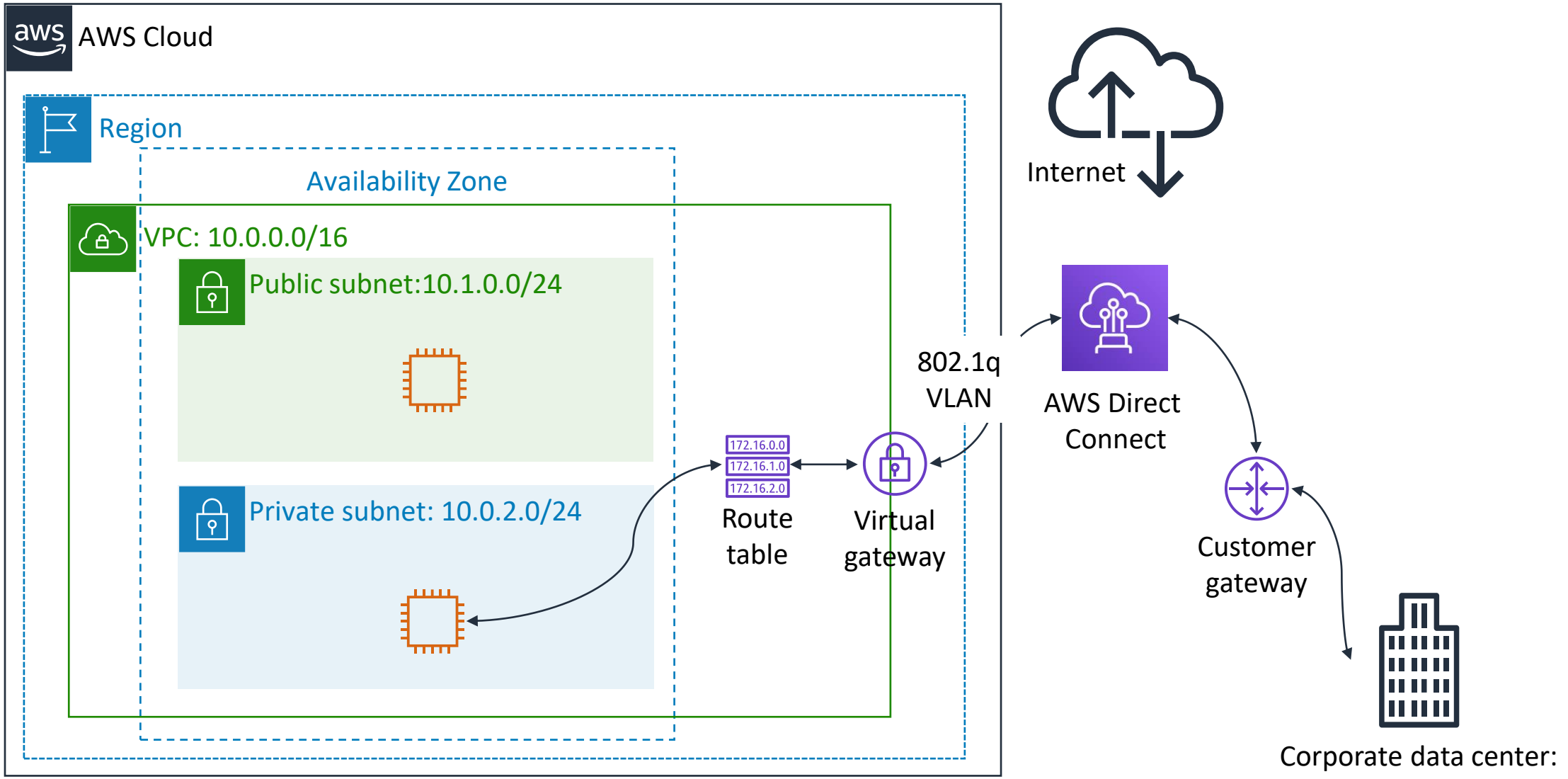
Public subnet route table

Destination	Target
10.0.0.0/16	local
0.0.0.0/0	igw-id

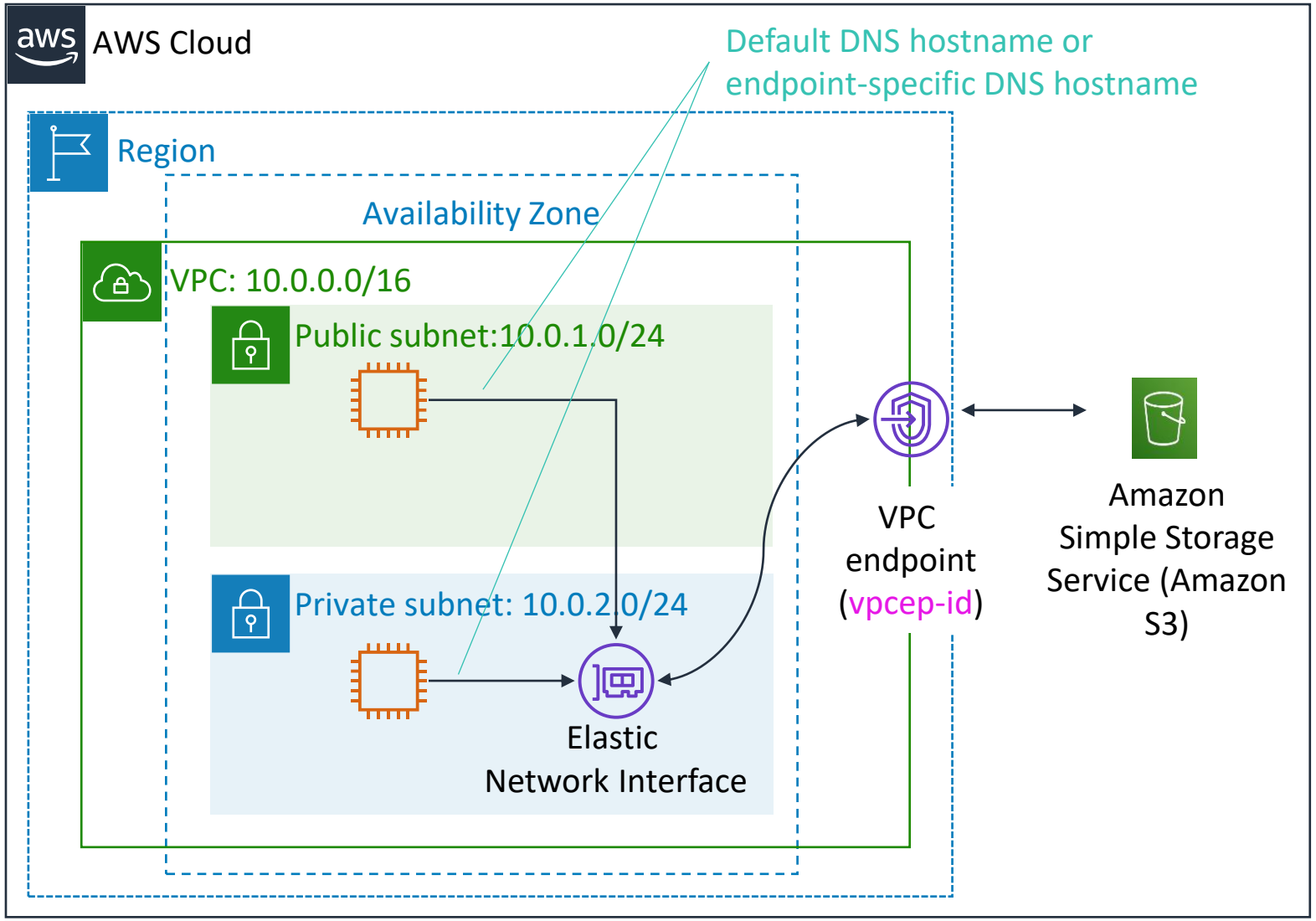
Private subnet route table

Destination	Target
10.0.0.0/16	local
192.168.10.0/24	vgw-id

AWS Direct Connect



VPC endpoints



Public Subnet Route Table

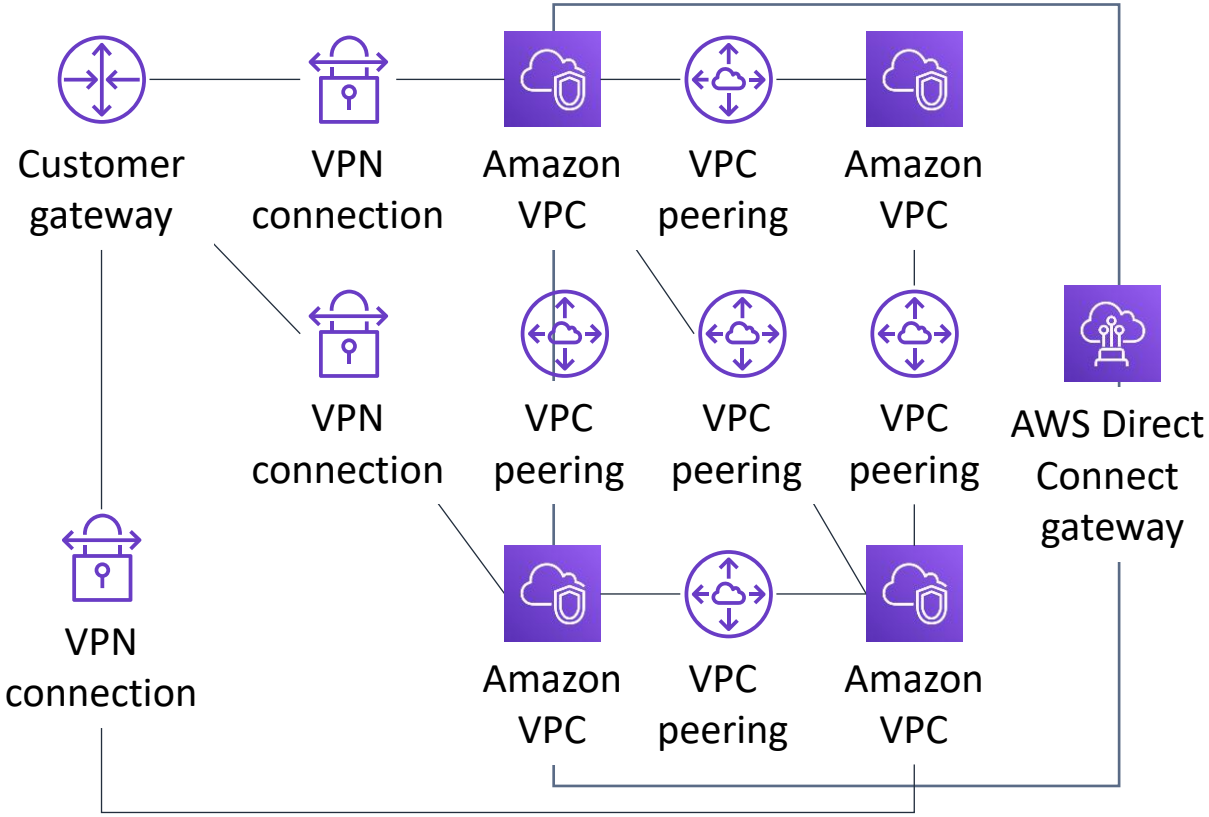
Destination	Target
10.0.0.0/16	local
Amazon S3 ID	vpcep-id

Two types of endpoints:

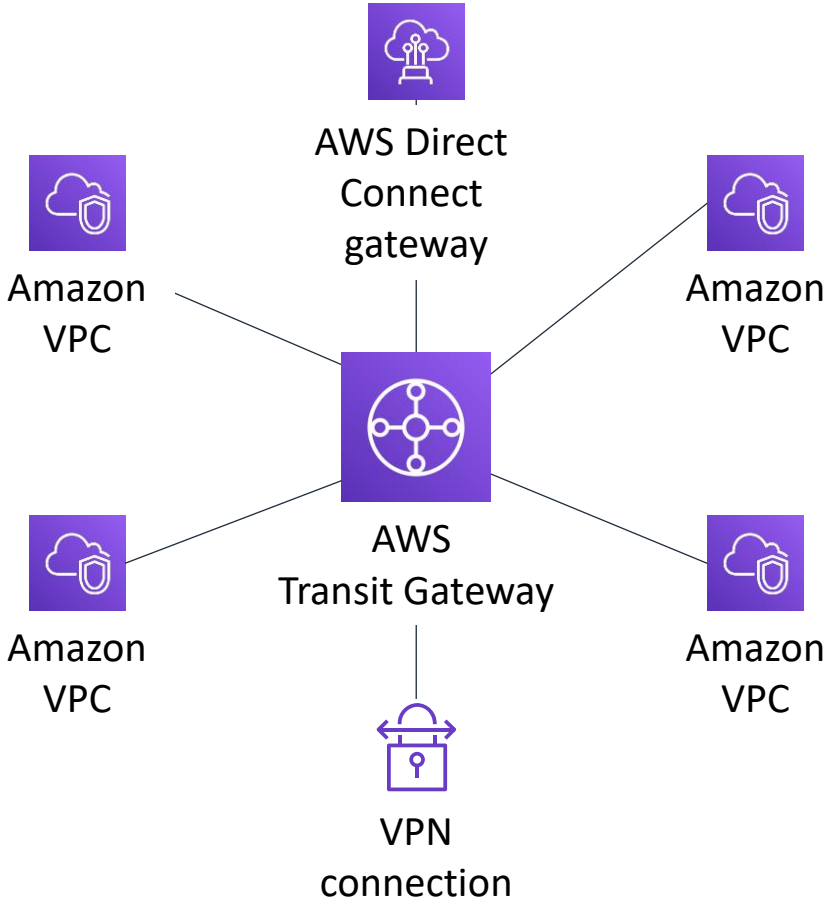
- **Interface** endpoints (powered by AWS PrivateLink)
- **Gateway** endpoints (Amazon S3 and Amazon DynamoDB)

AWS Transit Gateway

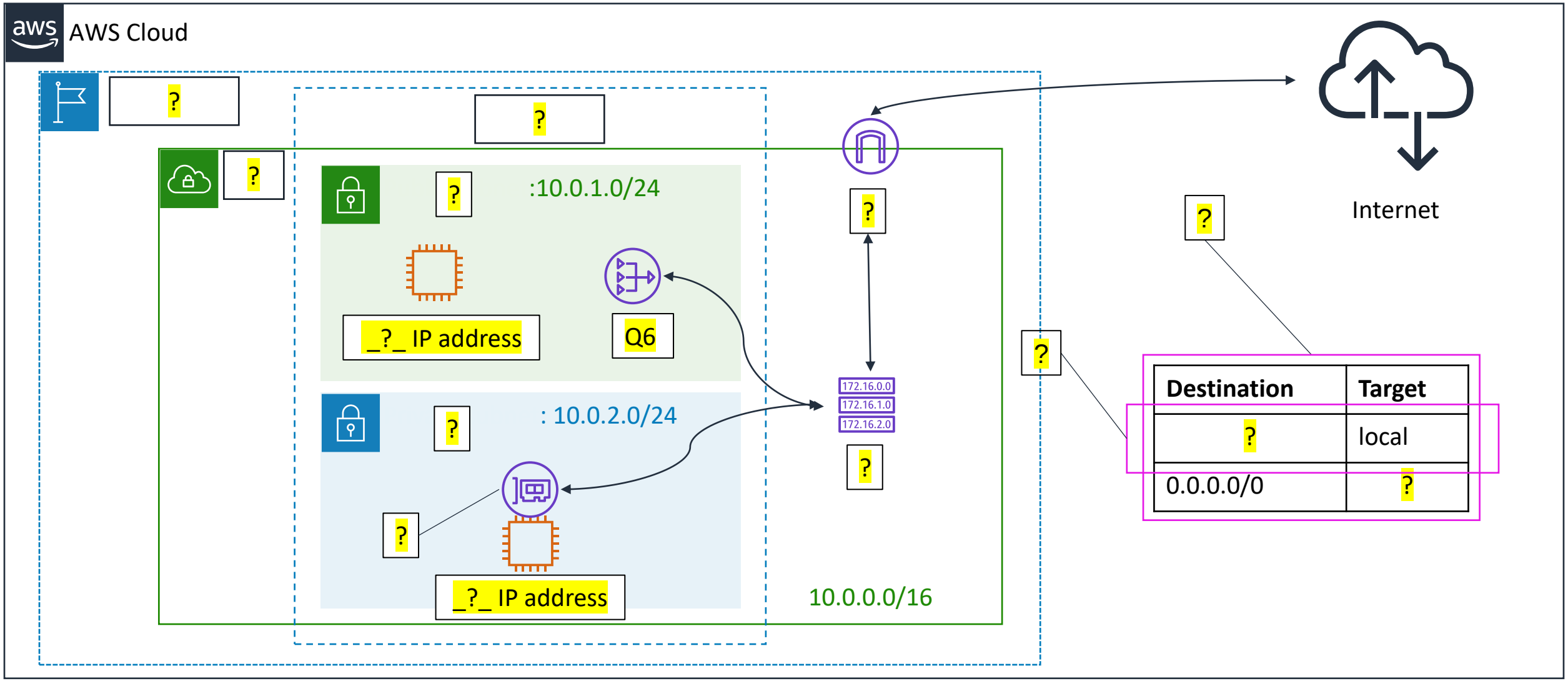
From this…



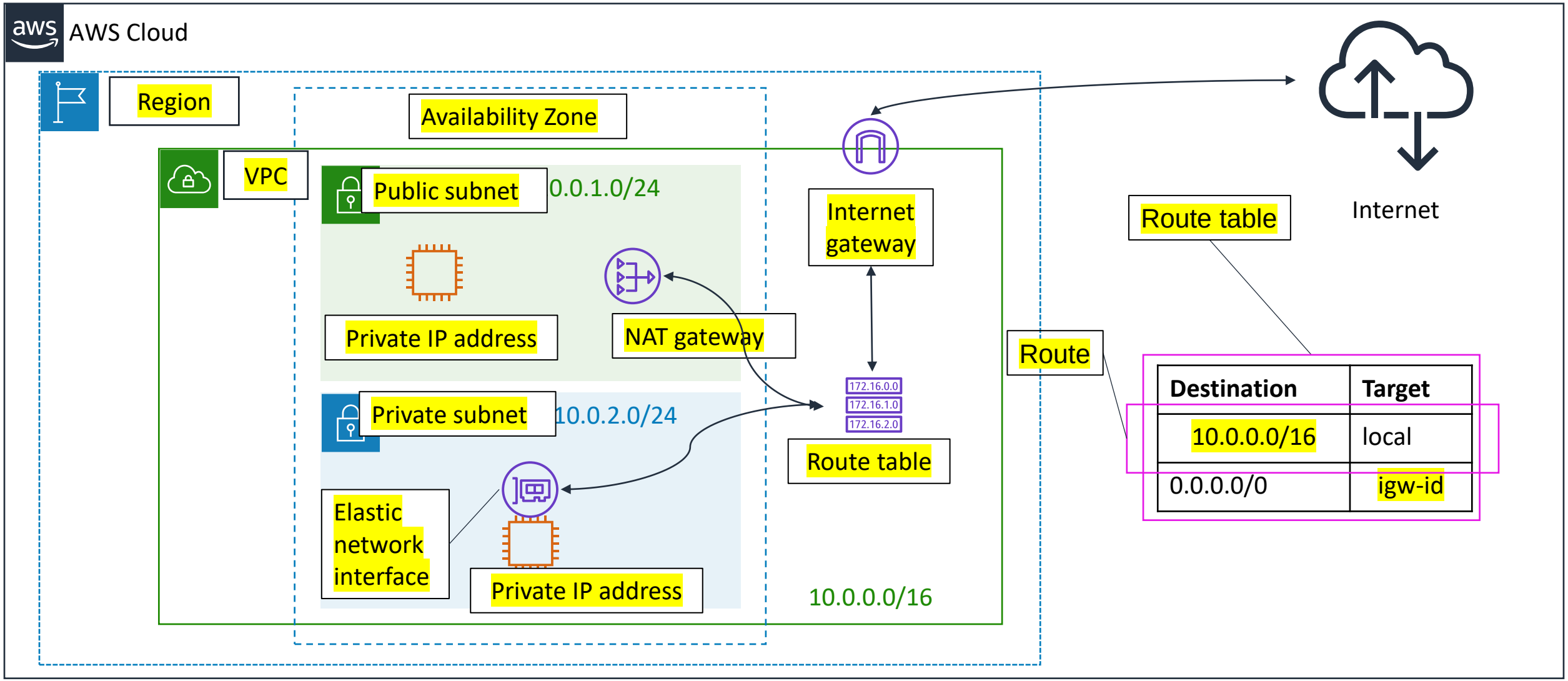
To this…



Activity: Label this network diagram



Activity: Solution



Recorded Amazon VPC demonstration

Section 3 key takeaways

- There are several VPC networking options, which include:
  - Internet gateway
  - NAT gateway
  - VPC endpoint
  - VPC peering
  - VPC sharing
  - AWS Site-to-Site VPN
  - AWS Direct Connect
  - AWS Transit Gateway
- You can use the VPC Wizard to implement your design.