aws health

AWS Cloud Fundamentals

Beril Uenay
Associate Solutions Architect
Amazon Web Services

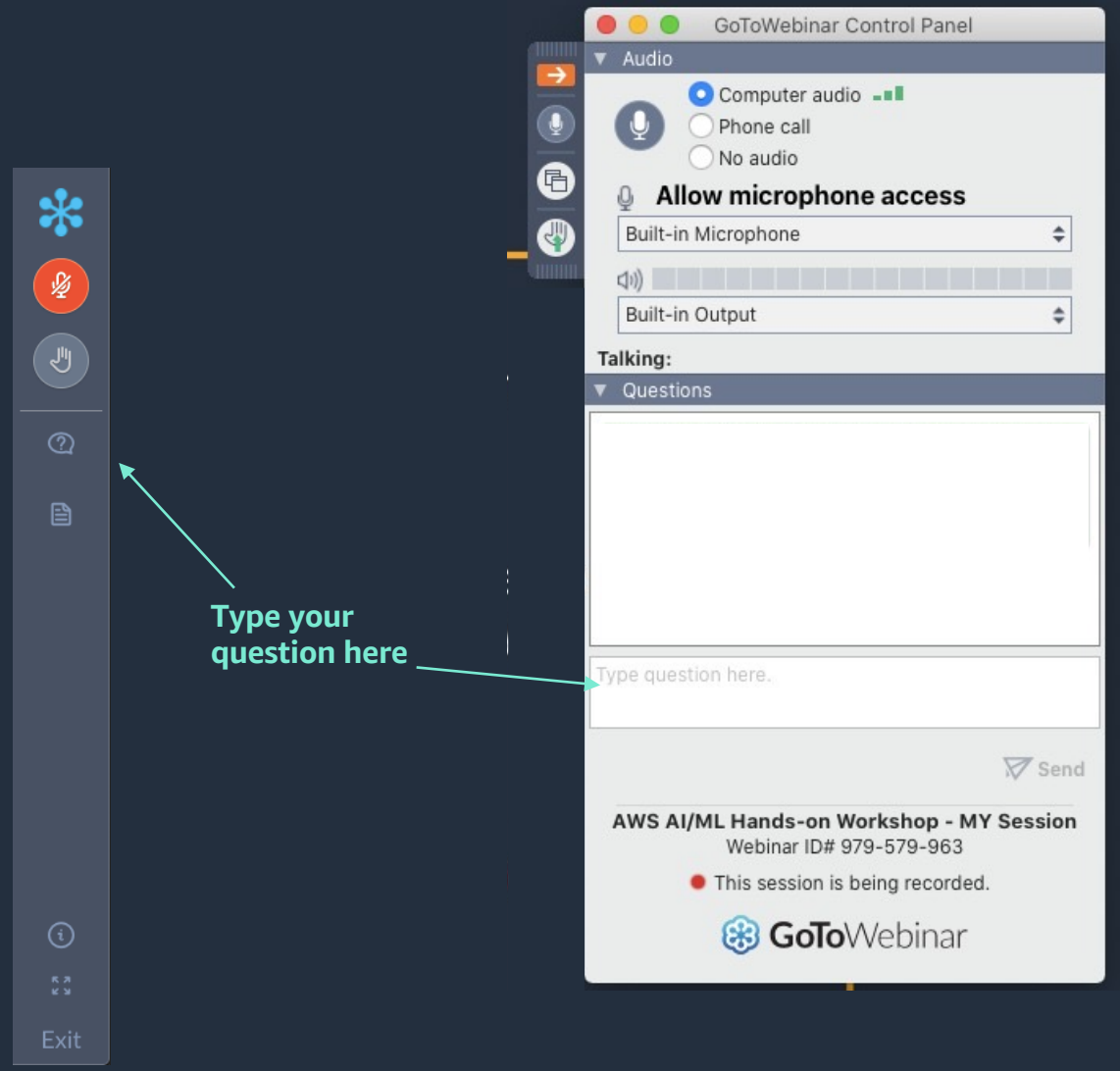
Monika Nowakowska
Associate Solutions Architect
Amazon Web Services

Manuel Gomez
Associate Solutions Architect
Amazon Web Services

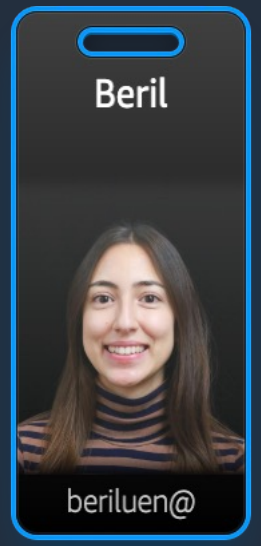
Questions & Answers

If you have any questions or encounter issues during the workshop, our support team is online.

You can submit your query in the GoToWebinar Questions function. To submit questions, select
“Send”

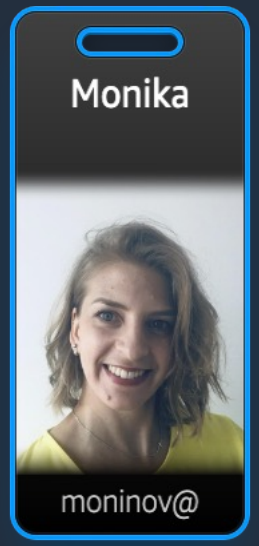


Your presenters today



Beril Uenay

beriluen@amazon.de



Monika Nowakowska

moninov@amazon.pl

Manuel Gomez

magomgom@amazon.at

Associate Solutions Architect
Amazon Web Services

Introduction to Amazon Cloud

Amazon EC2 Overview

Agenda

- Introduction to Amazon Cloud
- AWS Global Reach
- Amazon EC2 Overview
- Amazon EC2 Design

What is AWS?

AWS provides a highly reliable, scalable, low-cost infrastructure platform in the cloud that powers millions of businesses in over 245 countries and territories around the world.

Benefits

- Low Cost
- Elasticity & Agility
- Open & Flexible
- Secure
- Global Reach

What sets AWS apart?

Security	Fine-grained identity and access control; Build with the Highest Standards for Privacy and Data Security
Service Breadth & Depth; Pace of Innovation	200+ fully featured services to support any cloud workload; AWS released 3,332 significant features and services in 2022
Experience: 1M+ customers	Building and managing cloud since 2006
Global Footprint	99 Availability Zones within 31 geographic Regions, 34 Local Zones, 450+ Points of Presence and 13 regional edge caches in 90+ cities across 49 countries
Machine Learning	More machine learning happens on AWS than anywhere else. Machine learning in the hands of every developer and data scientist.
Ecosystem	100,000+ APN partners from over 150 countries. The AWS Marketplace 12,000+ Products across 65 Categories
Enterprise leader	AWS positioned as a Leader in the Gartner Magic Quadrant for Cloud Infrastructure and Platform Services

Pricing Philosophy

High volume / low margin businesses are in our core DNA

Trade capital expense for variable expense	Our economies of scale provide us with lower costs	Pricing model choice to support variable and stable workloads	Save more money as you grow bigger
Pay for what you use	129 price reductions since 2006	On-demand Savings Plans Reserved Instances Spot	Tiered pricing Volume discounts Custom pricing

Customer obsessed

90%

of roadmap originates with customer requests and are designed to meet specific needs

Nasdaq

"We were able to easily support the jump from 30 billion records to 70 billion records a day because of the flexibility and scalability of Amazon S3 and Amazon Redshift."

– **Robert Hunt,** Vice President of Software Engineering, Nasdaq

aws

It’s greener in the cloud.

AWS’s infrastructure is

3.6x more energy efficient

than the median of the surveyed U.S. enterprise data centers

AWS performs the same task with an

80% lower carbon footprint

Source: 451 Research, 2019, all rights reserved

Responsible water use

AWS has multiple initiatives to improve our water use efficiency for cooling data centers:

- Evaporative cooling
- Reduce potable water usage
- Recycled cooling water
- Invest in reclaimed water infrastructure

AWS has committed to being water positive by 2030. Our four pillars:

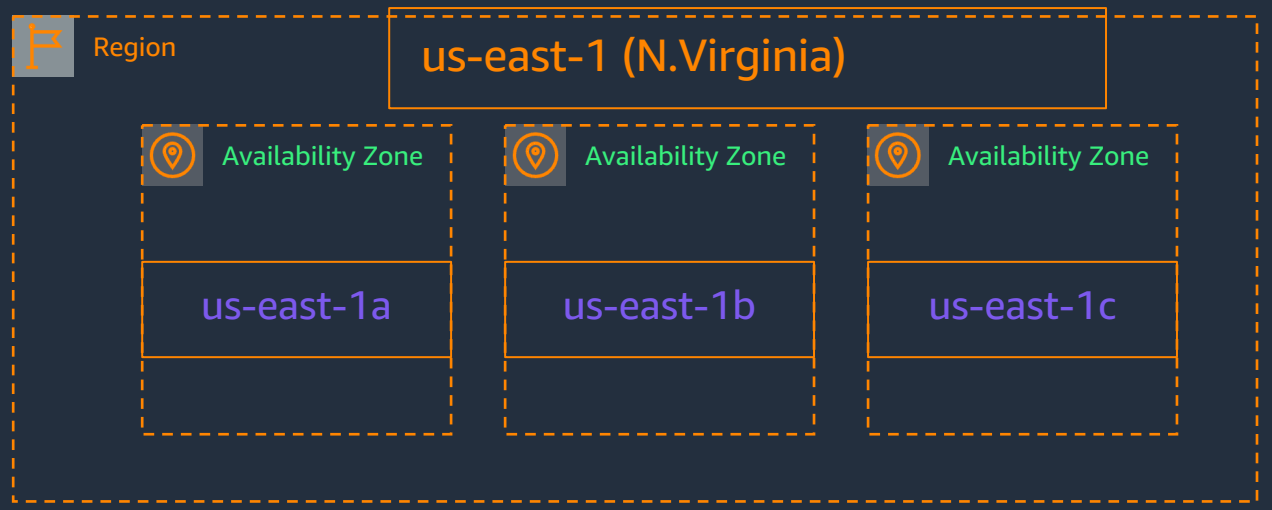
- Water efficiency
- Sustainable Sources
- Water reuse in communities
- Water replenishment

AWS Global Reach

31 Regions

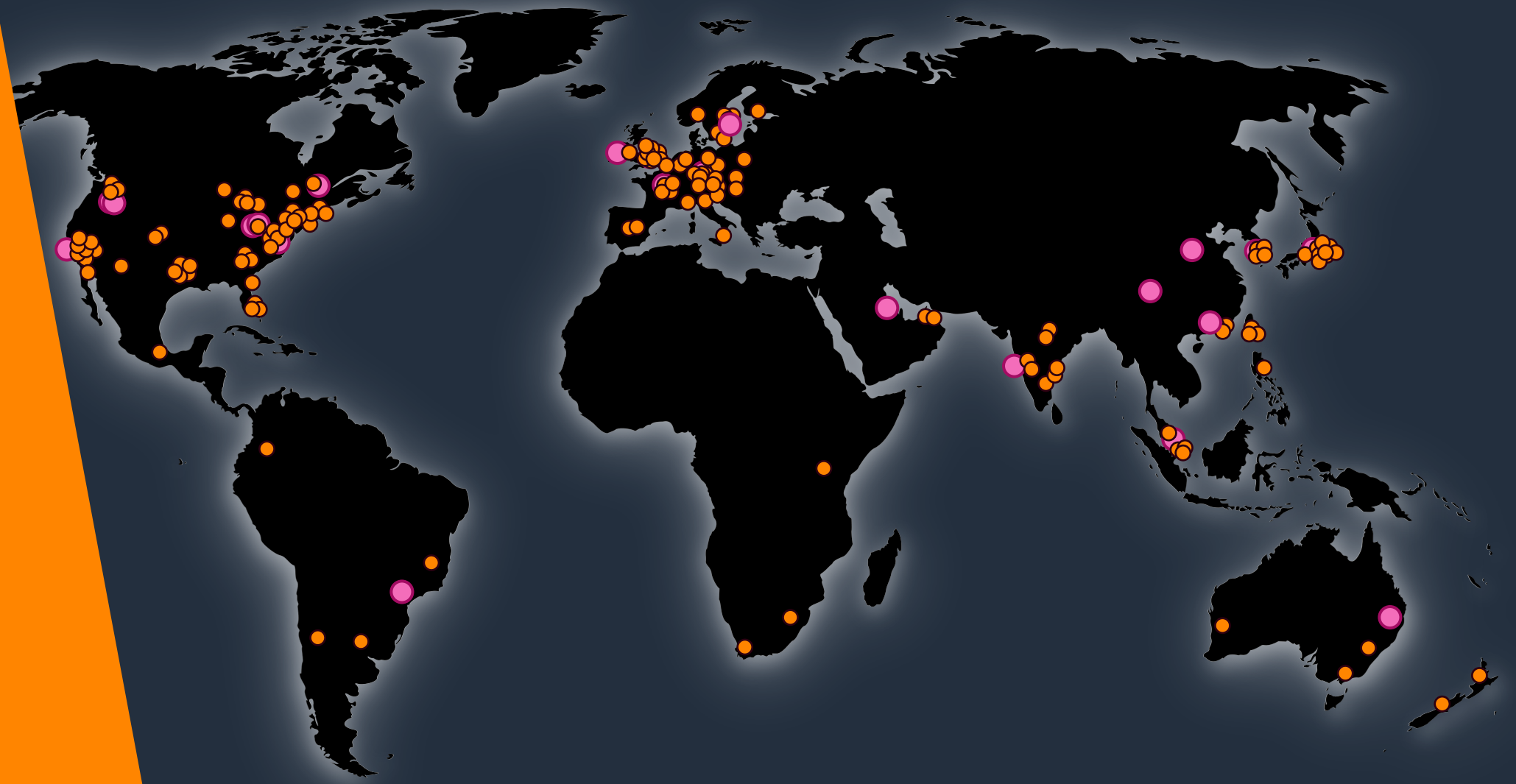
Availability Zones

- Each AWS Region consists of multiple, isolated, and physically separate AZs within a geographic area
- An Availability Zone (AZ) is one or more discrete data centers with redundant power, networking, and connectivity in an AWS Region
- High throughput, low latency (< 10 ms) network between Availability Zones
- All traffic between AZs is encrypted
- Physical separation with 100 km (60 miles)



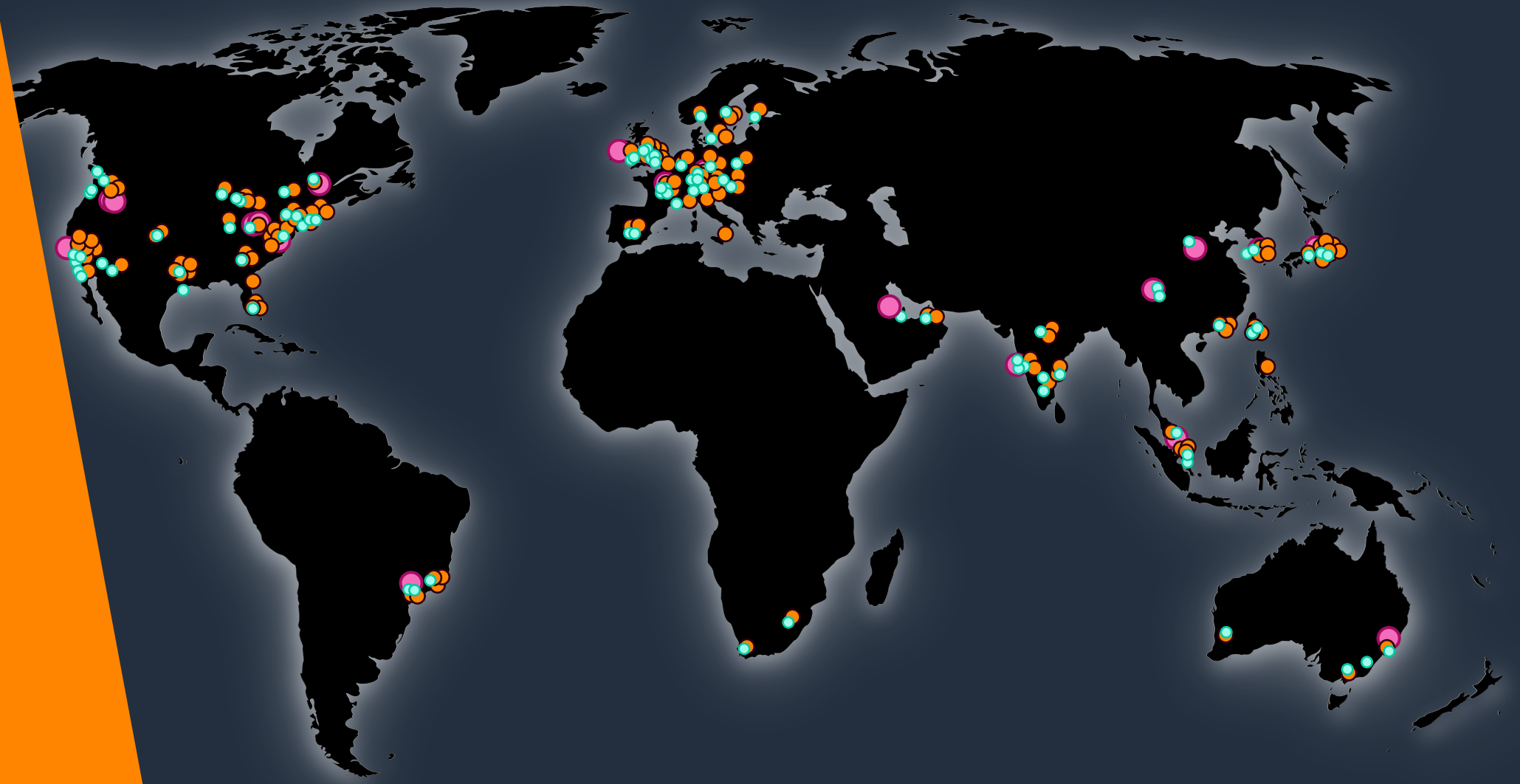
450+

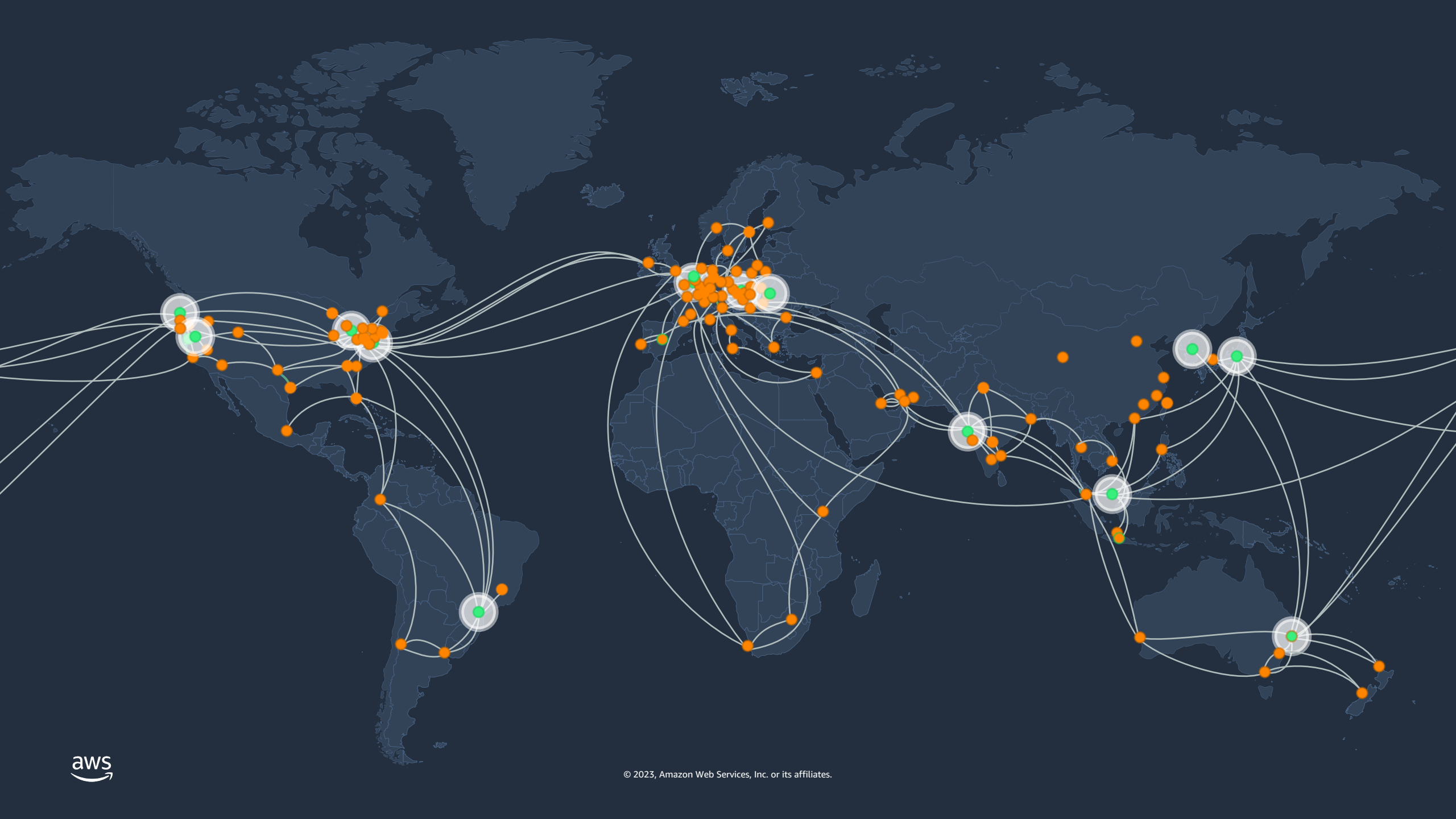
Amazon CloudFront Points of Presence



115

AWS Direct Connect locations

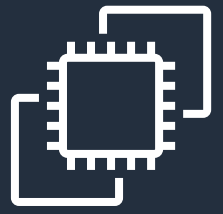




Amazon EC2 Overview

Choices for Compute

World-class performance, security, and innovation



AMAZON EC2

Virtual server instances in the cloud

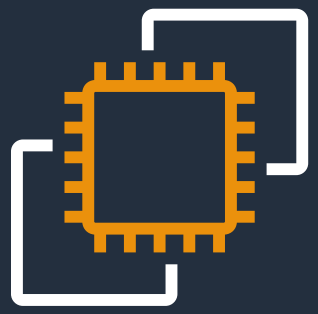
AMAZON ECS, EKS, and FARGATE*

Container management service for running Docker on a managed cluster of EC2

AWS LAMBDA

Serverless compute for stateless code execution in response to triggers

Amazon Elastic Compute Cloud (Amazon EC2)



AMAZON EC2

Linux | Windows | Mac

Arm and x86 architectures

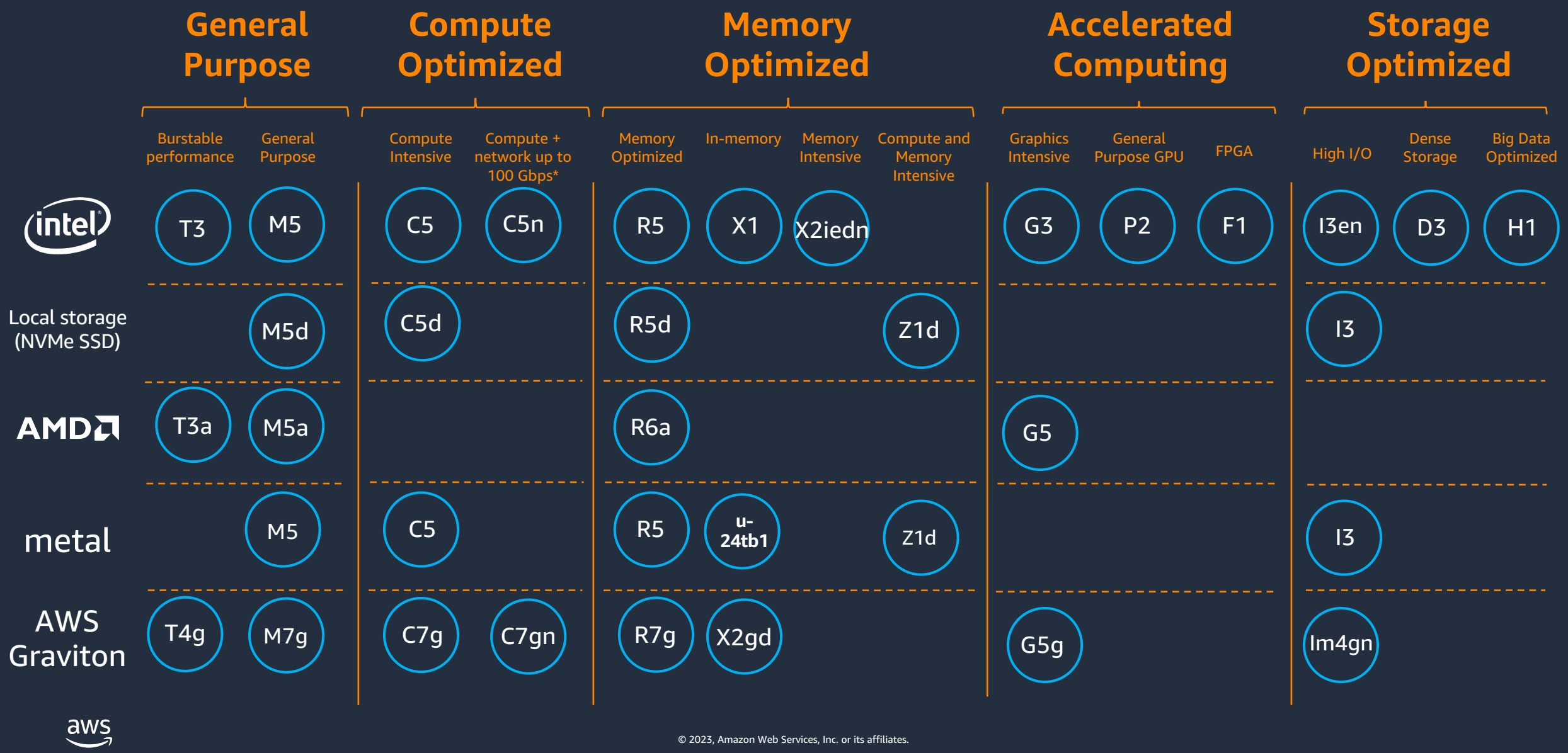
General purpose and workload optimized

Bare metal, disk, networking capabilities

Packaged | Custom | Community AMIs

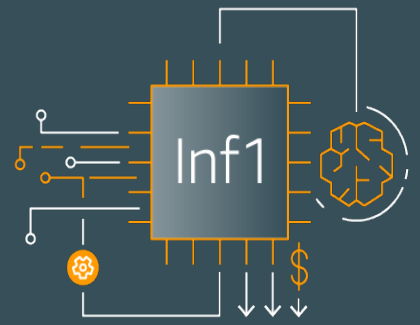
Multiple purchase options: On-Demand, Spot instances, Reserved Instances, Savings Plans, Dedicated Hosts

Instance Types



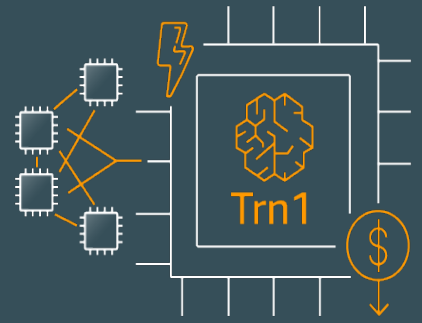
AWS chips optimized for deep learning

AWS Inferentia



Lowest cost inference in the cloud for running deep learning models—up to 70% lower cost than GPU instances

AWS Trainium

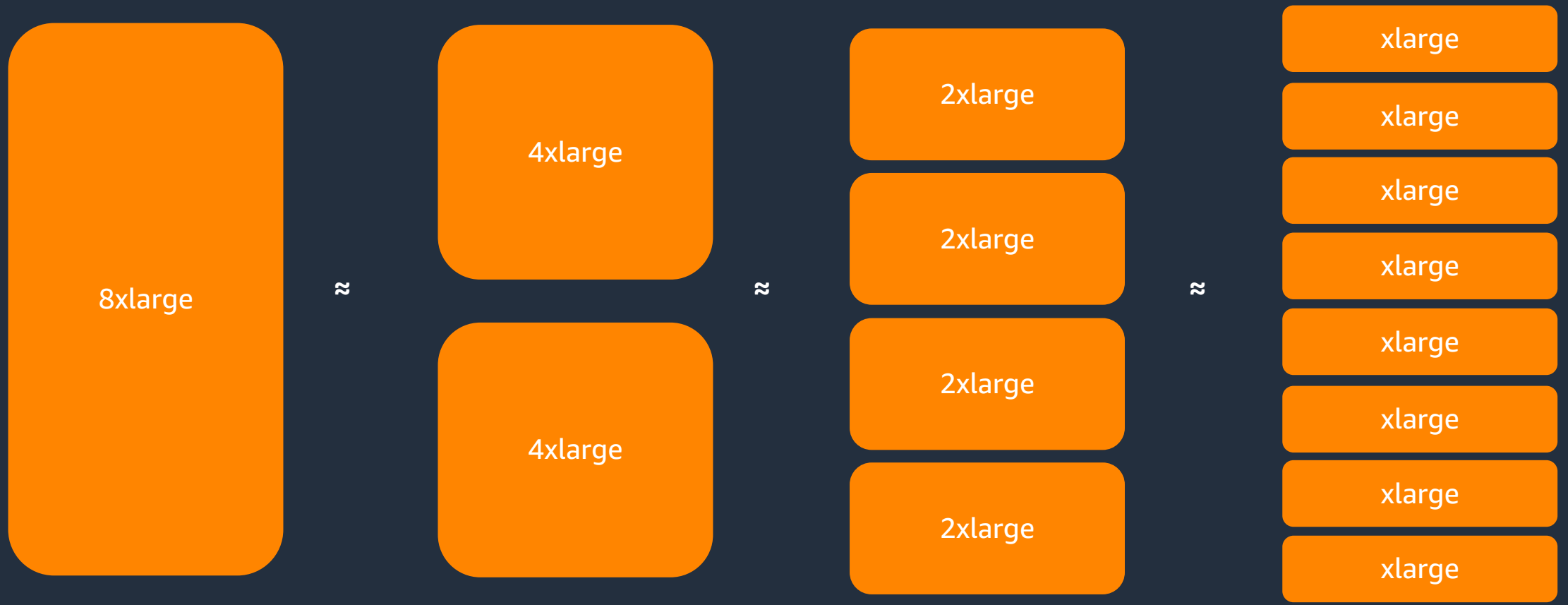


The most cost-efficient high performance DL training instance

Instance Naming

Instance generation

Instance Sizing



c7gn.8xlarge

2 – c7gn.4xlarge

4 – c7gn.2xlarge

8 – c7gn.xlarge

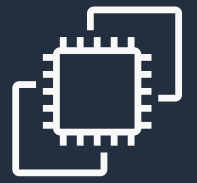
Choose your processor and architecture

Intel® Xeon® Scalable (Skylake) processor

NVIDIA V100 Tensor Core GPUs

AMD EPYC processor

AWS Graviton Processor (arm)



FPGAs for custom hardware acceleration

Right compute for the right application and workload

AWS Graviton Processor

Enabling the best price/performance for your cloud workloads

Graviton2 Processor

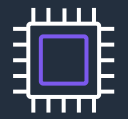
7x performance, 4x compute cores, and 5x faster memory

Built with 64-bit Arm Neoverse cores with AWS-designed silicon using 7 nm manufacturing technology

Up to 64 vCPUs, 25 Gbps enhanced networking, 19 Gbps EBS bandwidth

Graviton3/3E Processor

25% higher performance, 2x higher floating-point performance, 2x faster cryptographic performance



DDR5 memory provides 50% more memory bandwidth compared to DDR4

Support for bfloat16 and delivers up to 3x better performance for ML workloads

Broadest and deepest platform choice

Categories	Capabilities	Options
General purpose	Choice of processor (AWS Graviton, Intel, AMD)	Elastic Block Store (EBS)
Burstable	Fast processors (up to 4.5 GHz)	Elastic Fabric Adapter
Compute intensive	High memory footprint (up to 24 TiB)	Elastic Inference
Memory intensive	Instance storage (HDD and SSD)	Elastic Graphics
Storage (High I/O)	Accelerated computing (GPUs ,FPGA & ASIC)	Linux, Unix, Windows, macOS
Dense storage	Networking (up to 800 Gbps)	
GPU compute	Bare Metal	
Graphics intensive	Size (Nano to 48xlarge)	

600+

instance types

for virtually every workload and business need

Memory and Storage

What's a GiB?

- Memory is presented as GibiBytes (GiB) and not Gigabytes (GB)
- 256 GiB = 275 GB

What about storage?

- Storage is independent of compute
- You allocate drives known as Amazon Elastic Block Store (EBS) volumes
- Amazon EBS volumes support up to 64 TiB per volume
- Some instance types provide physically attached (ephemeral) storage

EC2 Operating Systems

- Windows Server 2012/2012 R2/2016/2019/2022
- Amazon Linux (NEW: Amazon Linux 2023)
- Debian
- SUSE
- CentOS
- Red Hat Enterprise Linux (RHEL)
- Ubuntu
- Mac, including M1 Mac instances

Visit the AWS Marketplace for more Operating Systems

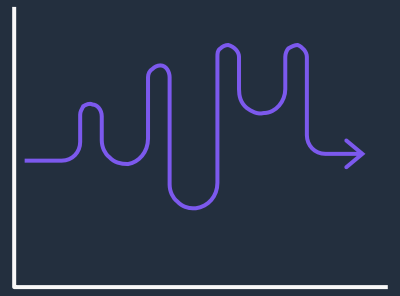
What is an Amazon Machine Image (AMI)?

- Provides the information required to launch an instance
- Launch multiple instances from a single AMI with the same configuration
- An AMI includes the following:
  - One or more Amazon Elastic Block Store (Amazon EBS) snapshots, or a template for the root volume (operating system, applications)
  - Launch permissions that control which AWS accounts can use the AMI
  - Block device mapping that specifies volumes to attach to the instance

Amazon EC2 purchase options

On-Demand

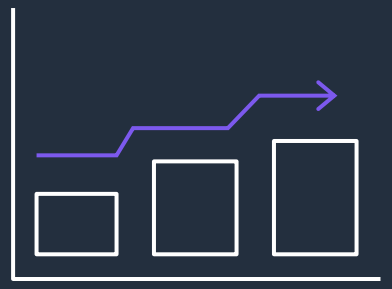
Pay for compute capacity by **the second** with no long-term commitments



Spiky workloads, to define needs

Reserved Instances

Make a 1 or 3 year commitment and receive a **significant discount** off On-Demand prices



Committed and steady-state usage

Savings Plans

Same great discounts as Amazon EC2 RIs with **more flexibility**

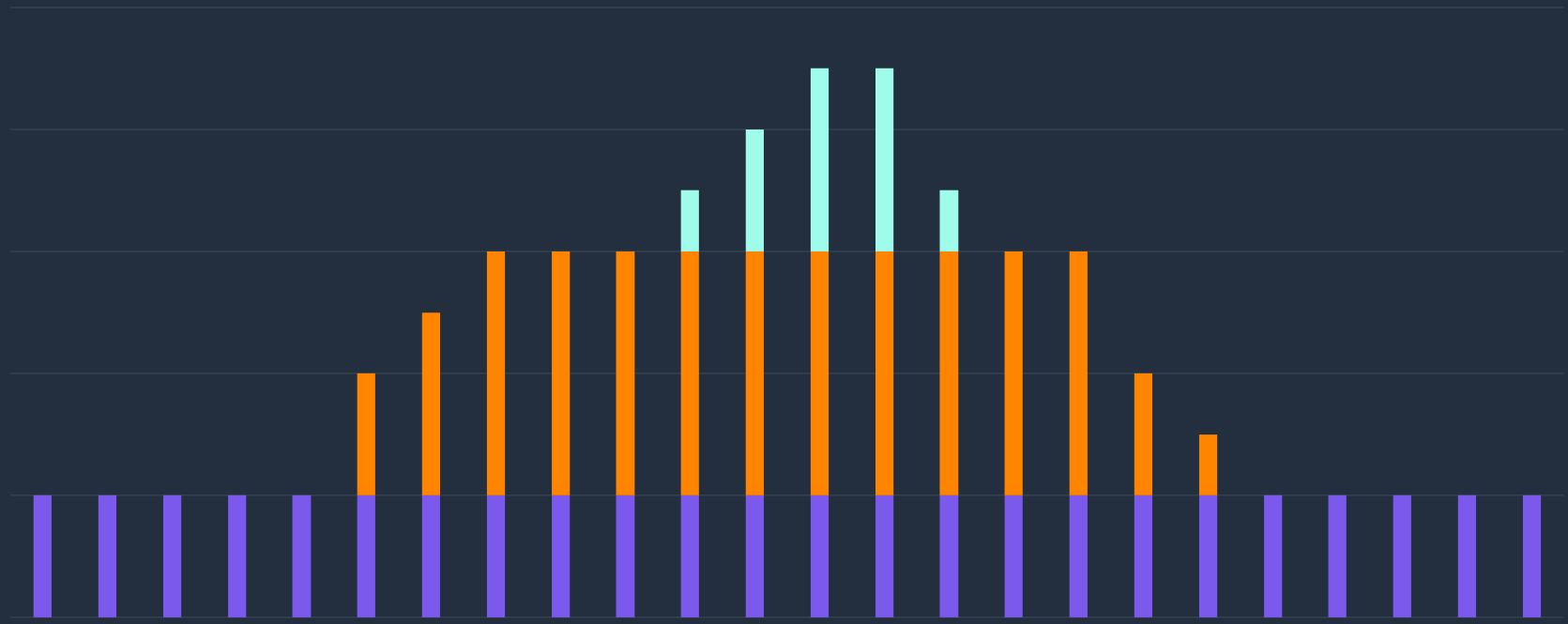
Committed flexible access to compute

Spot Instances

Spare Amazon EC2 capacity at **savings of up to 90%** off On-Demand prices

Fault-tolerant, flexible, stateless workloads

Simplifying capacity and cost optimization



SCALE USING **SPOT** FOR FLEXIBLE, FAULT-TOLERANT WORKLOADS

SCALE USING **ON-DEMAND** FOR NEW OR STATEFUL SPIKY WORKLOADS

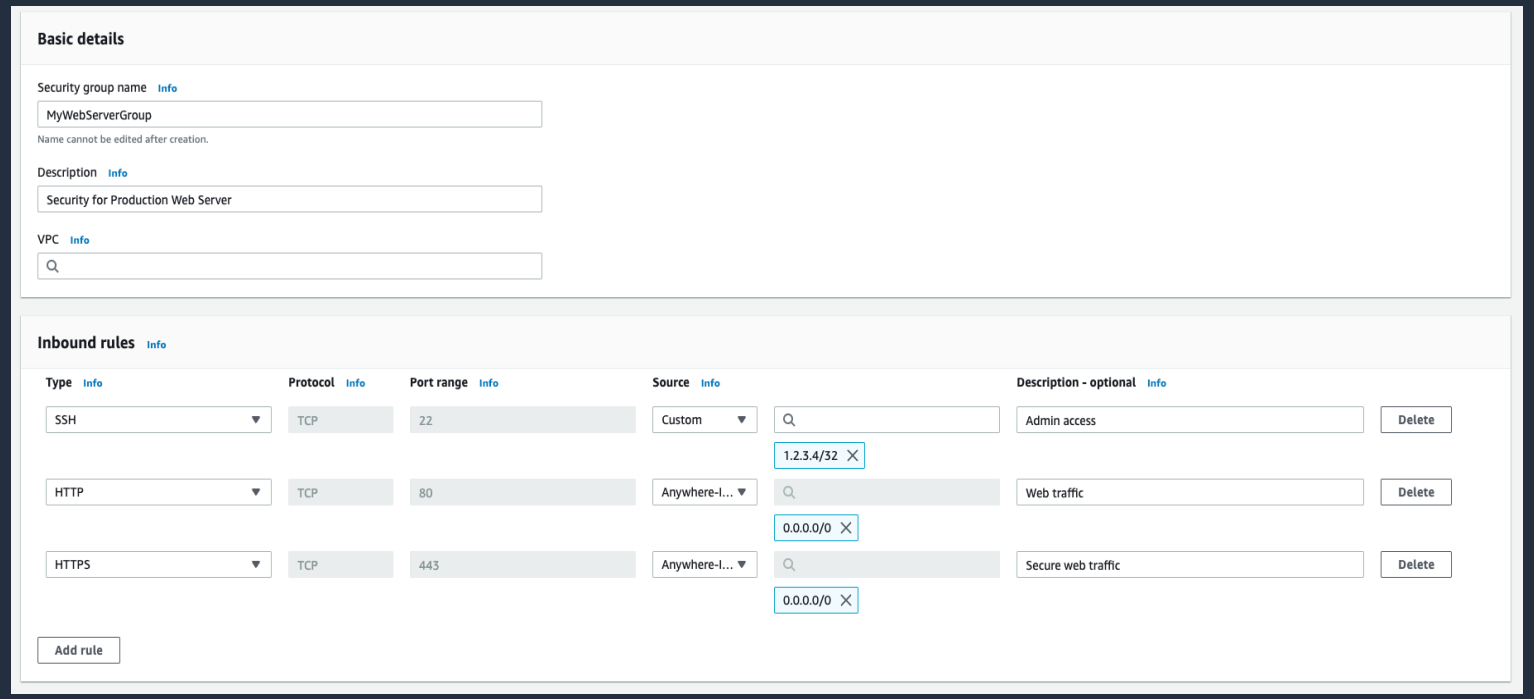
USE **RIs** AND **SAVINGS PLANS** FOR KNOWN/ STEADY-STATE WORKLOADS

AWS services make this easy and efficient

- Amazon EC2 Auto Scaling
- EC2 Fleet
- Amazon Elastic Container Service (Amazon ECS)
- Amazon Elastic Kubernetes Service (Amazon EKS)
- AWS Thinkbox
- Amazon EMR
- AWS CloudFormation
- AWS Batch

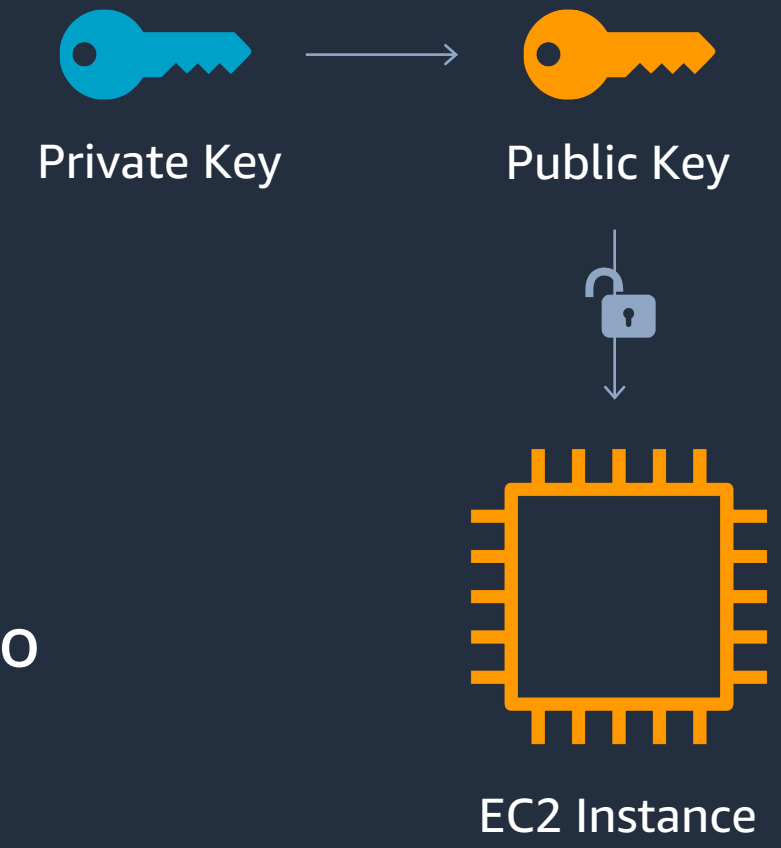
EC2 Security Groups

- Virtual firewall
- Security Group Rules
  - Security Group name
  - Description
  - Protocol
  - Port range
  - IP address, IP range



EC2-Specific Credentials

- EC2 key pairs
  - Linux – SSH key pair for first-time host login
  - Windows – Retrieve Administrator password
- Standard SSH RSA key pair
  - Public/Private Keys
  - Private keys are not stored by AWS
- AWS approach for providing **initial** access to a generic OS
  - Secure
  - Personalized
  - Non-generic (NIST, PCI DSS)



AWS Nitro System

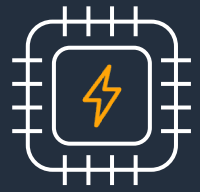
Nitro Card

Local NVMe storage

Elastic Block Storage

Networking, monitoring, and security

Nitro Security Chip



Integrated into motherboard

Protects hardware resources

Nitro Hypervisor

Lightweight hypervisor

Memory and CPU allocation

Bare metal-like performance

Modular building blocks for rapid design and delivery of **Amazon EC2** instances

Introduction to Storage on AWS

Agenda

- Introduction
- Storage Primer
- Object Store
- Q&A

Introduction: Why choose AWS for storage

Compelling Economics

Pay as you go

No risky capacity planning

No need to provision for redundancy or overhead

Easy to Use

Self service administration

SDKs for simple integration

No Commitment

Reduce risk

Durable and Secure

Avoid risks of physical media handling

Speed, Agility, Scale

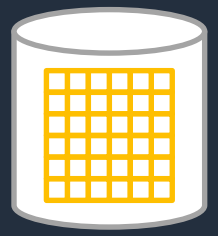
Reduce time to market

Focus on your business, not your infrastructure

Global Scale

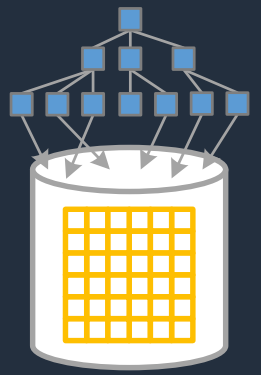
Storage Primer

Block vs File vs Object



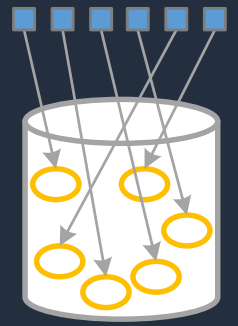
Block Storage

Raw Storage
Data organized as an array of unrelated blocks
Host File System places data on disk
Ex: Hard Disks, Storage Area Network (SAN) Storage Arrays



File Storage

Unrelated data blocks managed by a file (serving) system
Native file system places data on disk
Ex: Network Attached Storage (NAS) Appliances, Windows File Servers, NetApp OnTap



Object Storage

Stores Virtual containers that encapsulate the data, data attributes, metadata and Object IDs
API Access to data
Metadata Driven, Policy-based, etc.
Ex: Ceph, OpenStack Swift

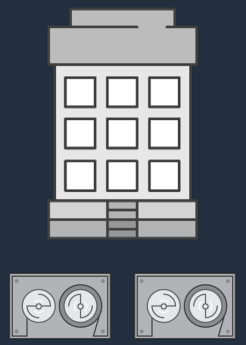
aws

Storage - Characteristics

Some of the ways we look at storage

Durability	Availability	Security	Cost	Scalability	Performance	Integration
Measure of expected data loss	Measure of expected downtime	Security measures for at-rest and in-transit data	Amount per storage unit, e.g. $ / GB	Upward flexibility, storage size, number of users	Performance metrics (bandwidth, latency…)	Ability to interact via API or with other services

Understanding Durability

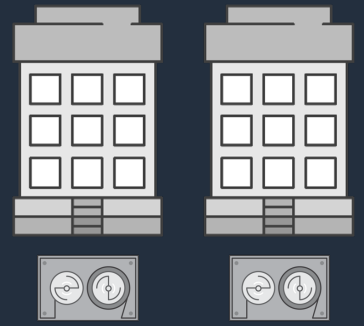


Two copies on one site

designed for

99.99%

durability



Copies on two sites

designed for

99.999%

durability

copies in three AZ

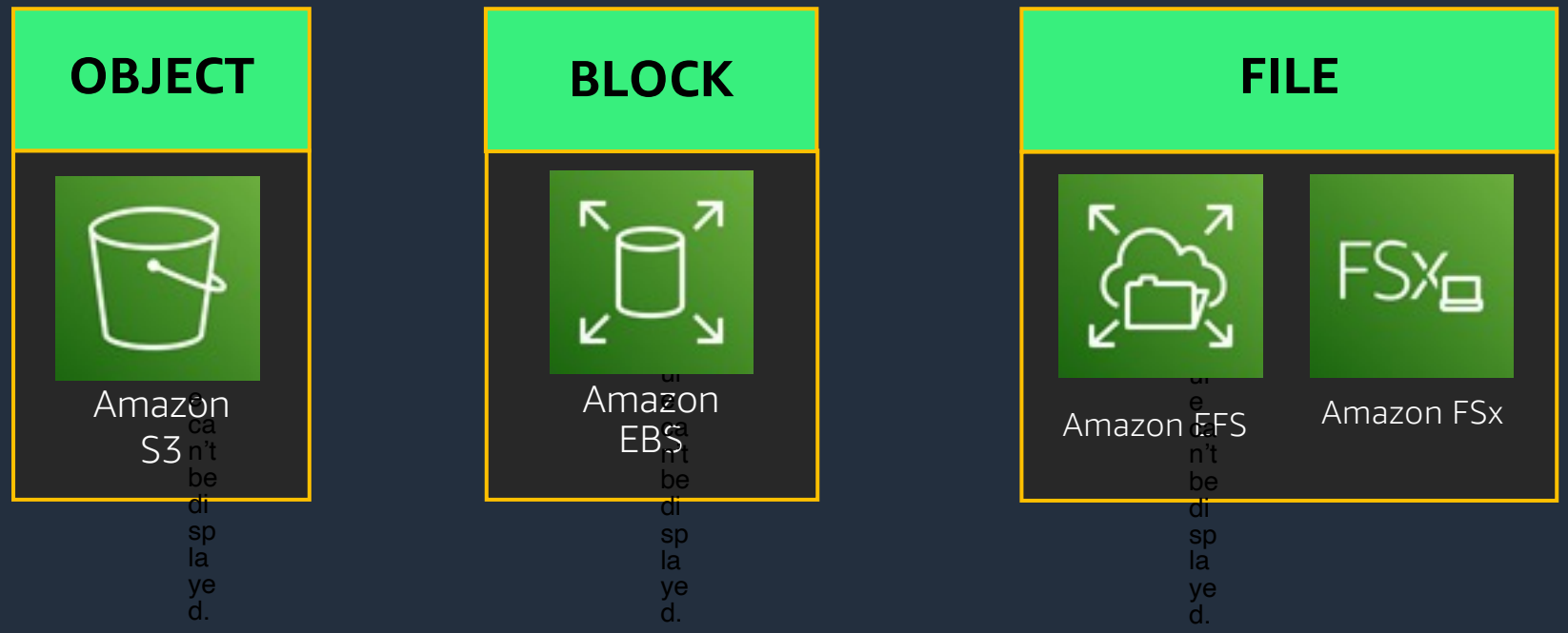
designed for

99.999999999%

durability

(1 in 100,000,000,000 objects)

AWS delivers broadest storage portfolio in industry



Object Stores

Amazon S3

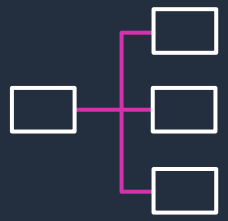
Amazon S3 (Simple Storage Service)

- Web accessible object store (through API or HTTPS)
- Highly durable (99.999999999% design)
- Limitlessly scalable
- Multiple Tiers to match your workload
- Static Website Hosting
- Security, Compliance, and Audit capabilities
- Standard Storage Pricing (us-east-1) - $0.024 per GB

Your choice of object storage classes

S3 Standard	S3 Intelligent-Tiering	S3 Standard-IA	S3 One Zone-IA	S3 Glacier Instant Retrieval	S3 Glacier Flexible Retrieval	S3 Glacier Deep Archive
Frequent ←			*Access Frequency*			→ *Infrequent*
• Active, frequently accessed data • Milliseconds access • ≥ 3 AZ • $0.023/GB	• Data with changing access patterns • Milliseconds access • ≥ 3 AZ • $0.023 to $0.0125/GB ($0.004 to $0.00099/GB Archive) • No retrieval fees • Monitoring fee per Obj. • Min storage duration • Min object size	• Infrequently accessed data • Milliseconds access • ≥ 3 AZ • $0.0125/GB • Retrieval fee per GB • Min storage duration • Min object size	• Re-creatable, less accessed data • Milliseconds access • 1 AZ • $0.0100/GB • Retrieval fee per GB • Min storage duration • Min object size	• Archive data instant retrieval • Milliseconds access • ≥ 3 AZ • $0.0040/GB • Retrieval fee per GB • Min storage duration • Min object size	• Archive data • Select minutes or hours • ≥ 3 AZ • $0.0036/GB – ($4.10/TB) • Retrieval fee per GB • Min storage duration • Min object size	• Archive data • Select 12 or 48 hours • ≥ 3 AZ • $0.00099/GB - ($1.01/TB) • Retrieval fee per GB • Min storage duration • Min object size

S3 Management Features



Organize

S3 Tagging

S3 Prefixes

S3 Versioning

Monitor

CloudWatch

CloudTrail

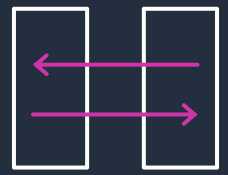
S3 Event Notifications

S3 Inventory

S3 Glacier Restore Notifications

S3 Storage Lens

AWS Config



Replicate & Tier

S3 Lifecycle

S3 Storage Class Analysis

S3 Intelligent-Tiering

Cross-Region Replication

Replication Time Control (RTC)

Modify

S3 Event Notifications + Lambda

S3 Batch Operations

S3 Object Lock

S3 Object Lambda

S3 Access Management & Security

S3 Features

- Bucket Policies
  ACLs
  Access Points
- Audit Logs
- Access Analyzer
- Encryption Support
- Query String Authentication
- S3 Object Lock

Q&A

Thank you!

aws health

EMEA HEALTHCARE & LIFE SCIENCES WORKSHOPS

AWS Cloud Fundamentals

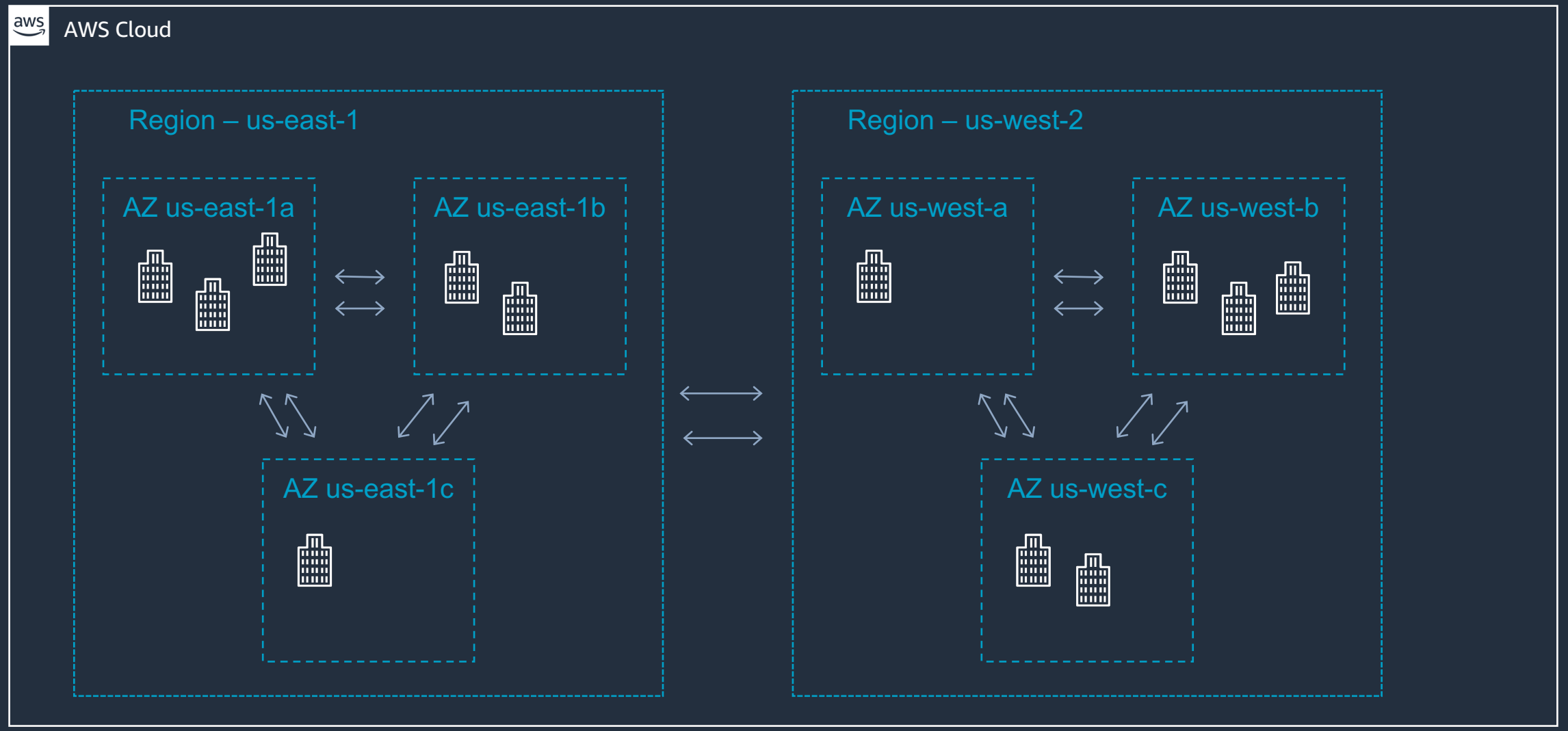
Monika Nowakowska

Solutions Architect
AWS

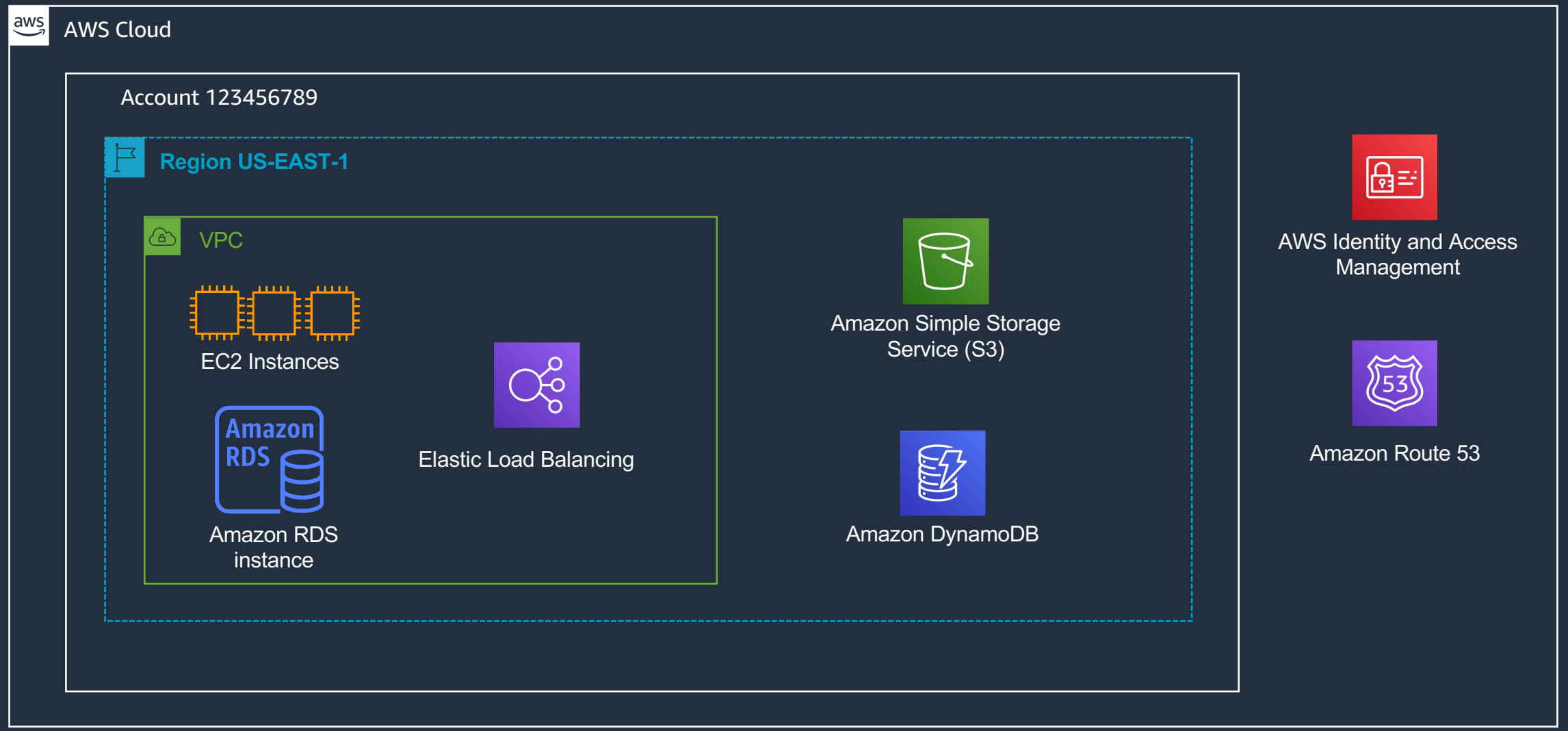
Agenda

- Regions and Availability Zones (AZs)
- VPC Overview
- Subnets and AZs
- Route Tables
- Internet Access
- Multi-AZ Best Practices
- Security Groups
- Hands-on Labs

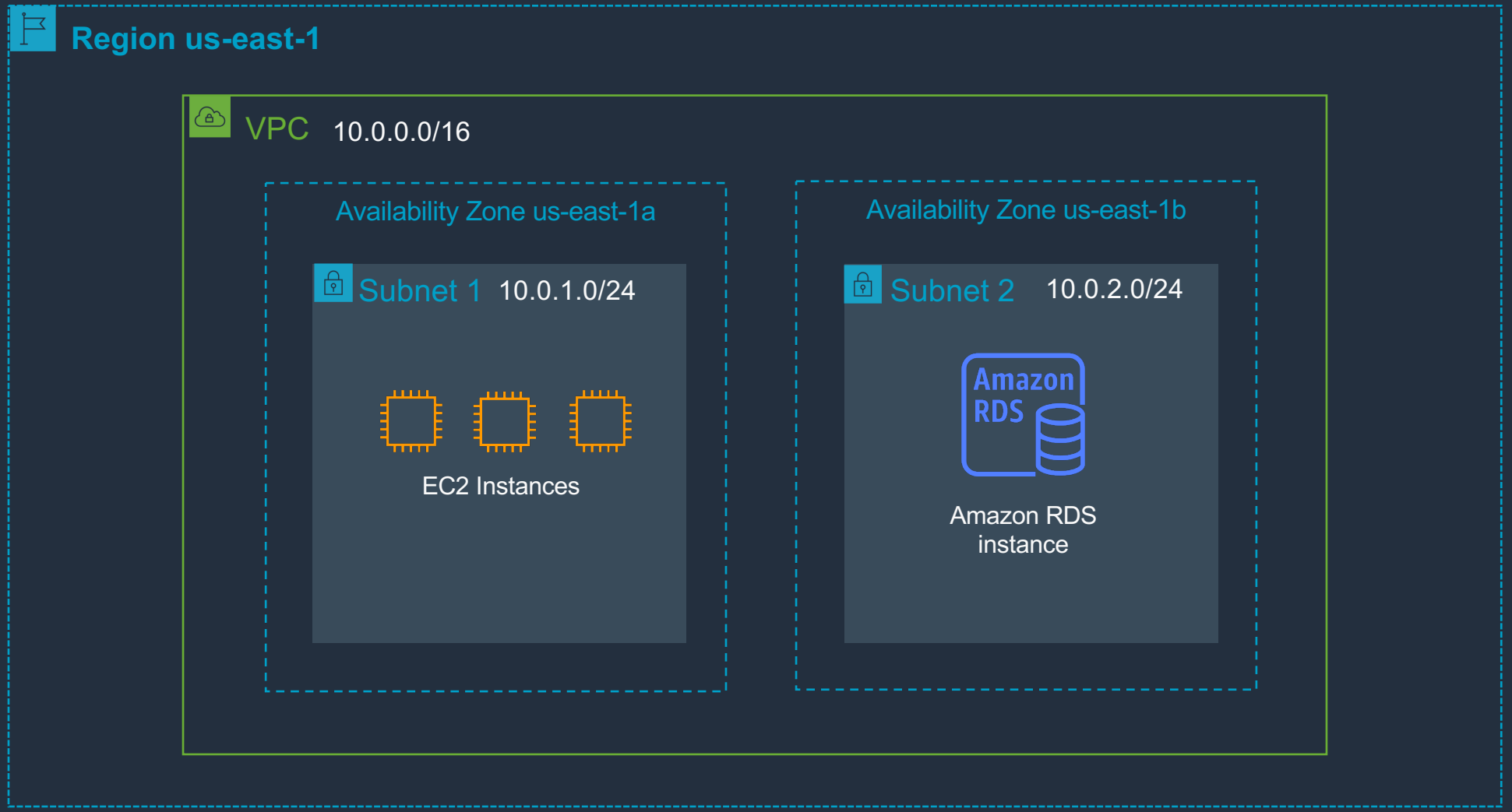
Regions and Availability Zones (AZs)



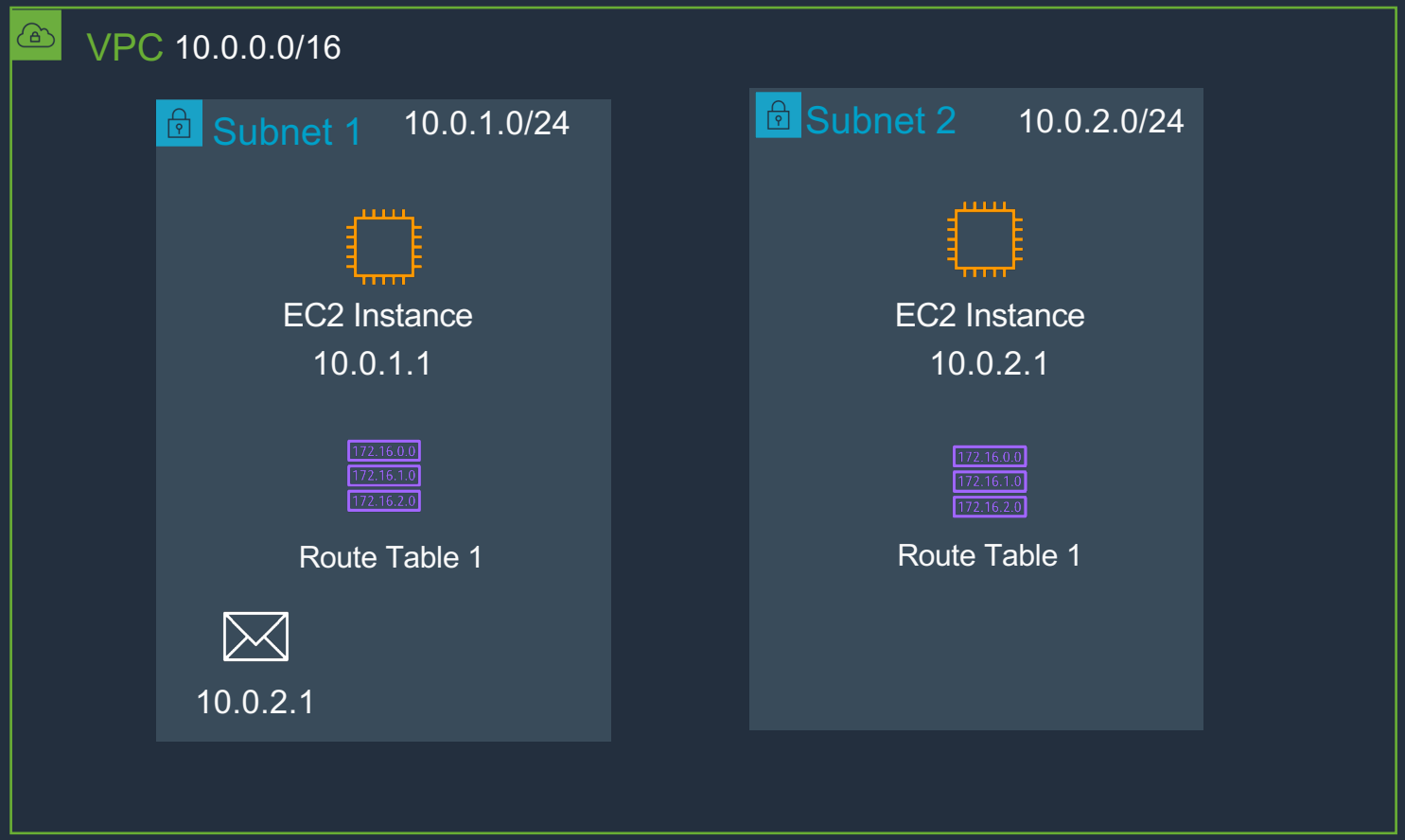
AWS VPC - Overview



Subnets and AZs



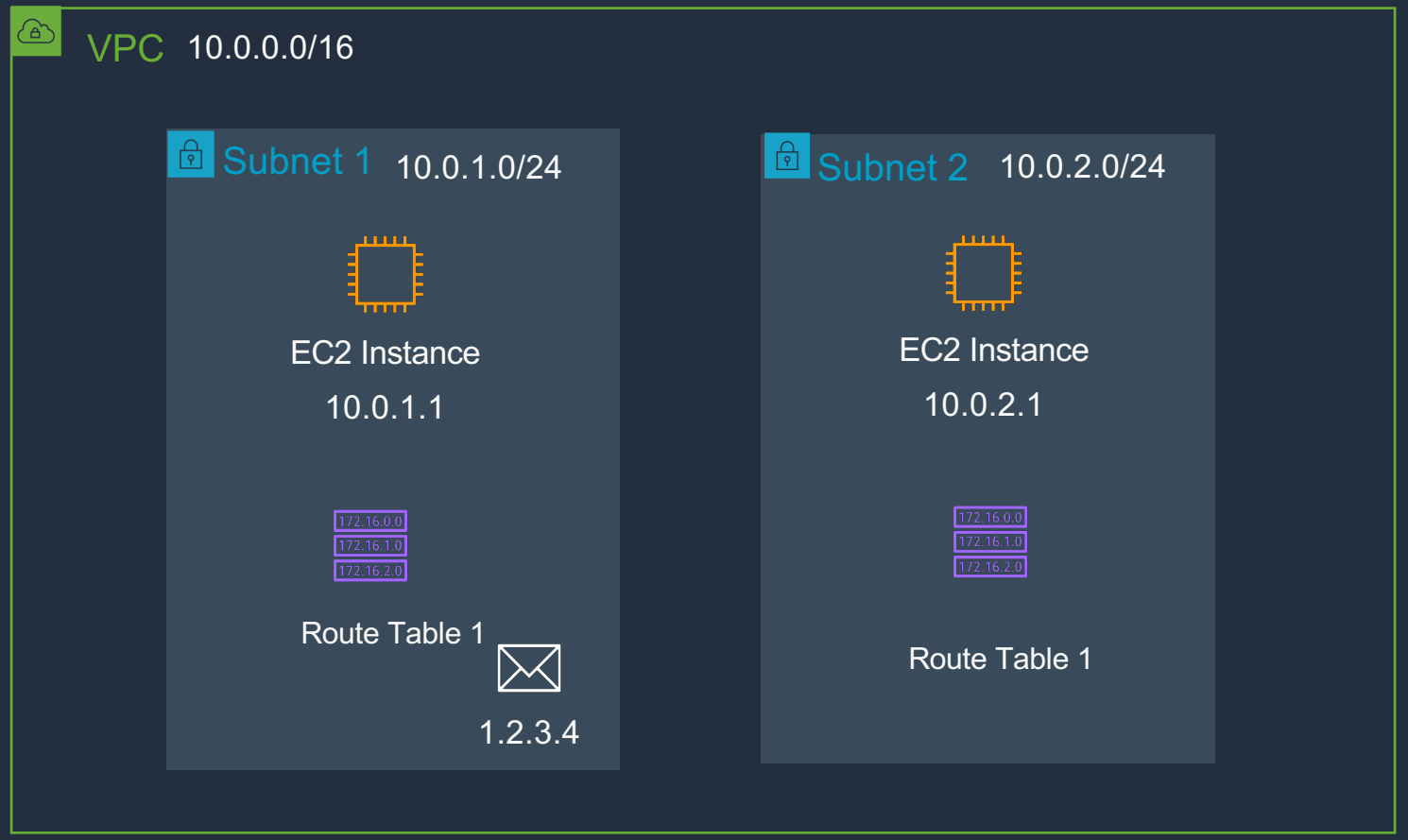
Route Tables – Internal VPC Traffic



Route Table 1 - Rules

Destination	Target
10.0.0.0/16	*local*

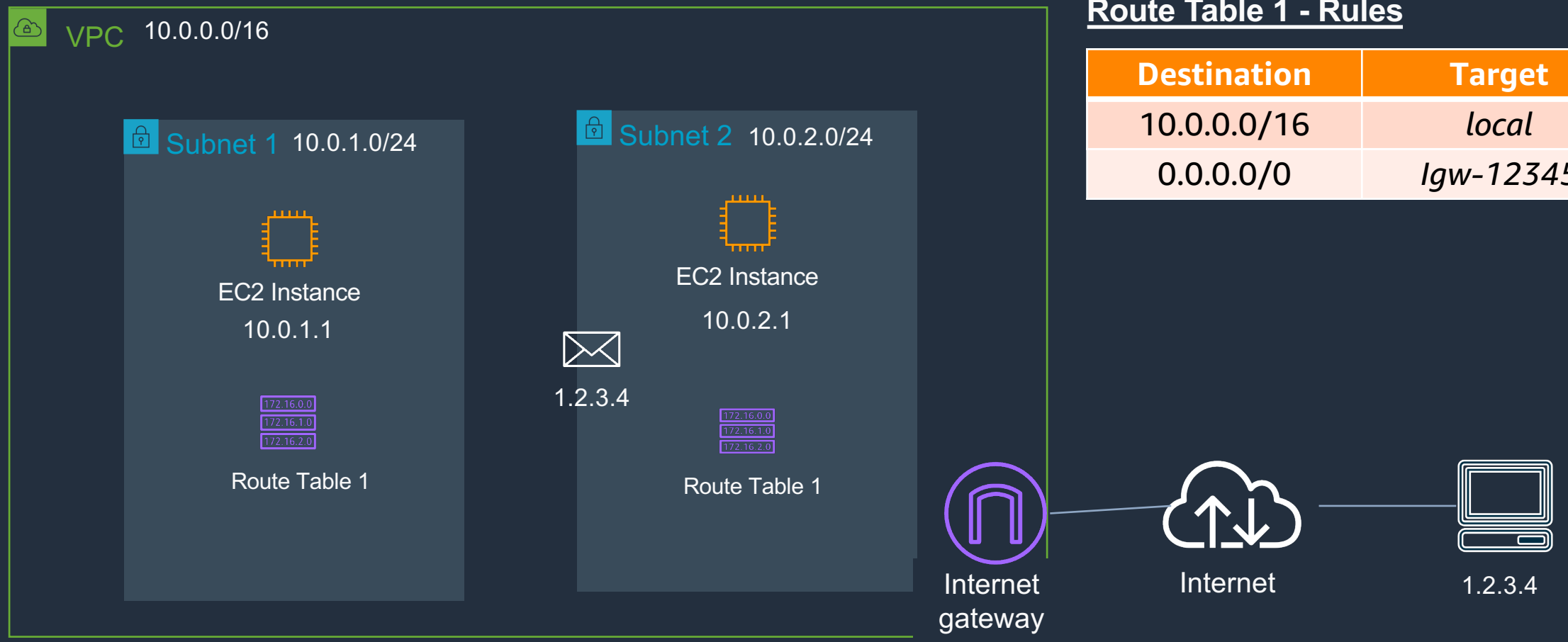
Route Tables – Internet Traffic



Route Table 1 - Rules

Destination	Target
10.0.0.0/16	*local*

Route Tables – Internet Traffic



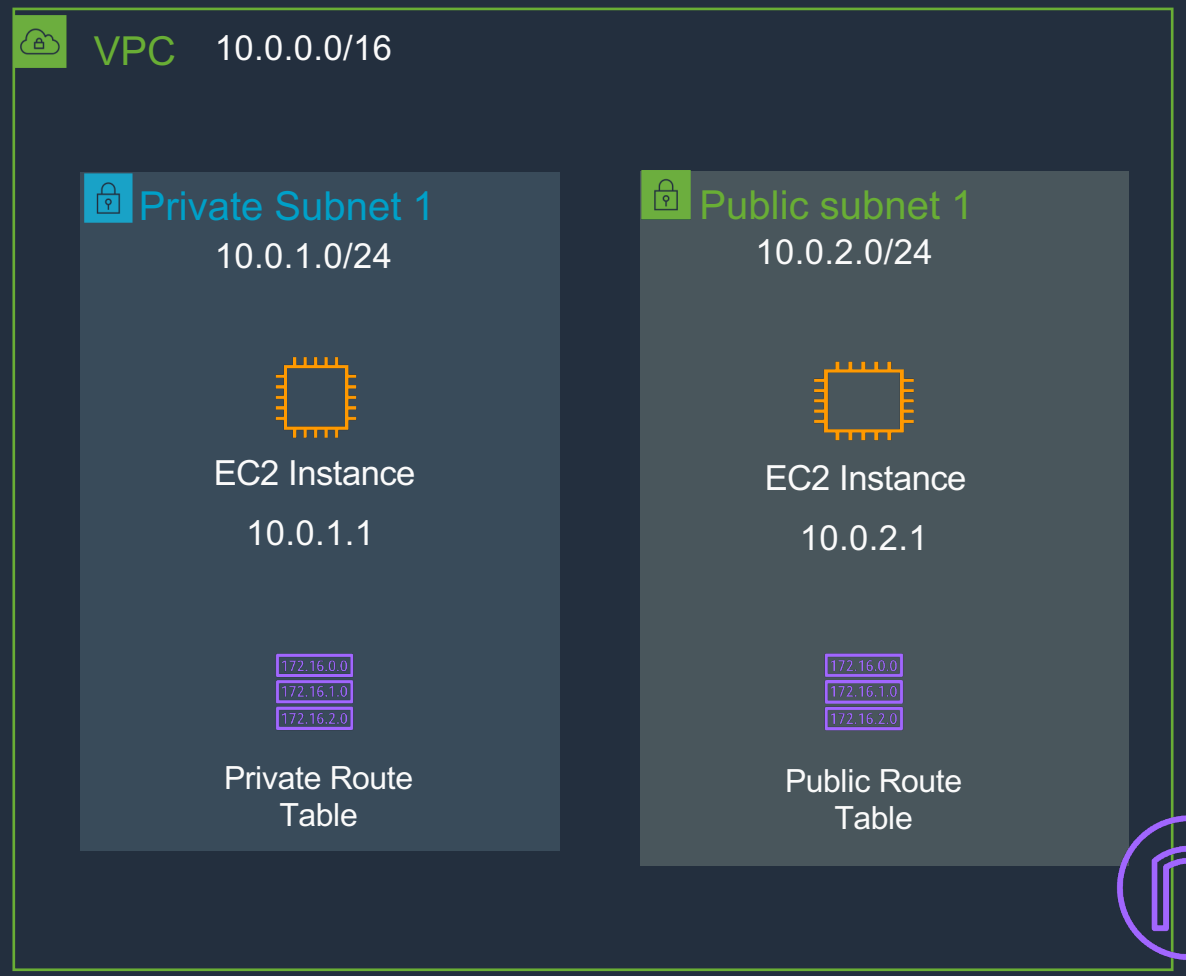
Route Table 1 - Rules

Destination	Target
10.0.0.0/16	*local*
0.0.0.0/0	*Igw-12345*

Public vs. Private Subnet

Private Route Table

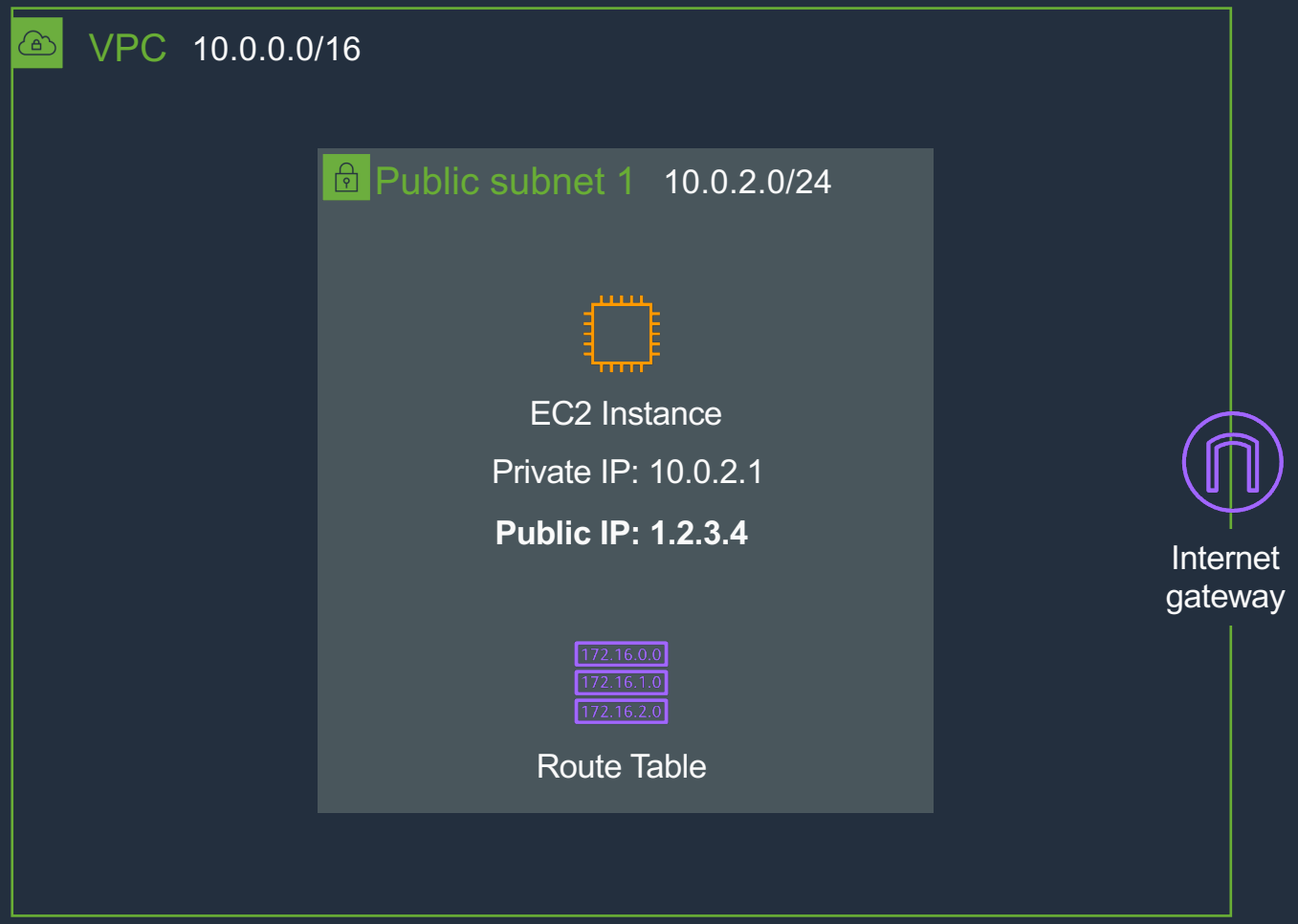
Destination	Target
10.0.0.0/16	*local*



Public Route Table

Destination	Target
10.0.0.0/16	*local*
0.0.0.0/0	*Igw-12345*

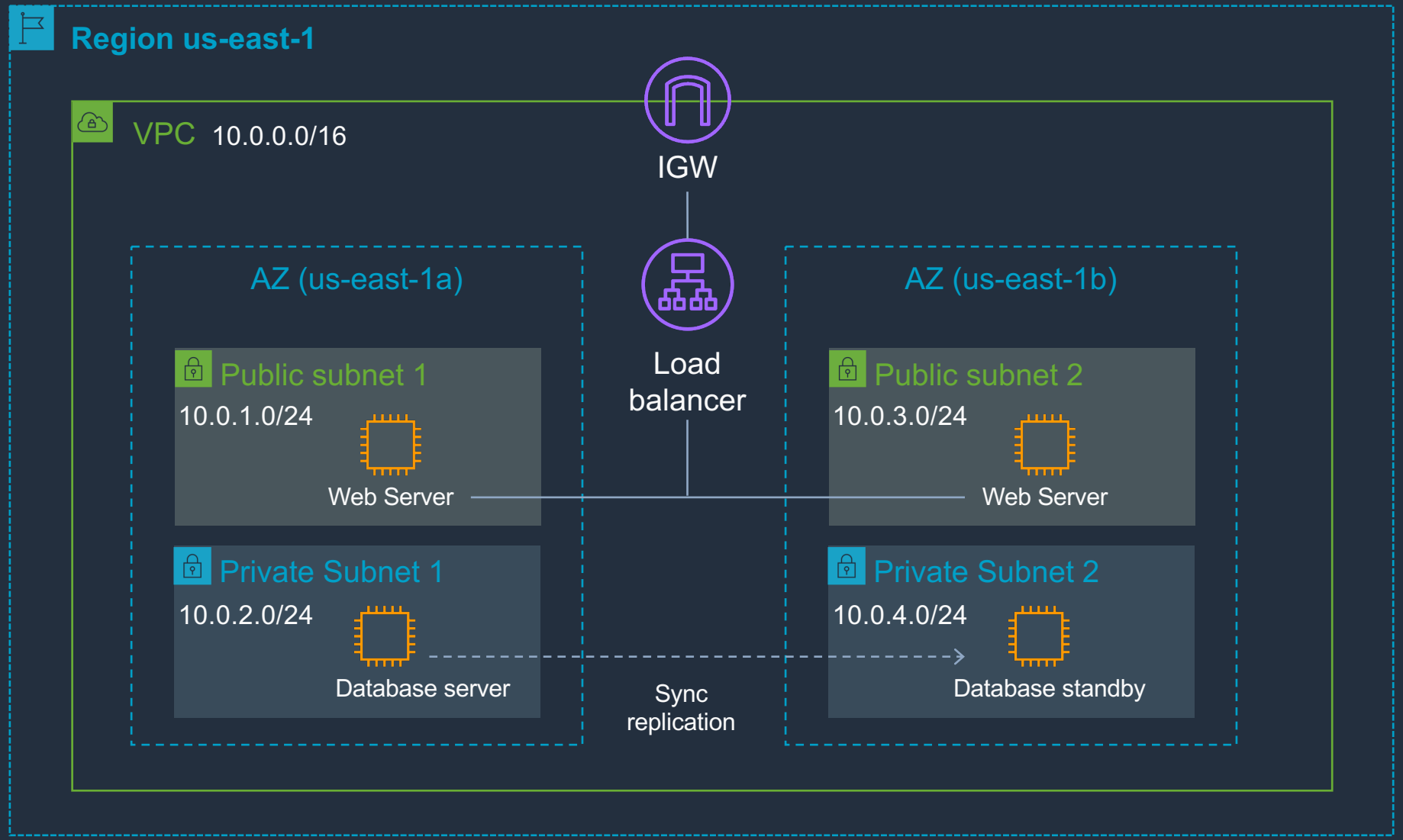
Public IPs



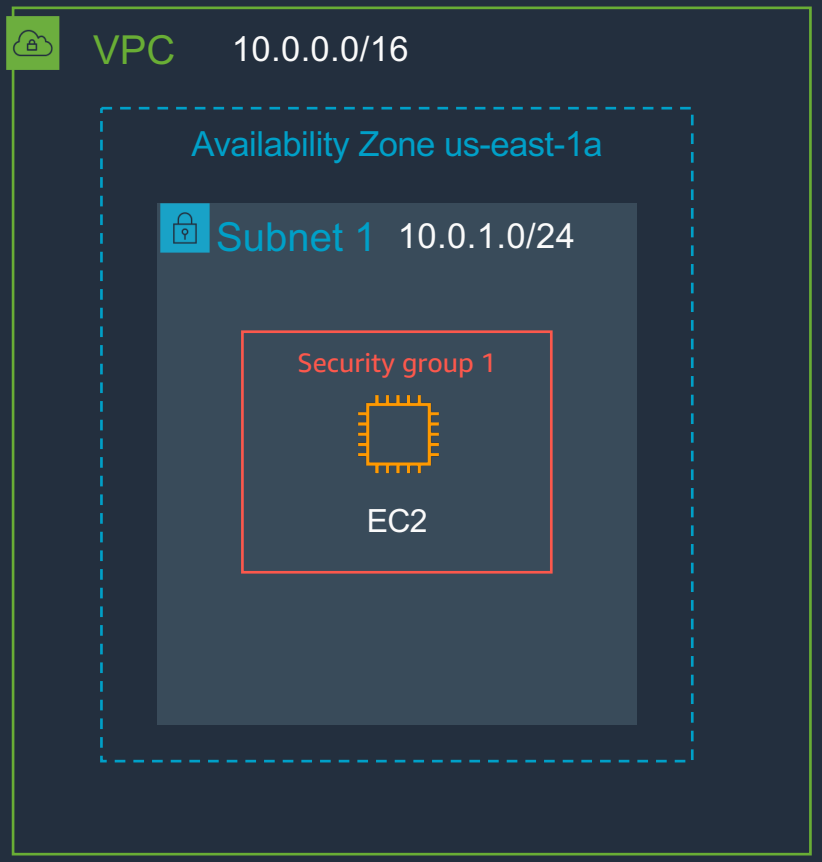
Public Route Table

Destination	Target
10.0.0.0/16	*local*
0.0.0.0/0	*Igw-12345*

Multi-AZ Best Practices



Security Groups – Default Group Rules



Security Group 1

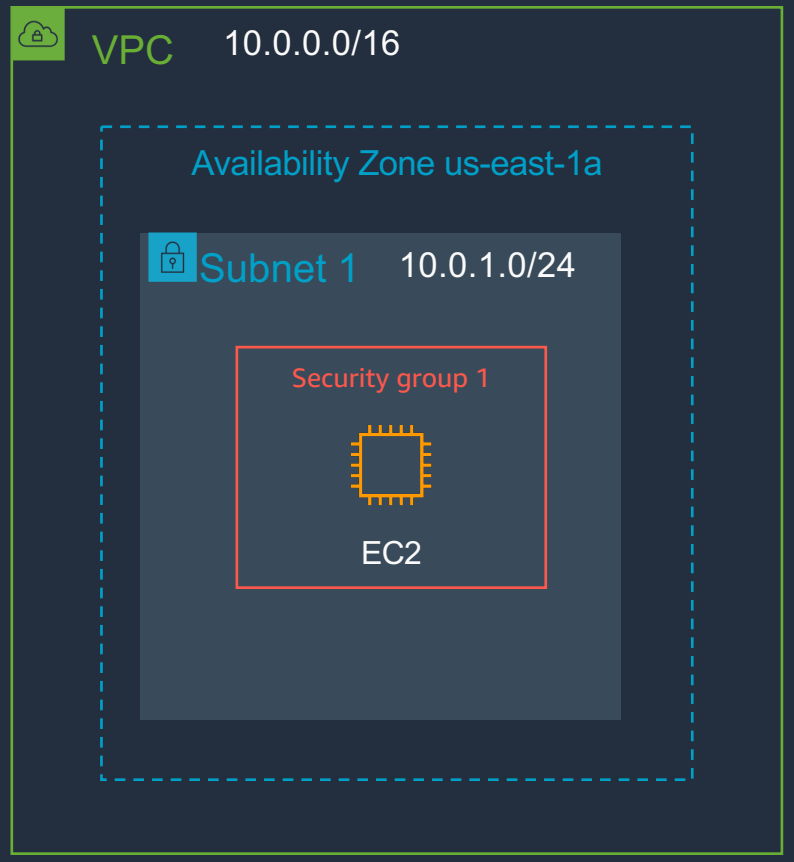
Inbound Rules

Protocol	Port	Source

Outbound Rules

Protocol	Port	Destination
All	*All*	*0.0.0.0/0*

Security Groups – Web Server Example



Security Group 1

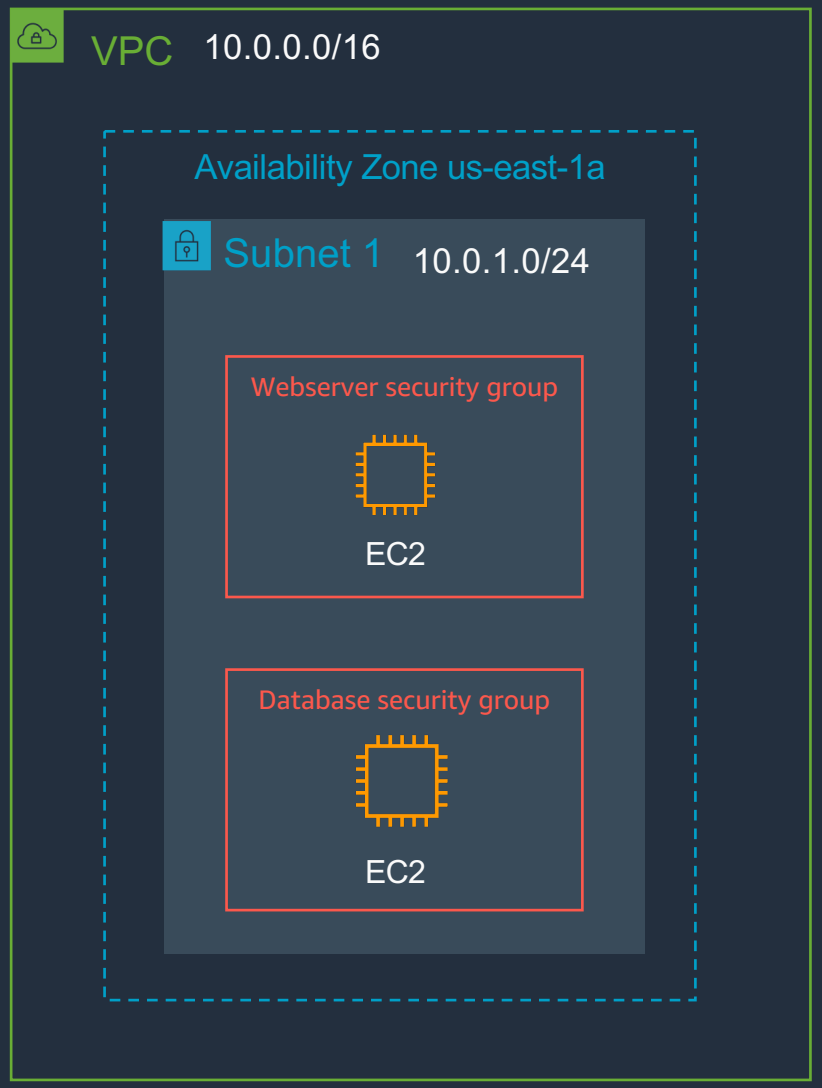
Inbound Rules

Protocol	Port	Source
TCP	*80*	*0.0.0.0/0*

Outbound Rules

Protocol	Port	Destination
All	*All*	*0.0.0.0/0*

Security Groups – Reference other groups



Web server security group

Inbound Rules

Protocol	Port	Source
TCP	*80*	*0.0.0.0/0*

Outbound Rules

Protocol	Port	Destination
All	*All*	*0.0.0.0/0*

Database security group

Inbound Rules

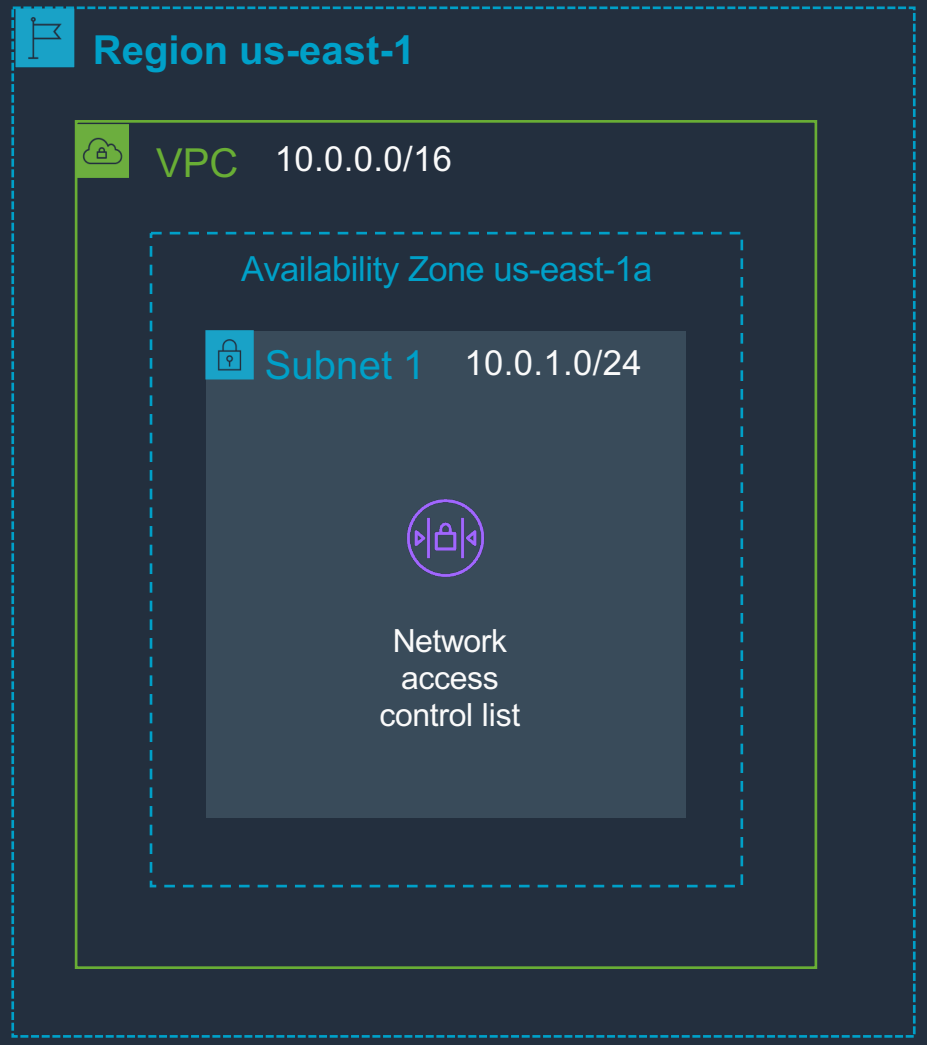
Protocol	Port	Source
TCP	*3306*	*sg-webserver*

Outbound Rules

Protocol	Port	Destination
All	*All*	*0.0.0.0/0*

aws health

Network Access Control Lists (NACLs)



NACL Configuration

Inbound Rules

Rule #	Protocol	Port	Source	Effect
1	All	*All*	*0.0.0.0/0*	*Allow*

Outbound Rules

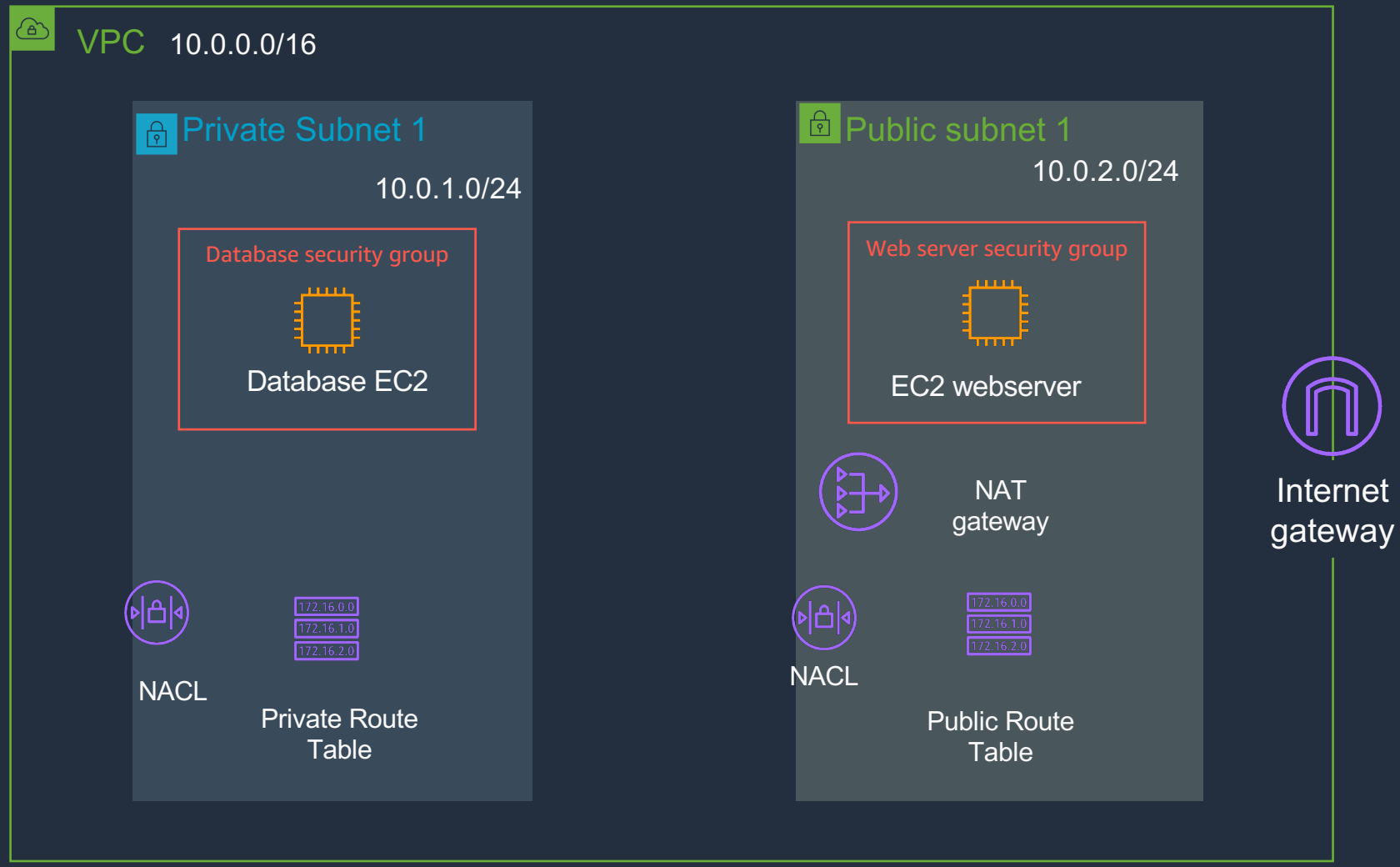
Rule #	Protocol	Port	Source	Effect
1	All	*All*	*0.0.0.0/0*	*Allow*

NACL vs. Security Groups

- Security Groups
  - Resource-level
  - Stateful
  - Evaluate rules independently
  - Define rules based on IP addresses, protocols, port numbers
  - Explicit ALLOW
  - Flexible at the resource level

- NACL
  - Subnet-level
  - Stateless
  - Rule evaluation order
  - Define rules based on subnets, IP ranges, protocols
  - Explicit ALLOW/DENY
  - Flexible at the subnet level

VPC Building Blocks - Summary



aws health

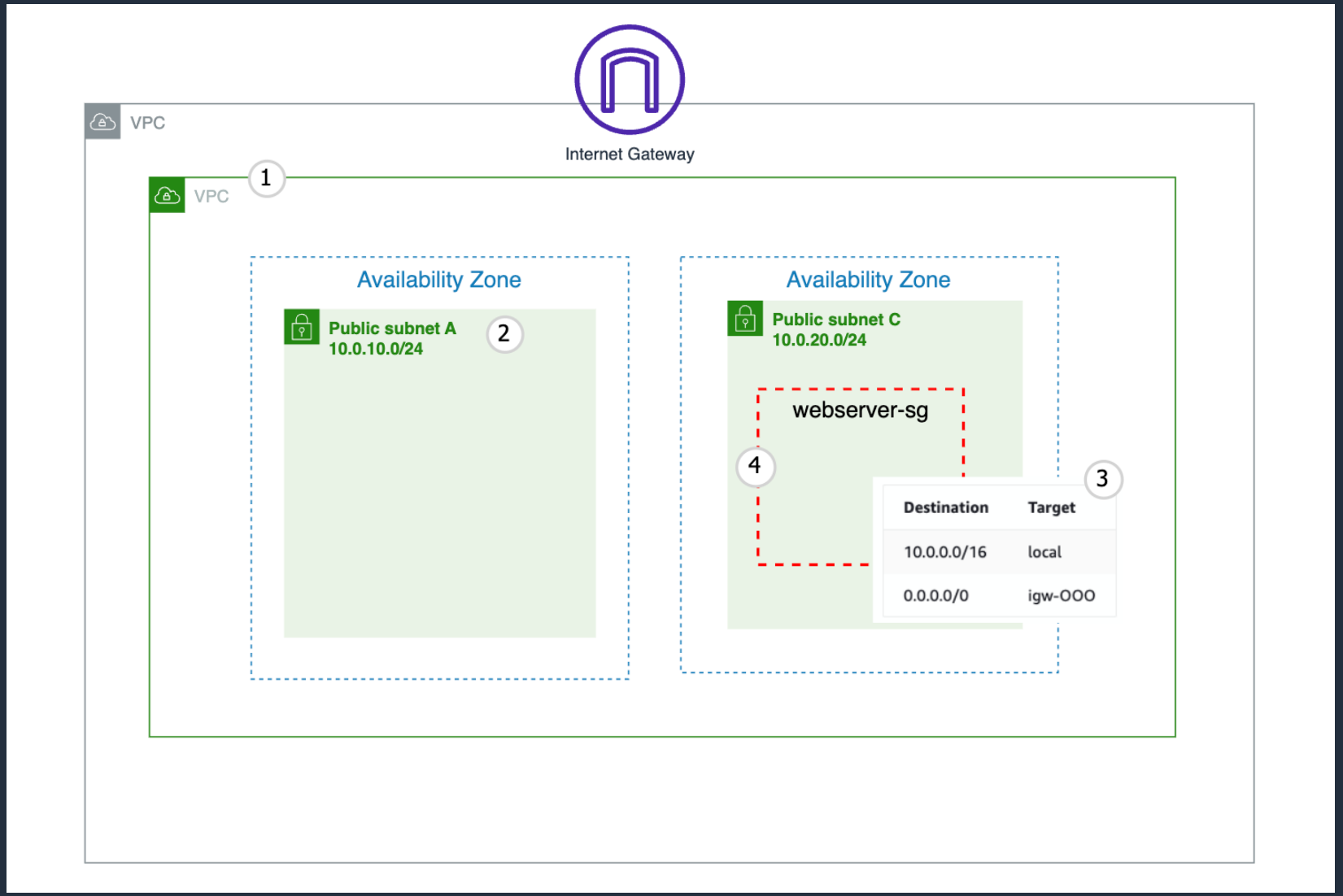
Up-Next

Hands-on-Lab - VPC

Let’s build!

1. Create a VPC
2. Create subnets
3. Edit the routing table
4. Create a Security Group

***VPC Flow Logs (Optional)*



aws health

EMEA HEALTHCARE & LIFE SCIENCES WORKSHOPS

https://aws-experience.com/

- June 27th: AWS Cloud Fundamentals
- June 28th: Genomic Data Analysis with Amazon Omics
- July 4th: Machine Learning
- July 5th: AWS for Pharma Manufacturing
- July 6th: Security, Encryption & Data Protection Immersion Day
- July 11th: Sustainability
- July 13th: High-performance computing
- July 18th: Compliance in the Cloud

aws health

Please complete the workshop survey

https://www.aws-experience.com/emea/dach-cee/event-survey/6a7ece835a55-42d9-7b04-9045-5655e005

aws health

Thank you!

Beril Uenay
beriluen@amazon.de

Manuel Gomez
magomgom@amazon.com

Monika Nowakowska
moninov@amazon.com