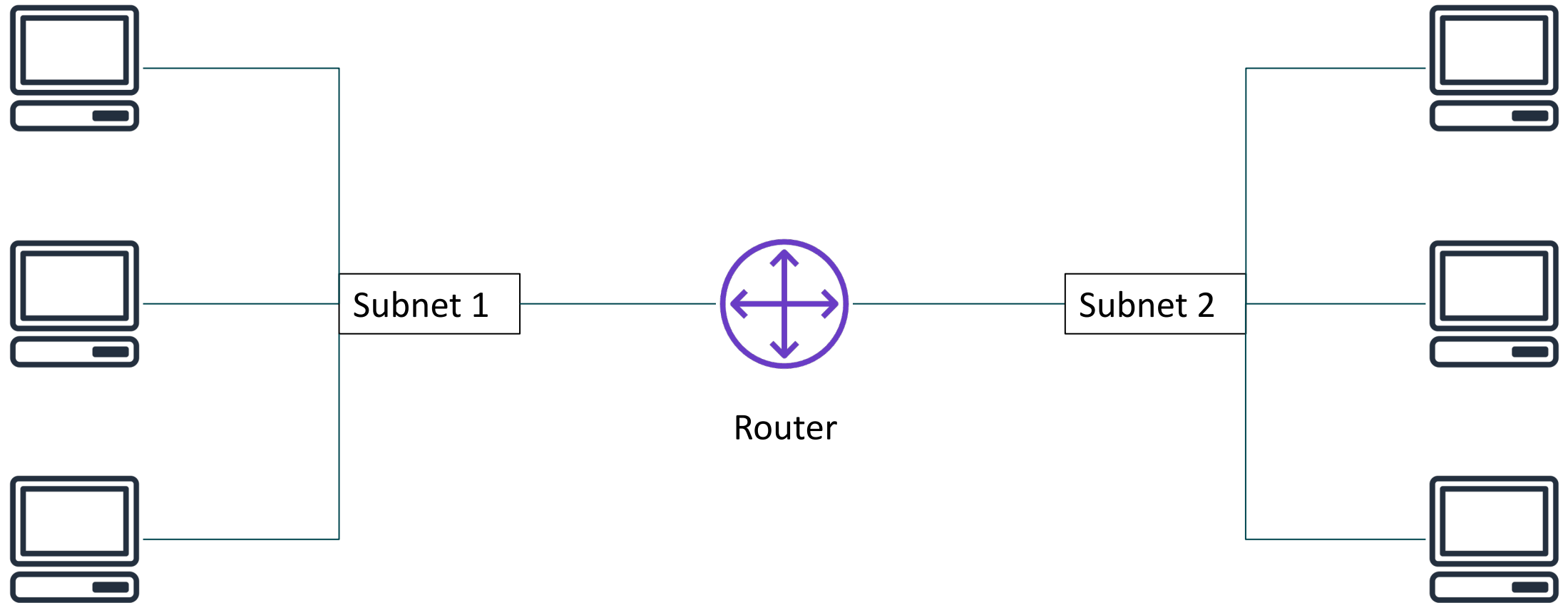




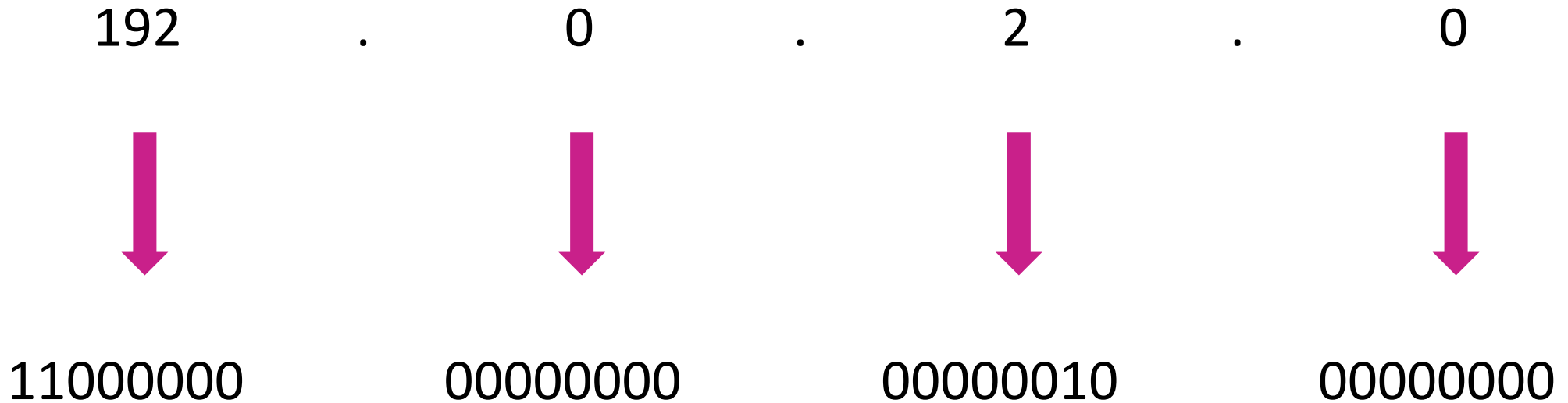
Module 5: Networking and Content Delivery

AWS Academy Cloud Foundations

Networks



IP addresses



IPv4 and IPv6 addresses

IPv4 (32-bit) address: 192.0.2.0

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

Classless Inter-Domain Routing (CIDR)

Network identifier (routing prefix)

192 . 0 . 2



11000000

Fixed



00000000

Fixed



00000010

Fixed

Host identifier

. 0 /



00000000
to 11111111

Flexible

24

Tells you how
many bits are
fixed

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	<ul style="list-style-type: none">• Ensures that the application layer can read the data• Encryption	ASCII, 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)

Section 2: Amazon VPC

Module 5: Networking and Content Delivery

Amazon VPC

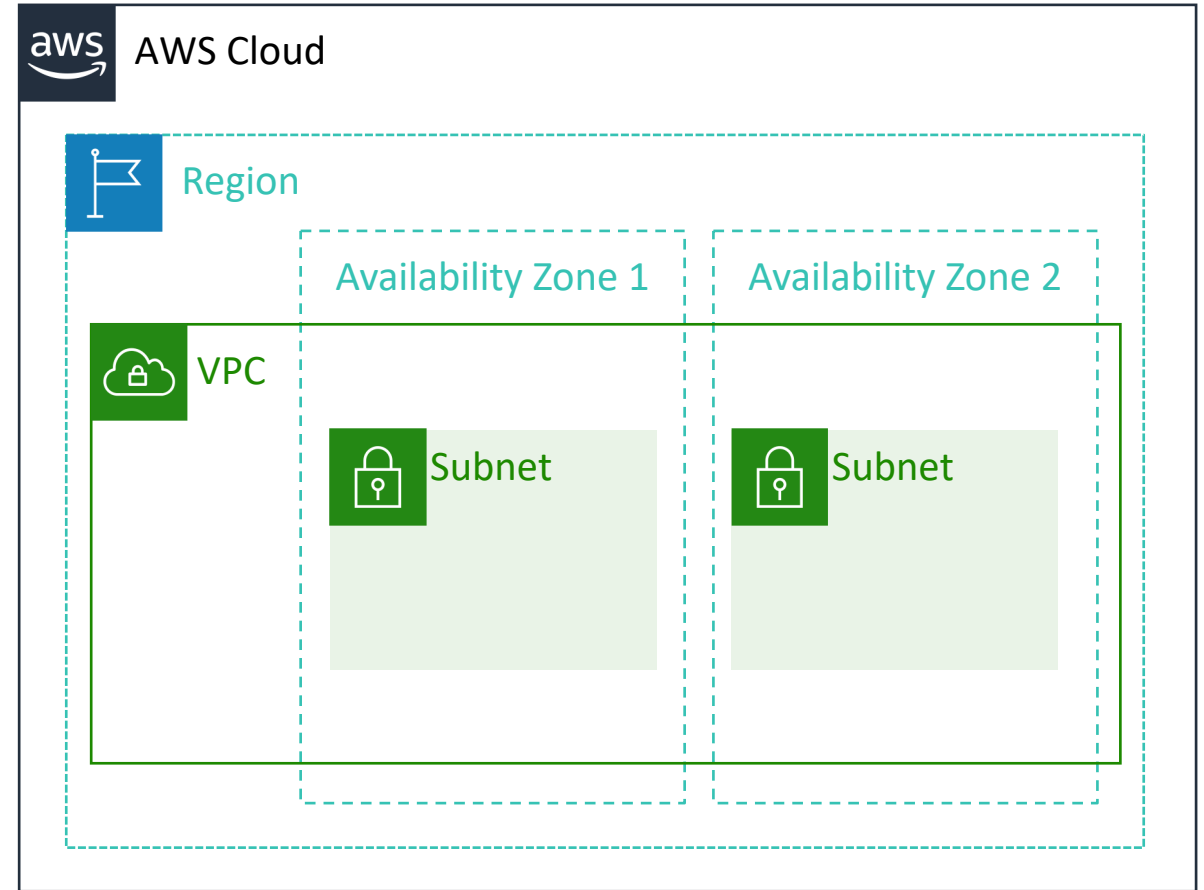


Amazon VPC

- 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

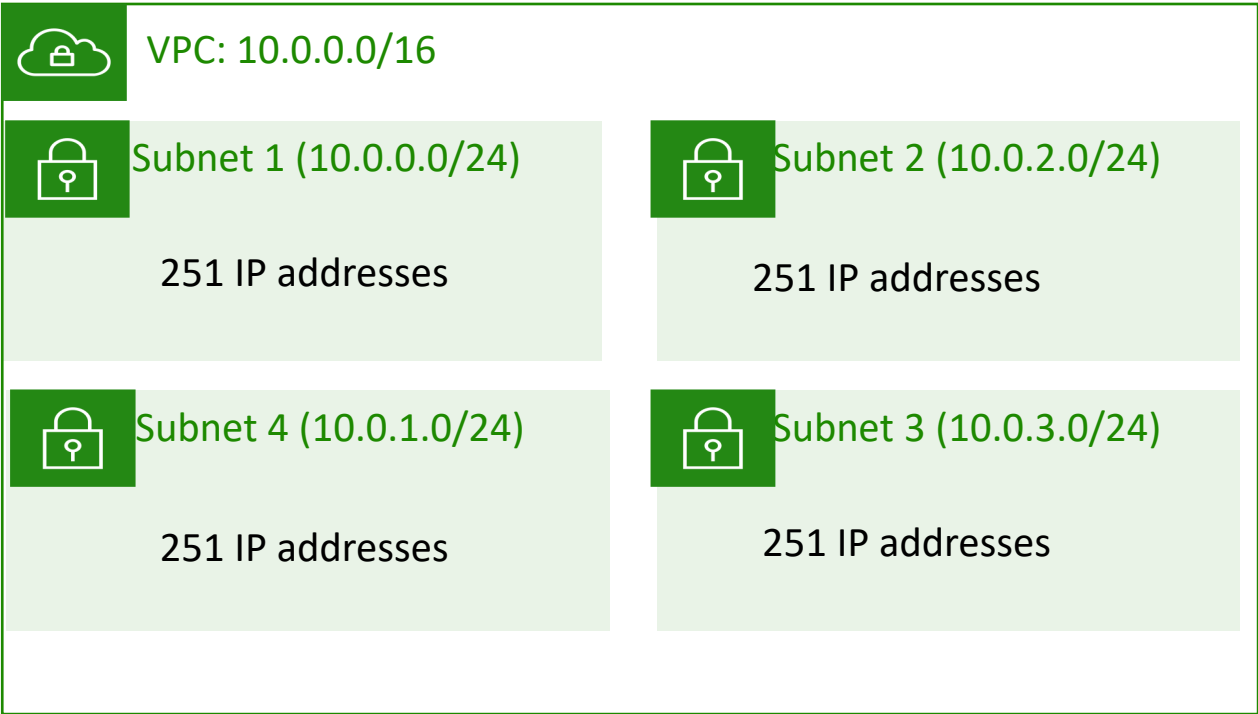
- When you create a VPC, you assign it to an IPv4 **CIDR block** (range of **private** IPv4 addresses).
- You **cannot change the address range** after you create the VPC.
- The **largest** IPv4 CIDR block size is **/16**.
- The **smallest** IPv4 CIDR block size is **/28**.
- IPv6 is also supported (with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

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

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

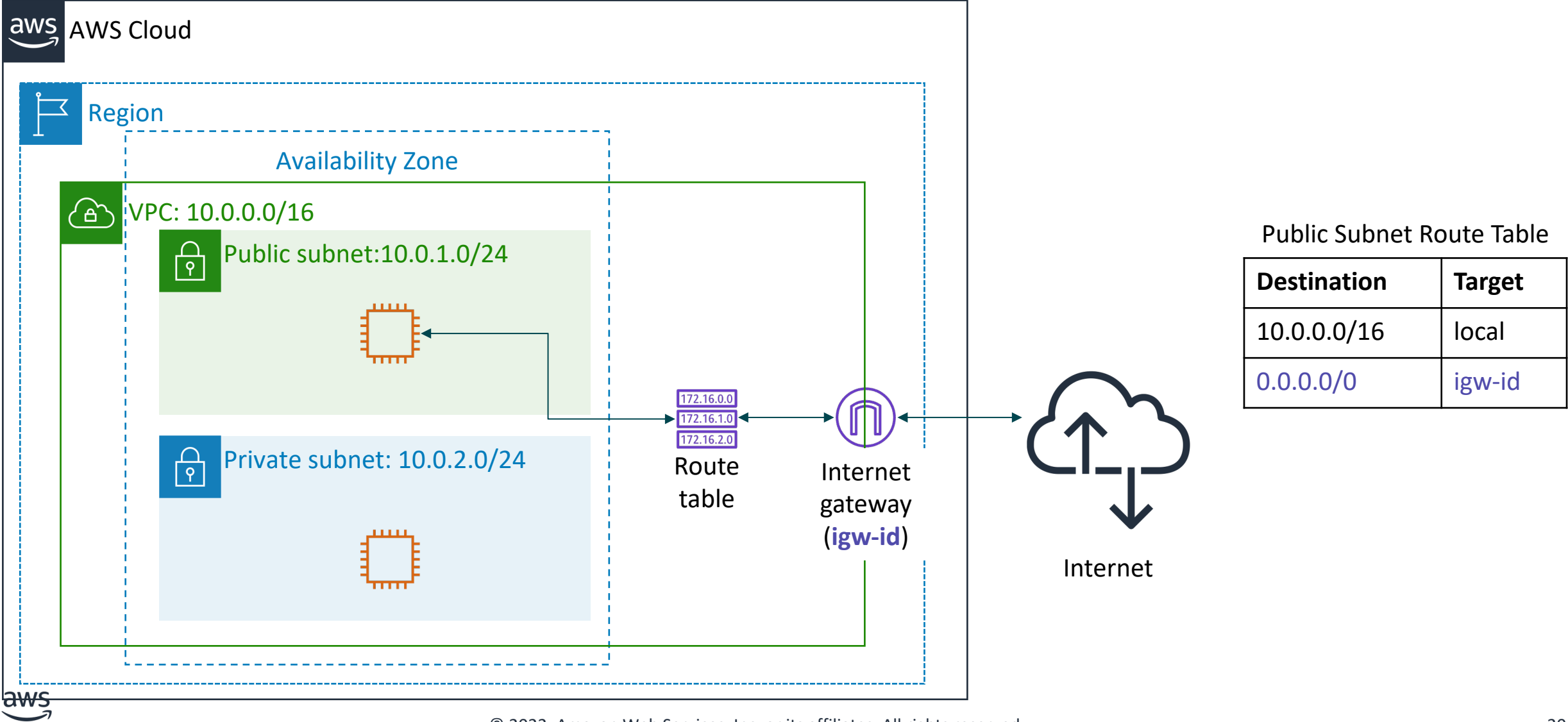
Destination	Target
10.0.0.0/16	local

VPC CIDR block

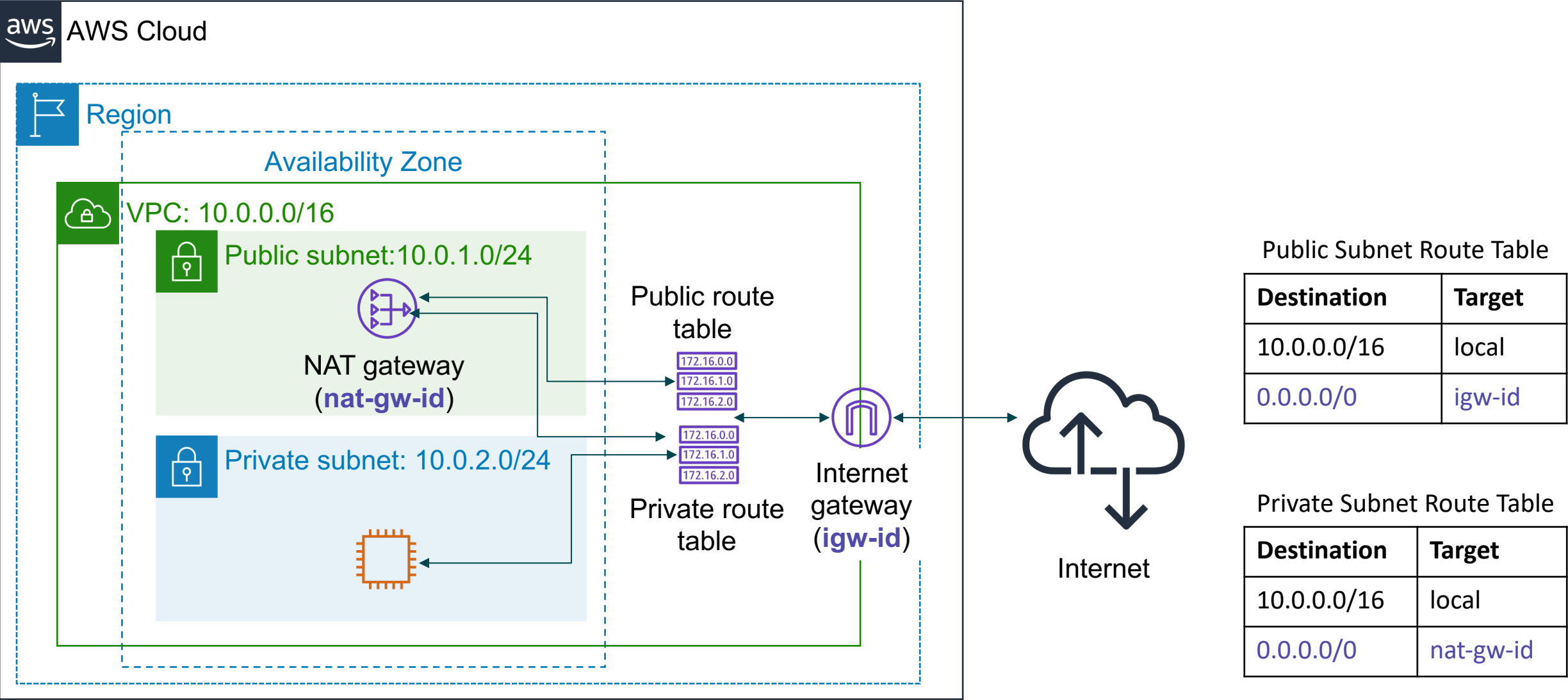
Section 3: VPC networking

Module 5: Networking and Content Delivery

Internet gateway



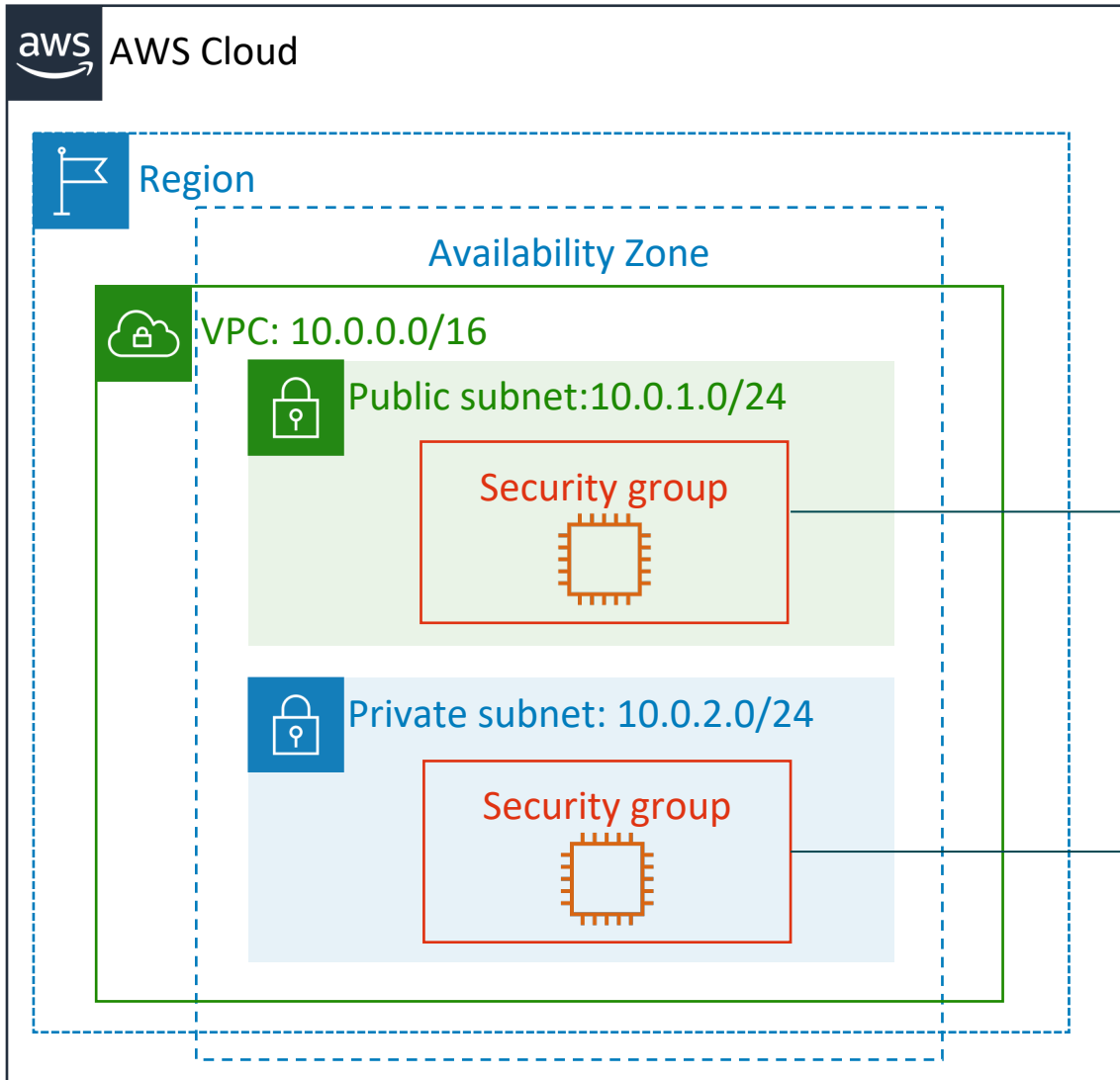
Network address translation (NAT) gateway



Section 4: VPC security

Module 5: Networking and Content Delivery

Security groups (1 of 2)



Security groups act at the **instance level**.

Security groups (2 of 2)

- Security groups have **rules** that control inbound and outbound instance traffic.
- Default security groups **deny all inbound** traffic and **allow all outbound** traffic.
- Security groups are **stateful**.

Inbound			
Source	Protocol	Port Range	Description
sg-xxxxxxx	All	All	Allow inbound traffic from network interfaces assigned to the same security group.

Outbound			
Destination	Protocol	Port Range	Description
0.0.0.0/0	All	All	Allow all outbound IPv4 traffic.
::/0	All	All	Allow all outbound IPv6 traffic.

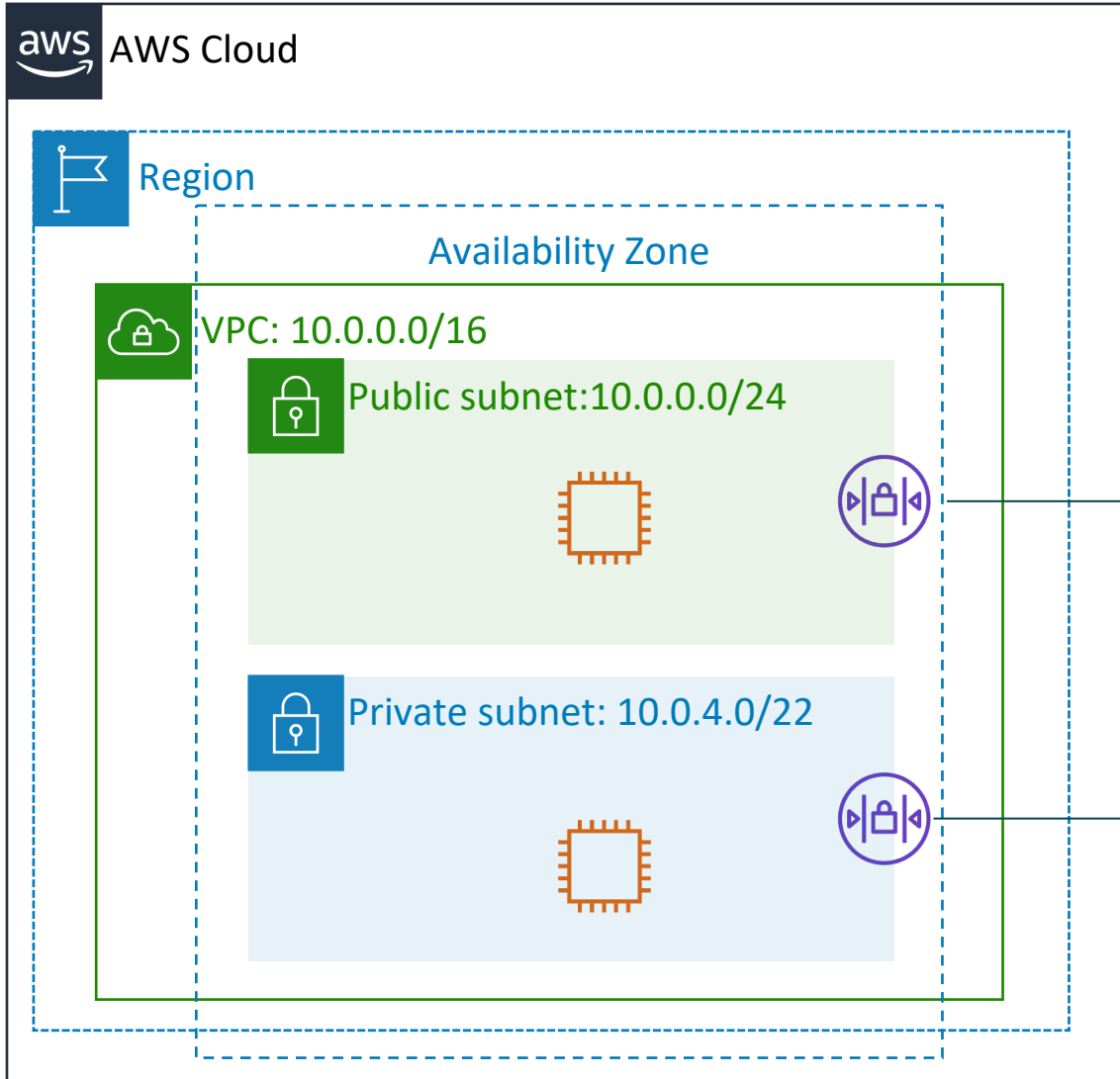
Custom security group examples

- You can **specify allow** rules, but not deny rules.
- **All rules are evaluated** before the decision to allow traffic.

Inbound			
Source	Protocol	Port Range	Description
0.0.0.0/0	TCP	80	Allow inbound HTTP access from all IPv4 addresses
0.0.0.0/0	TCP	443	Allow inbound HTTPS access from all IPv4 addresses
Your network's public IPv4 address range	TCP	22	Allow inbound SSH access to Linux instances from IPv4 IP addresses in your network (over the internet gateway)

Outbound			
Destination	Protocol	Port Range	Description
The ID of the security group for your Microsoft SQL Server database servers	TCP	1433	Allow outbound Microsoft SQL Server access to instances in the specified security group

Network access control lists (network ACLs 1 of 2)



Network ACLs act at the **subnet level**.

Network access control lists (network ACLs 2 of 2)

- A network ACL has **separate inbound and outbound rules**, and each rule can either **allow or deny traffic**.
- **Default** network ACLs **allow** all inbound and outbound IPv4 traffic.
- Network ACLs are **stateless**.

Inbound					
Rule	Type	Protocol	Port Range	Source	Allow/Deny
100	All IPv4 traffic	All	All	0.0.0.0/0	ALLOW
*	All IPv4 traffic	All	All	0.0.0.0/0	DENY

Outbound					
Rule	Type	Protocol	Port Range	Destination	Allow/Deny
100	All IPv4 traffic	All	All	0.0.0.0/0	ALLOW
*	All IPv4 traffic	All	All	0.0.0.0/0	DENY

Custom network ACLs examples

- **Custom** network ACLs **deny** all inbound and outbound traffic until you add rules.
- You can specify **both allow and deny** rules.
- Rules are evaluated in number order, starting with the **lowest number**.

Inbound					
Rule	Type	Protocol	Port Range	Source	Allow/Deny
100	HTTPS	TCP	443	0.0.0.0/0	ALLOW
120	SSH	TCP	22	192.0.2.0/24	ALLOW
*	All IPv4 traffic	All	All	0.0.0.0/0	DENY

Outbound					
Rule	Type	Protocol	Port Range	Destination	Allow/Deny
100	HTTPS	TCP	443	0.0.0.0/0	ALLOW
120	SSH	TCP	22	192.0.2.0/24	ALLOW
*	All IPv4 traffic	All	All	0.0.0.0/0	DENY

Security groups versus network ACLs

Attribute	Security Groups	Network ACLs
Scope	Instance level	Subnet level
Supported Rules	Allow rules only	Allow and deny rules
State	Stateful (return traffic is automatically allowed, regardless of rules)	Stateless (return traffic must be explicitly allowed by rules)
Order of Rules	All rules are evaluated before decision to allow traffic	Rules are evaluated in number order before decision to allow traffic

Section 5: Amazon Route 53

Module 5: Networking and Content Delivery

Amazon Route 53



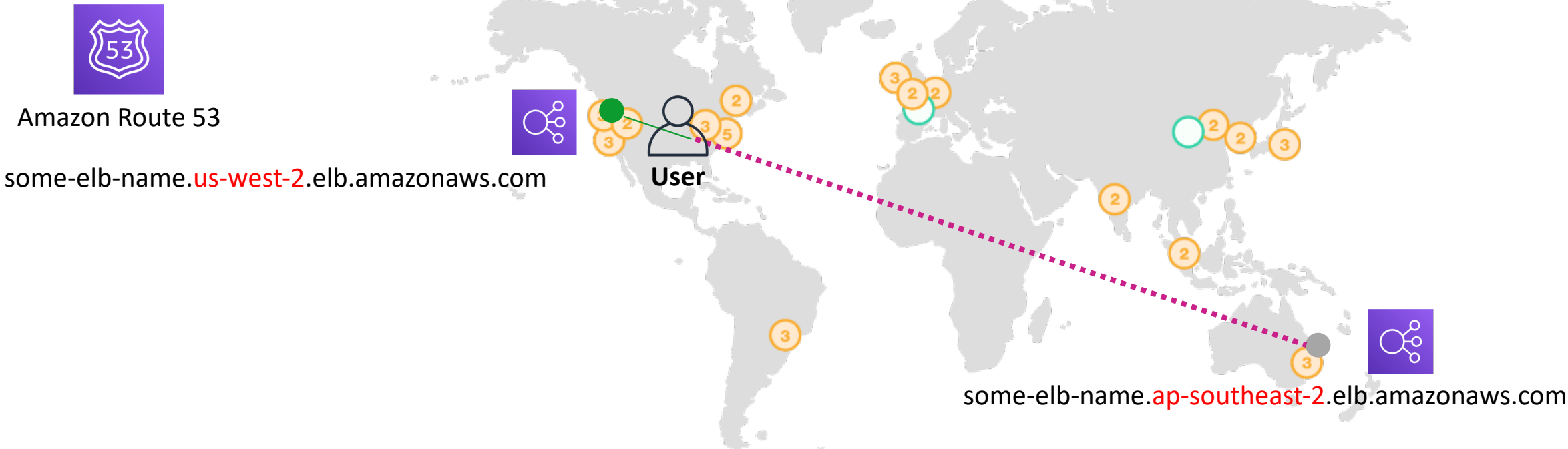
Amazon
Route 53

- Is a highly available and scalable Domain Name System (DNS) web service
- Is used to route end users to internet applications by translating names (like www.example.com) into numeric IP addresses (like *192.0.2.1*) that computers use to connect to each other
- Is fully compliant with IPv4 and IPv6
- Connects user requests to infrastructure running in AWS and also outside of AWS
- Is used to check the health of your resources
- Features traffic flow
- Enables you to register domain names

Amazon Route 53 supported routing

- **Simple routing** – Use in single-server environments
- **Weighted round robin routing** – Assign weights to resource record sets to specify the frequency
- **Latency routing** – Help improve your global applications
- **Geolocation routing** – Route traffic based on location of your users
- **Geoproximity routing** – Route traffic based on location of your resources
- **Failover routing** – Fail over to a backup site if your primary site becomes unreachable
- **Multivalue answer routing** – Respond to DNS queries with up to eight healthy records selected at random

Use case: Multi-region deployment

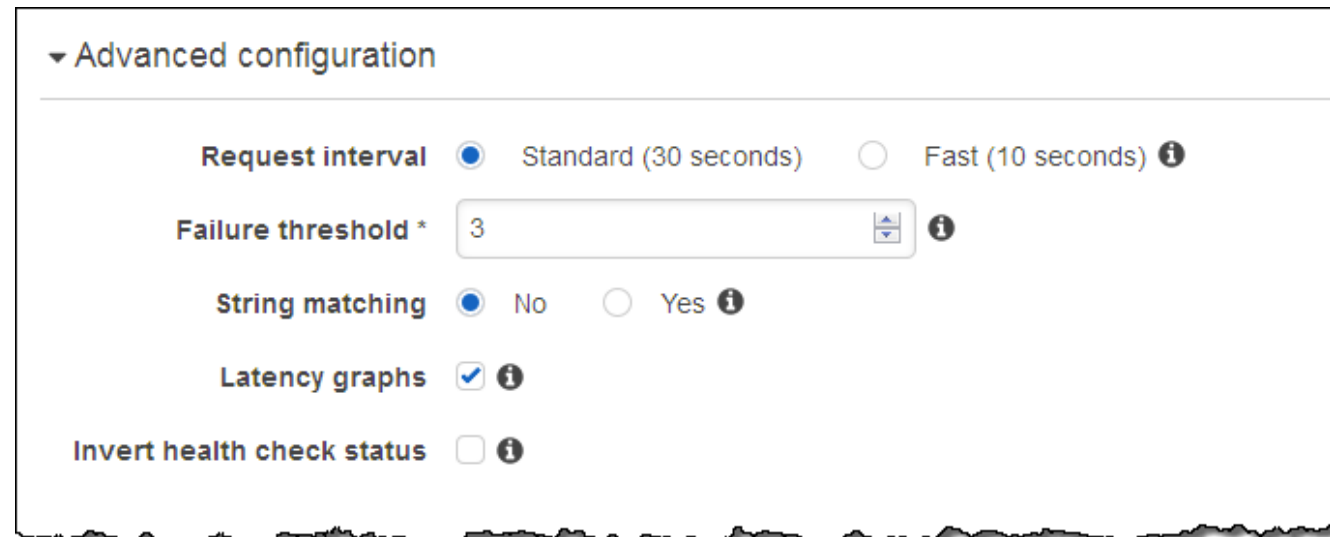


Name	Type	Value
example.com	ALIAS	some-elb-name.us-west-2.elb.amazonaws.com
example.com	ALIAS	some-elb-name.ap-southeast-2.elb.amazonaws.com

Amazon Route 53 DNS failover

Improve the availability of your applications that run on AWS by:

- Configuring backup and failover scenarios for your own applications
- Enabling highly available multi-region architectures on AWS
- Creating health checks



▼ Advanced configuration

Request interval ☒ Standard (30 seconds) ☐ Fast (10 seconds) ⓘ

Failure threshold * ⓘ

String matching ☒ No ☐ Yes ⓘ

Latency graphs ☒ ⓘ

Invert health check status ☐ ⓘ

DNS failover for a multi-tiered web application

Record Sets CNAME www

elastic_load_balancer
Routing Policy = Failover
Record Type = Primary

Amazon S3 website
Routing Policy = Failover
Record Type = Secondary



User



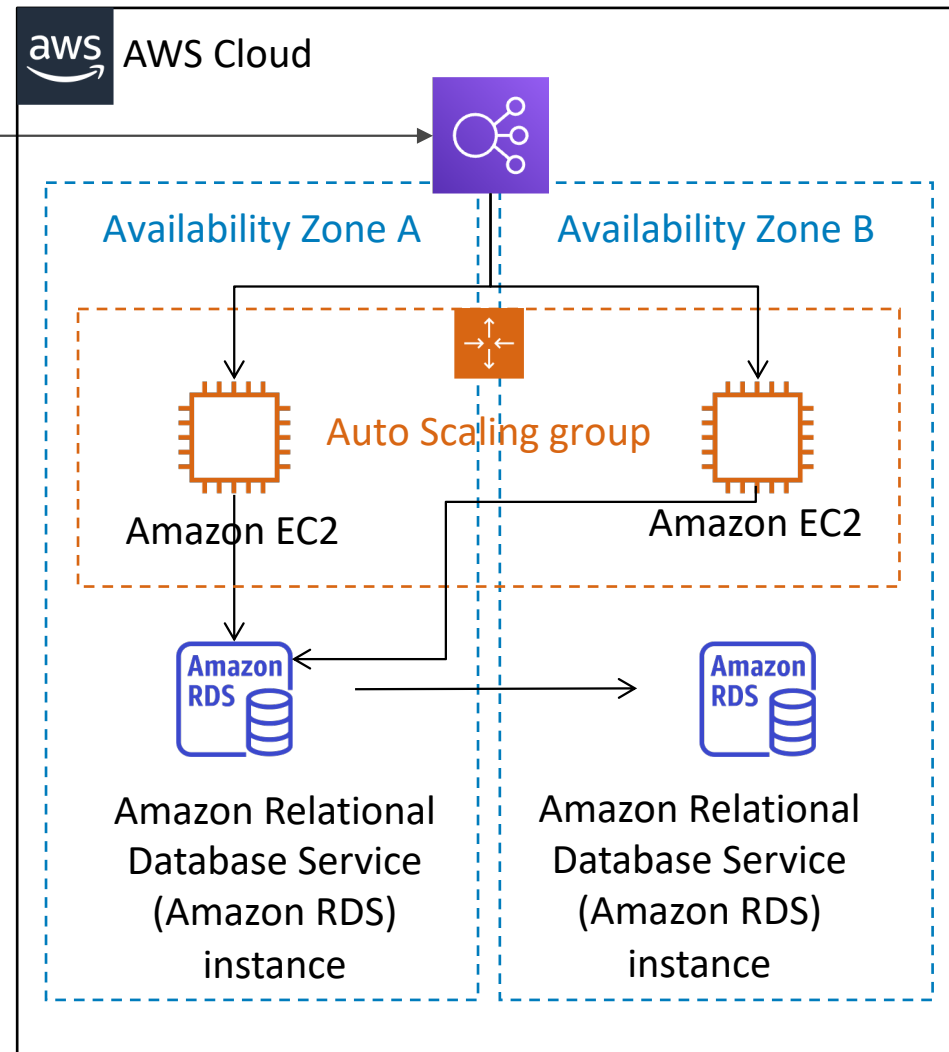
Amazon Route
53

Primary

Secondary



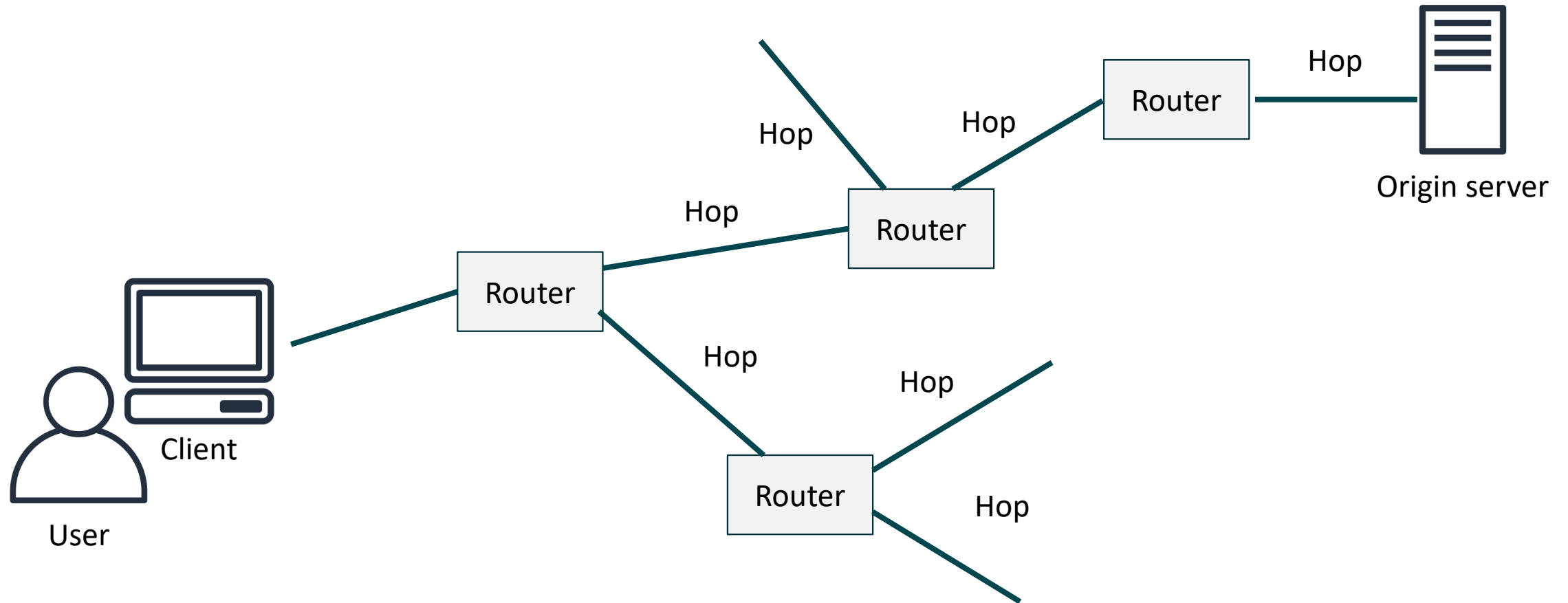
Amazon S3
static website



Section 6: Amazon CloudFront

Module 5: Networking and Content Delivery

Content delivery and network latency

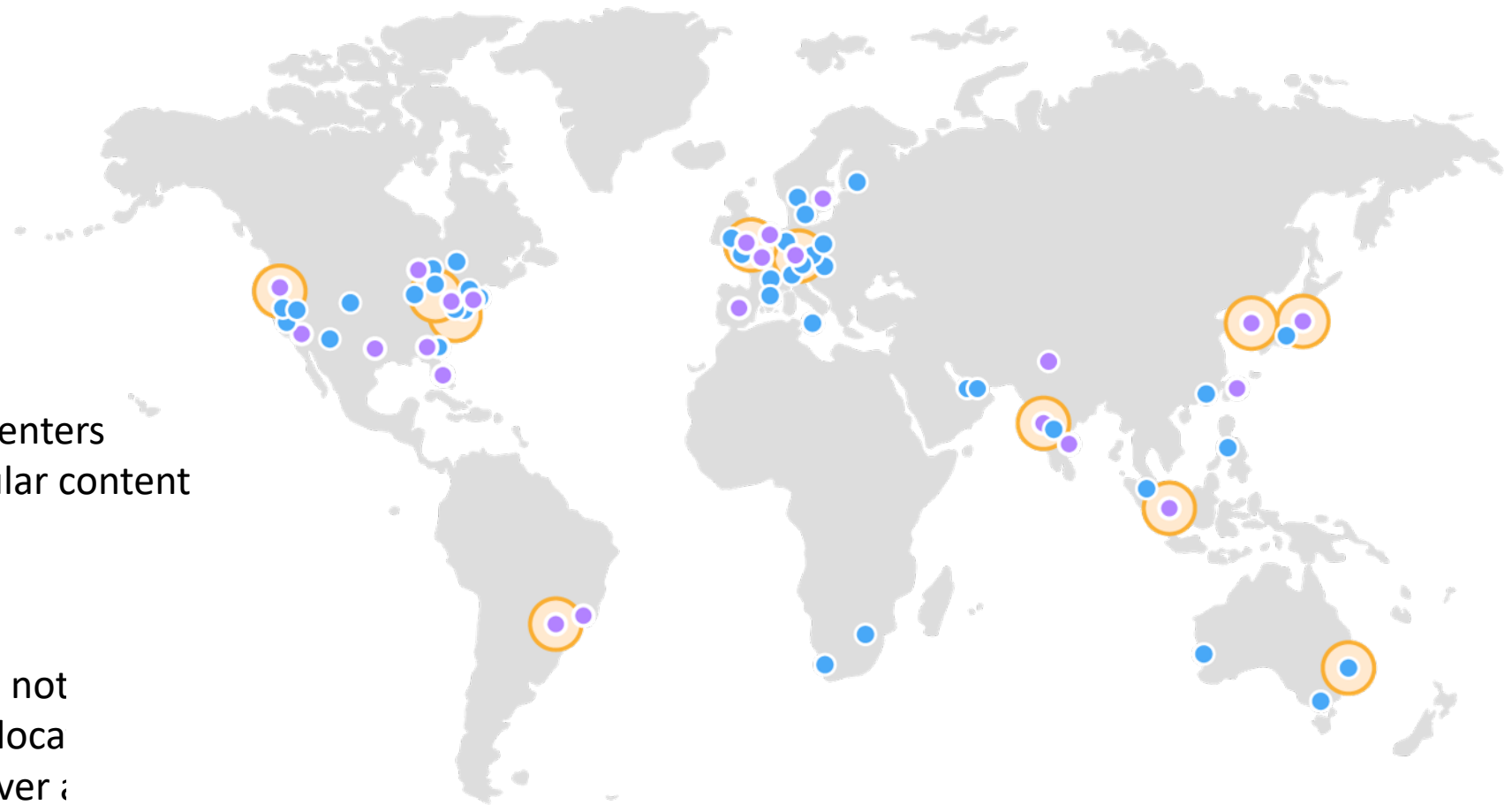


Content delivery network (CDN)

- Is a globally distributed system of caching servers
- Caches copies of commonly requested files (static content)
- Delivers a local copy of the requested content from a nearby cache edge or Point of Presence
- Accelerates delivery of dynamic content
- Improves application performance and scaling

Amazon CloudFront infrastructure

- Edge locations
- Multiple edge locations
- Regional edge caches



- **Edge locations** – Network of data centers that CloudFront uses to serve popular content quickly to customers.
- **Regional edge cache** – CloudFront location that caches content that is not popular enough to stay at an edge location. It is located between the origin server and the global edge location.

Amazon CloudFront benefits

- Fast and global
- Security at the edge
- Highly programmable
- Deeply integrated with AWS
- Cost-effective