



Introduction to AWS

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Agenda

- Intro to AWS
- Technical foundations
- Compute in AWS
- Networking in AWS
- Relational databases in AWS
- Example SIS architecture
- Web application hands-on lab



Cloud computing is the on-demand delivery of IT resources over the internet with pay-as-you-go pricing

Benefits of the AWS Cloud in **K12 education**



Innovate faster and with on-demand, purpose-built resources and services.



Lower costs and reallocate resources so you can deliver more efficient and equitable solutions.



Reduce risk by utilizing security infrastructure and practices designed to meet the most stringent requirements.



Improve equity and create better experiences for students, parents, teachers, and staff.



Portland Public Schools PeopleSoft ERP migration



“Now, our annual cost is a third of what it would have been to replace. And we have increased capacity and disaster recovery—things we didn’t have access to with an on-premises data center.”

— **Travis Paakki**
Portland Public Schools

<https://aws.amazon.com/blogs/publicsector/migrating-to-the-cloud-tips-from-portland-public-schools/>
<https://www.zdnet.com/education/computers-tech/oregon-school-district-adopting-aws-to-improve-student-outcomes/>

Loudoun County Public Schools migrates SIS and more

“We don’t have to think about spending \$1-2 million on a facility to house a data center.”

— Aaron Smith, Director of Infrastructure

THEN



Two data centers
over 20 years old



Rigid IT resources and
delayed time to value

NOW



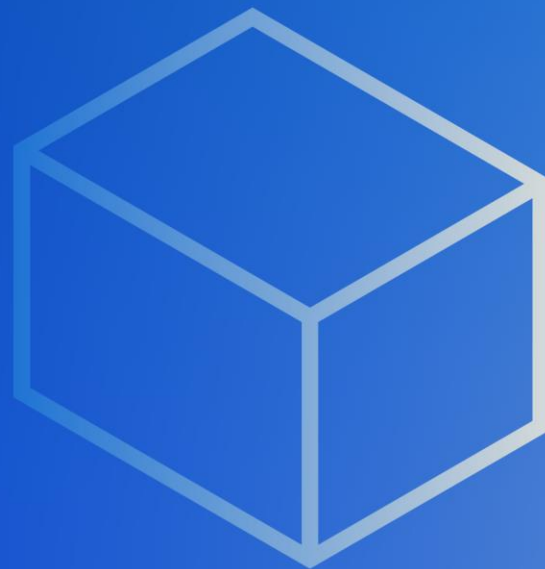
Increased agility, faster
time to value, and
improved security



Moved 50% of workloads
to AWS – SIS, backups,
VDI

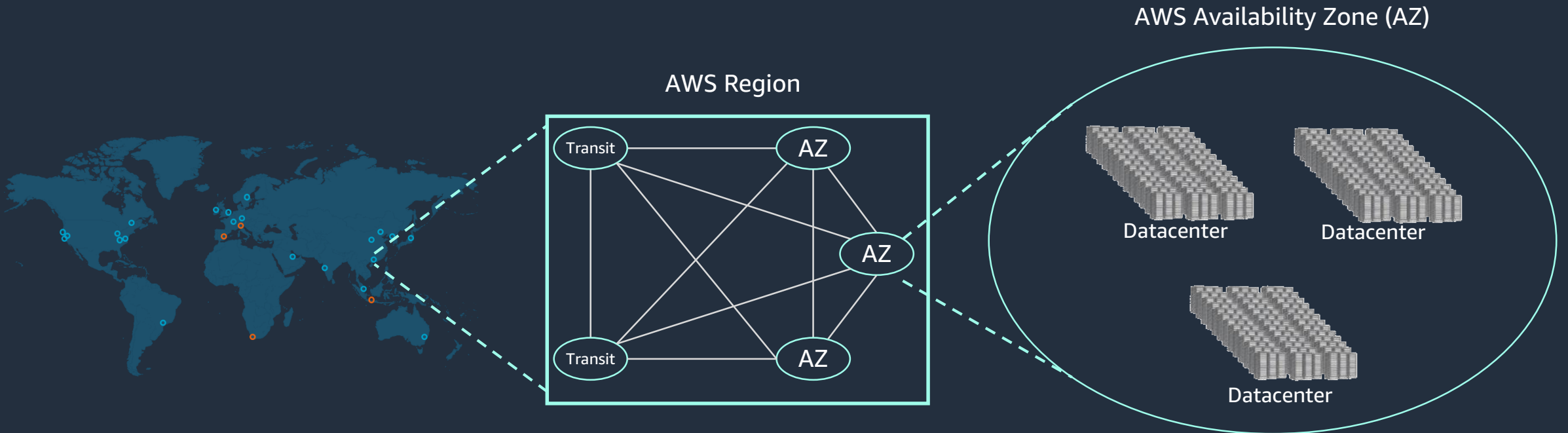
Sources: Blog - Loudoun County Public Schools Digitally Transforms With AWS

Technical foundations



AWS Region design

AWS Regions are comprised of multiple **Availability Zones (AZs)** for high **availability**, **scalability**, and **fault tolerance**.



A Region is a physical location in the world where we have multiple **Availability Zones**.

Availability Zones consist of one or more discrete data centers, each with redundant power, networking, and connectivity, housed in separate facilities.

Shared Responsibility Model - Security

You are responsible for
security **in** the cloud

Customer
AWS

AWS is responsible for
security **of** the cloud

Customer responsibility is determined by the AWS Cloud services a customer selects.

AWS is responsible for protecting the infrastructure that runs all the services offered in the AWS Cloud.

Shared Responsibility Model – Compliance and Regulation

You are responsible for compliance **in** the cloud

Customer
AWS

AWS is responsible for compliance **of** the cloud

Compliance Requirements



Control Mapping

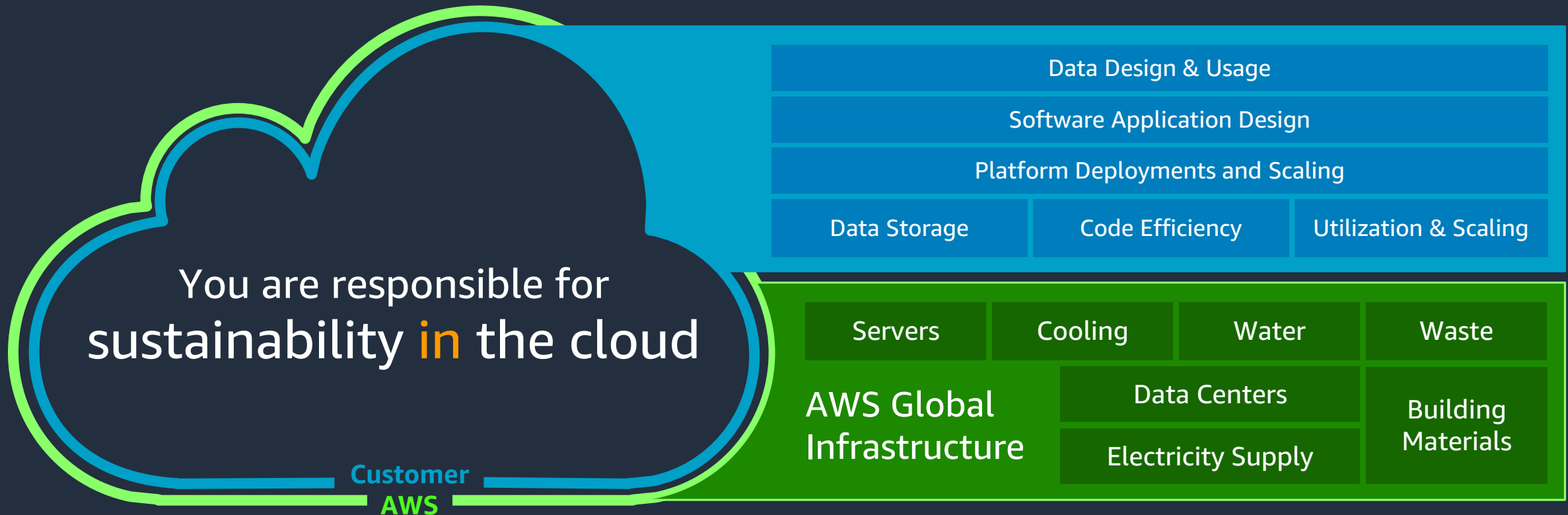


3rd Party Audits
(If Required)



Full list at <https://aws.amazon.com/compliance/>

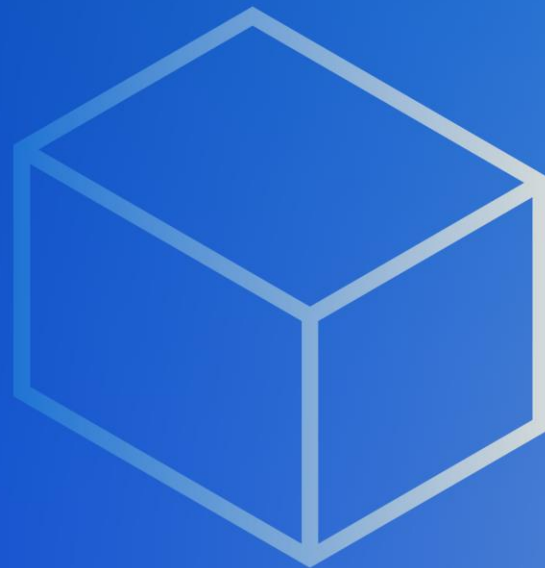
Shared Responsibility Model - Sustainability



<https://sustainability.aboutamazon.com/products-services/the-cloud>

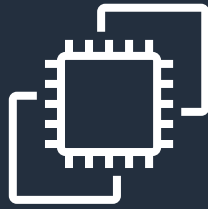
AWS is responsible for sustainability **of** the cloud

Compute in AWS



Choices for Compute

World-class performance, security, and innovation



AMAZON EC2

Virtual server instances
in the cloud



AMAZON ECS, EKS, and FARGATE*

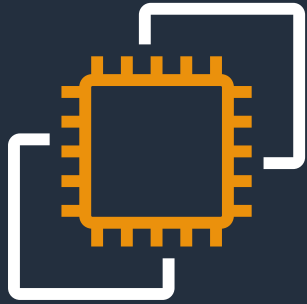
Container management
service for running
Docker on a managed
cluster of EC2



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

Storage independent of compute, allocated as Amazon Elastic Block Store (EBS) volumes

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

Instance Types



General Purpose

Compute Optimized

Memory Optimized

Accelerated Computing

Storage Optimized

	Burstable performance	General Purpose	Compute Intensive	Compute + network up to 100 Gbps	Memory Optimized	In-memory	Memory Intensive	Compute and Memory Intensive	Graphics Intensive	General Purpose GPU	FPGA	High I/O	Dense Storage	Big Data Optimized
	T3	M5	C5	C5n	R5	X1	X2iedn		G3	P2	F1	I3en	D3	H1
Local storage (NVMe SSD)		M5d	C5d		R5d			Z1d				I3		
	T3a	M5a			R6a				G5					
metal		M5	C5		R5	u-24tb1		Z1d				I3		
AWS Graviton	T4g	M6g	C7g	C6gn	R7g	X2gd			G5g			Im4gn		



Choosing an AMI

AWS Console

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 1: Choose an Amazon Machine Image (AMI)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Quick Start

My AMIs

AWS Marketplace

Community AMIs

Free tier only

Image ID	Name	Architecture
ami-04681a1dbd79675a5	Amazon Linux 2 AMI (HVM), SSD Volume Type -	64-bit
ami-0ff8a9107177f867	Amazon Linux 2018.03.0 (HVM), SSD Volume Type -	64-bit
ami-6871a115	Red Hat Enterprise Linux 7.5 (HVM), SSD Volume Type -	64-bit

AWS Marketplace

aws marketplace

View Categories Migration Mapping Assistant Your Saved List Sell in AWS Marketplace Amazon Web Services Home Help

Operating Systems (336 results) showing 1 - 10

Categories

All Categories

Infrastructure Software

Operating Systems

Filters

Vendors

clickwrk Ltd (84)

Amazon Web Services (84)

Center for Internet Security (20)

Thinking Software, Inc. (13)

CentOS.org (9)

Technology Leadership Corporation (9)

Plesk (9)

Canonical Group Limited (8)

SmartAMI (7)

Cloud Linux (6)

Show more

Operating System

+ All Windows

+ All Linux/Unix

Software Pricing Plans

Free (104)

Hourly (212)

Monthly (3)

Name	Rating	Version
CentOS 7 (x86_64) - with Updates HVM	★★★★★ (58)	Version 1805_01
CentOS 6 (x86_64) - with Updates HVM	★★★★★ (33)	Version 1805_01
Debian GNU/Linux 8 (Jessie)	★★★★★ (86)	Version 8.7
CentOS 6.5 (x86_64) - Release Media	★★★★★ (55)	Version 6.5 - 2013-12-01

Use the AMI ID to launch through the API or AWS Command Line Interface (AWS CLI)

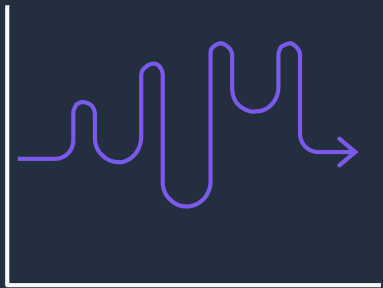
```
aws ec2 run-instances --image-id ami-04681a1dbd79675a5 --instance-type c4.8xlarge --count 10 --key-name MyKey
```



Amazon EC2 purchasing options

On-Demand

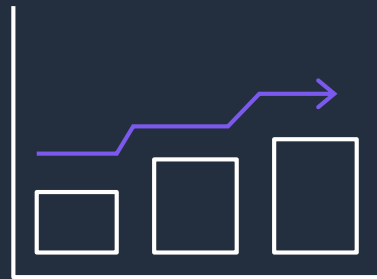
Pay for compute capacity by **the second** with no long-term commitments



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

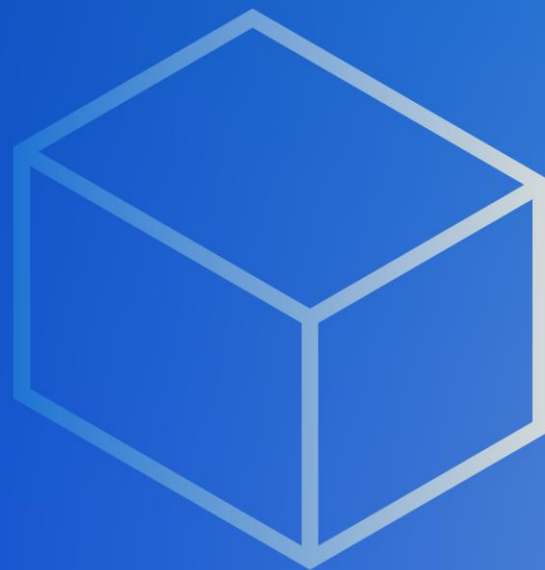
Spot Instances

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



Fault-tolerant, flexible,
stateless workloads

Networking in AWS

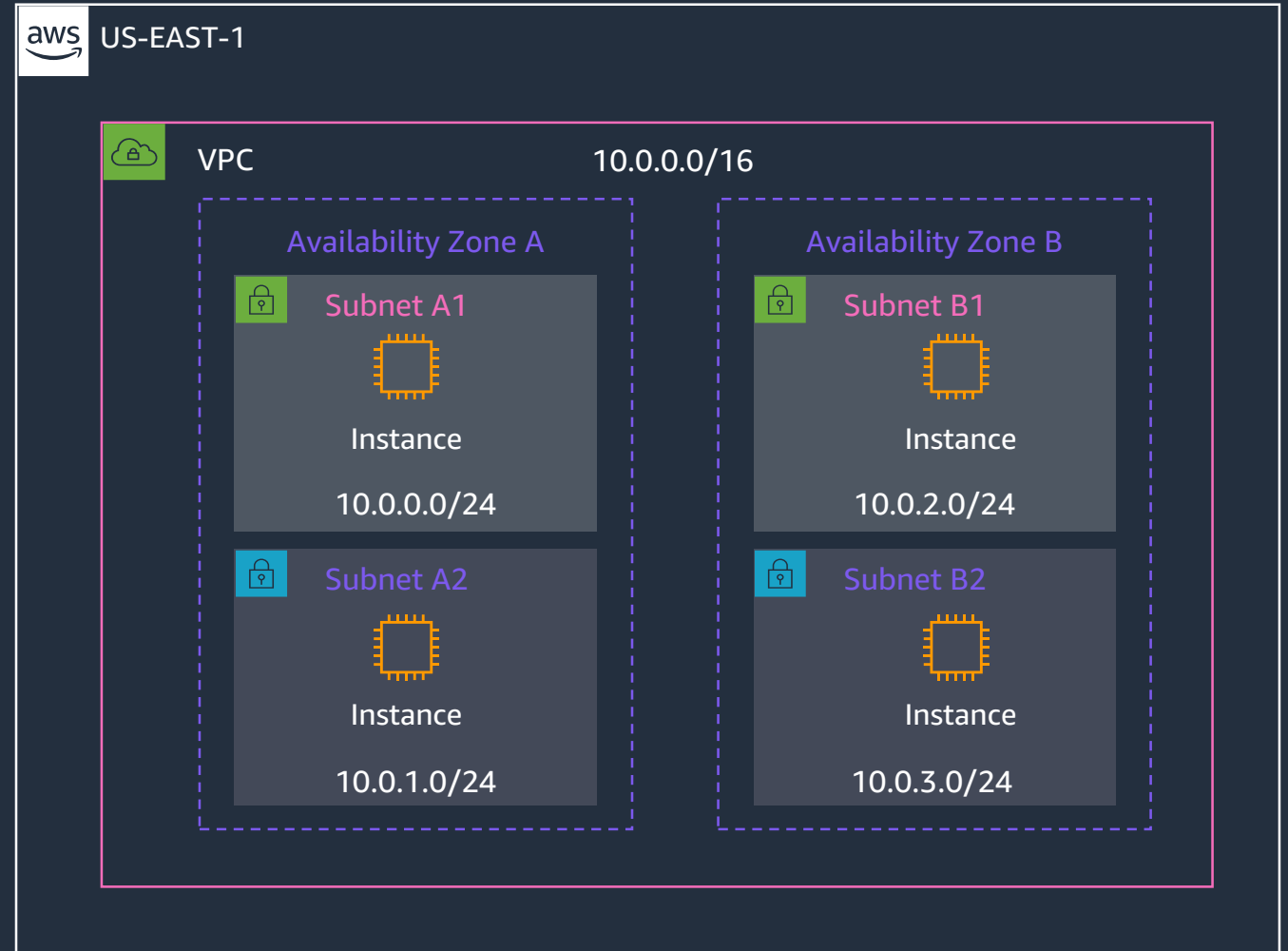


Amazon Virtual Private Cloud (VPC) overview

Your own logically isolated, virtual network in the AWS cloud

Define your own:

- IP addresses
- Subnets
- Network topology
- Firewalls
- Routing tables
- Private connectivity

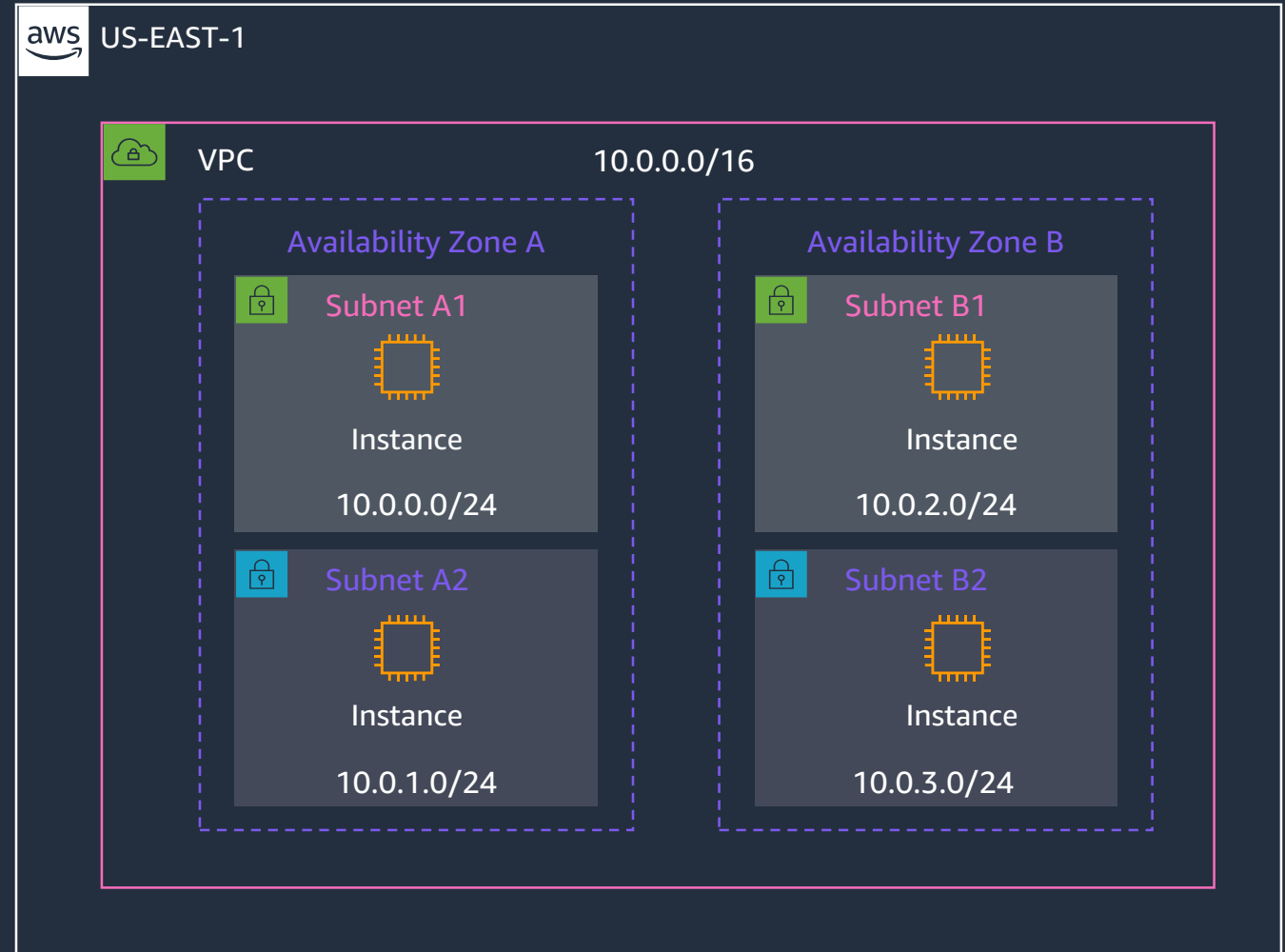


VPC IP addressing considerations

- Plan your IP space before creating it
 - Overlapping IP spaces = future headache
 - Consider using multiple VPCs
 - Consider future AWS region expansion
 - Consider future connectivity to existing networks
 - Consider subnet design
- The VPC IP Address Manager (IPAM) feature can be leveraged to plan, track, and monitor IP addressing in AWS
- Amazon VPC IP Address Manager (IPAM) now manages IP Addresses in your network outside your AWS Organization

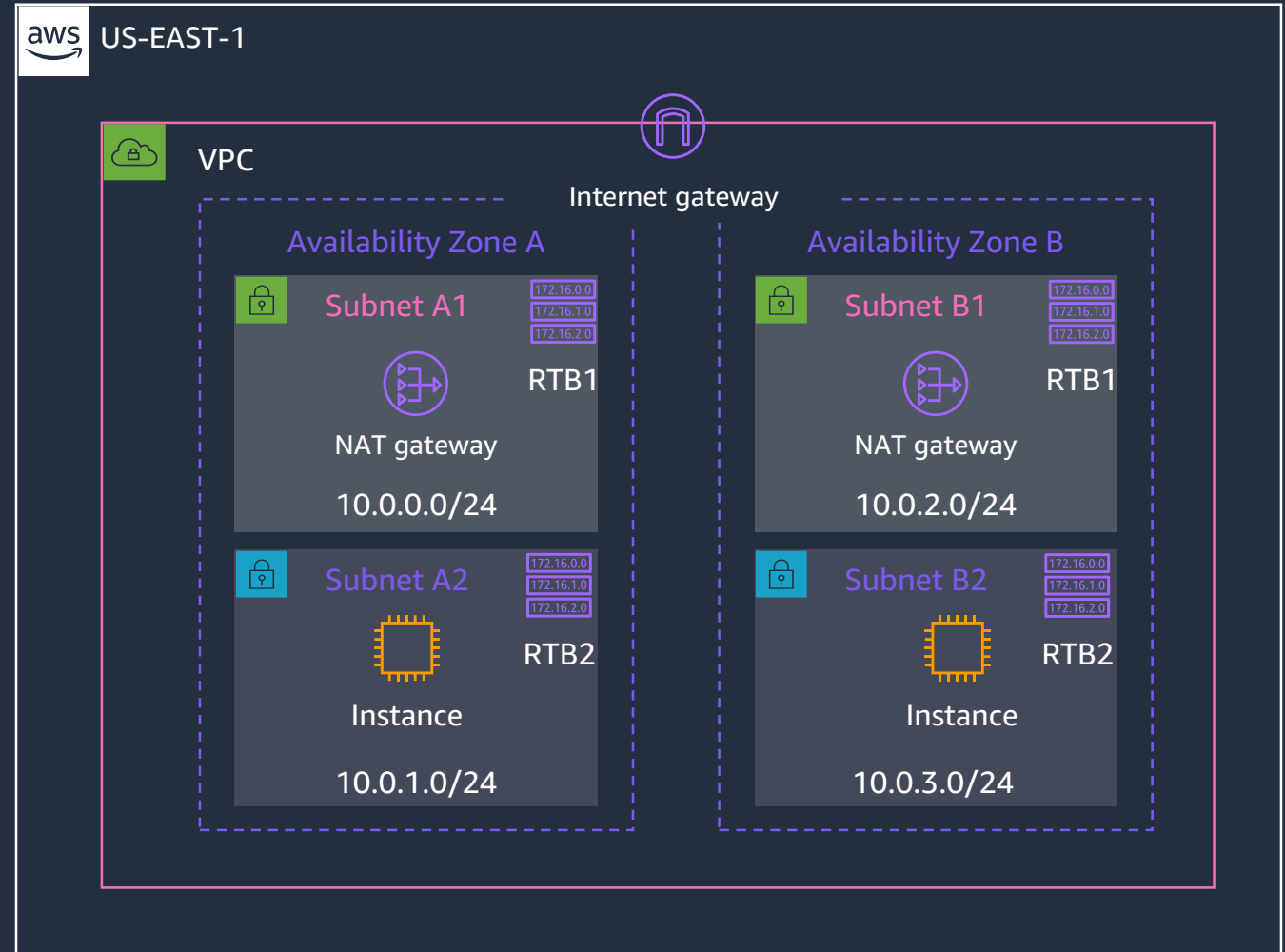
Subnets

- VPCs span a region
- Subnets are allocated as a subset of the VPC CIDR range and span a specific AZ
- Can be public or private depending on how route tables are configured



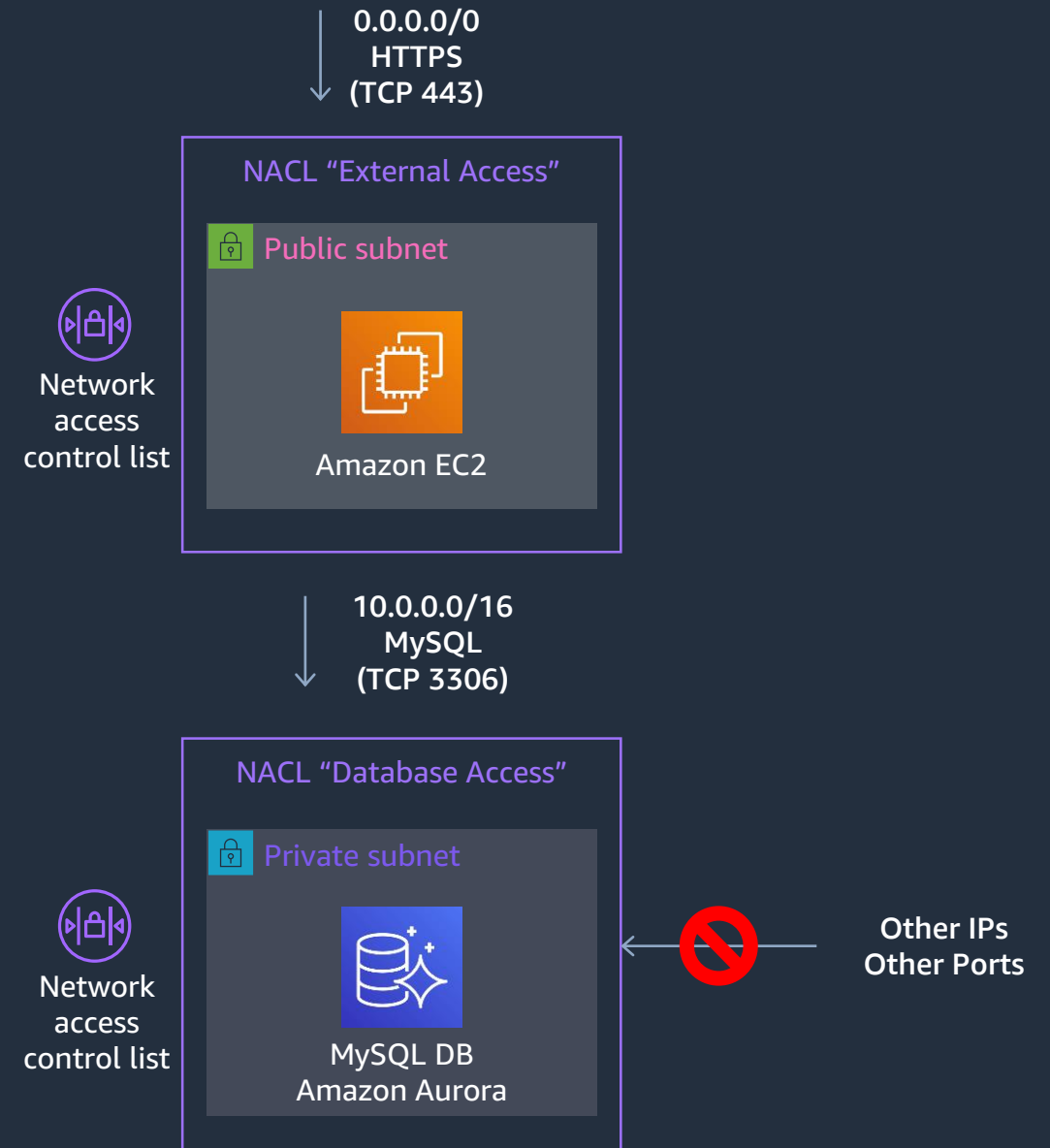
Routing tables

- Each subnet has an associated routing table
- Route Internet traffic from public subnets out through an **Internet Gateway**
- Route Internet traffic from private subnets out through a **NAT Gateway**
- Multiple connectivity options for private traffic



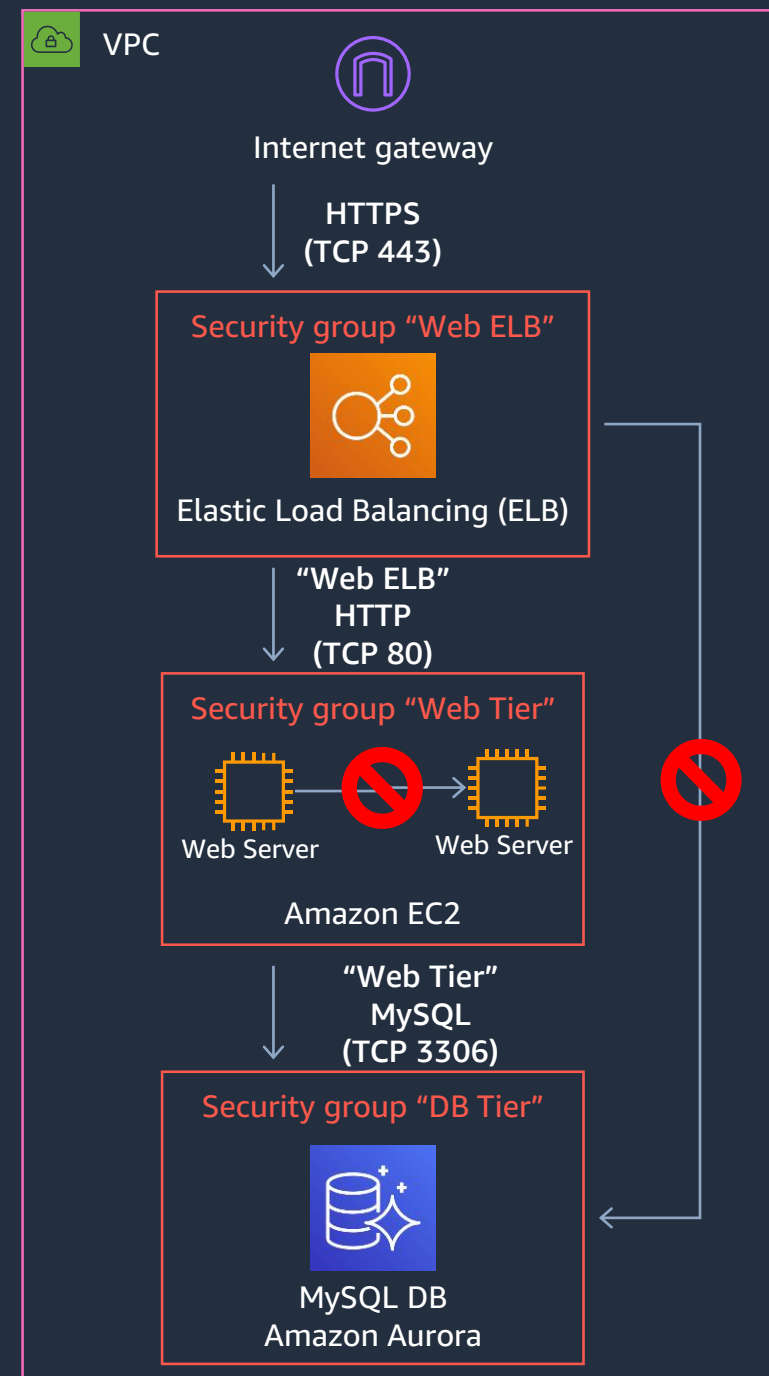
Network Access Control List

- Stateless firewall
- IP and TCP/UDP port based
- Inbound and Outbound
- Subnet level inspection
- Optional level of security - by default, allow all traffic
- Supports allow and deny rules



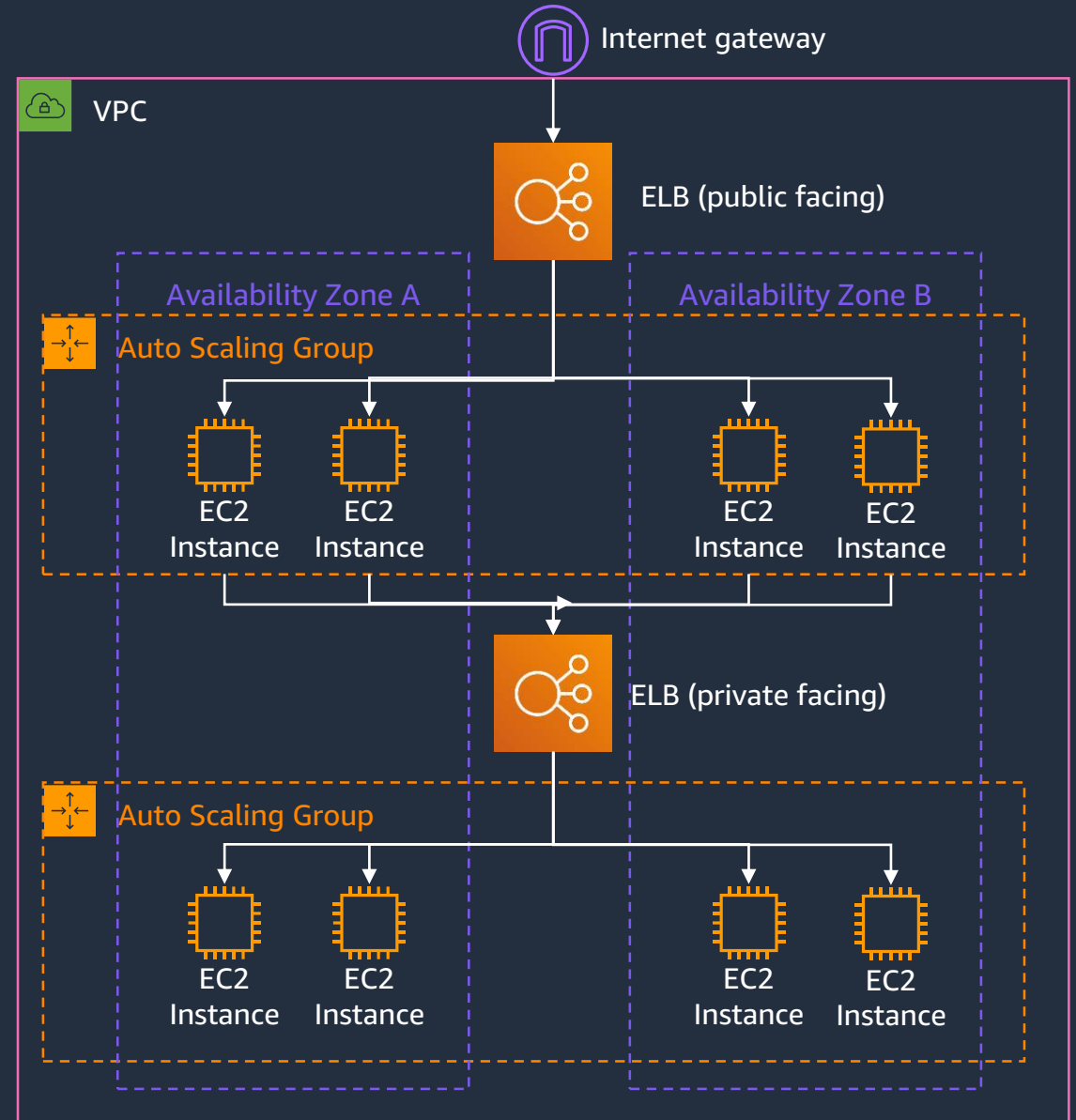
Security Groups

- Stateful firewall
- Only supports allow rules
- Implicit deny all if not allowed
- Inbound and outbound customer defined rules
- Instance/Interface level inspection
- Micro segmentation
- Can be cross referenced
- Mandatory - all instances have an associated Security Group



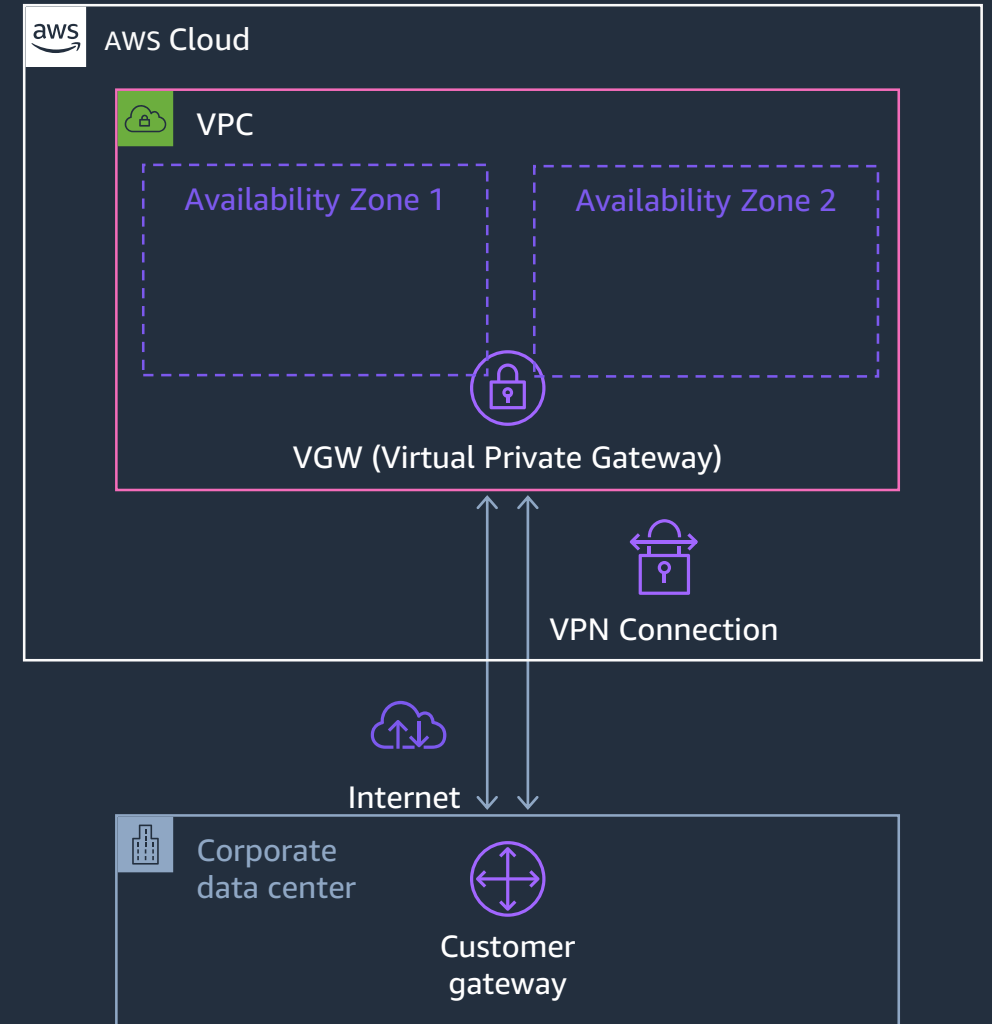
Elastic Load Balancing

- Distribute traffic to multiple targets
 - EC2 instances
 - Containers
 - Lambda
 - IP addresses
- Highly available and scalable across AZs
- Application (L7) and Network (L4) options
- Supports Auto Scaling Groups
 - Automatically (de)register instances to the ELB based on health checks



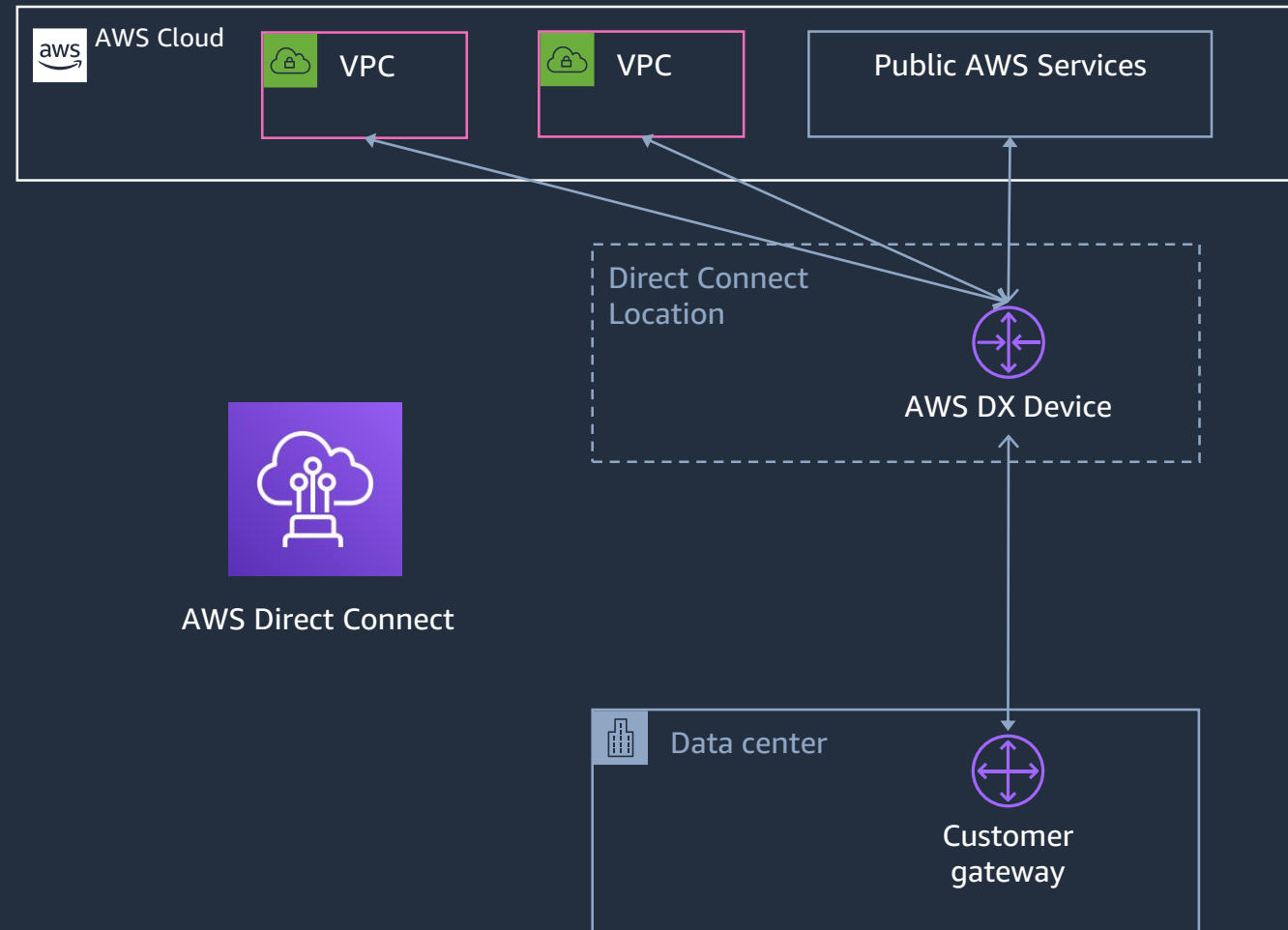
Private connectivity: Site-to-site VPN

- Fully managed VPN endpoint device
- One Virtual Private Gateway per VPC
- Redundant IPSec VPN Tunnels Terminating in different AZs
- IPSec AES 256-bit encryption SHA-2 hashing
- Scalable
- Dynamic (BGP) or Static Routing



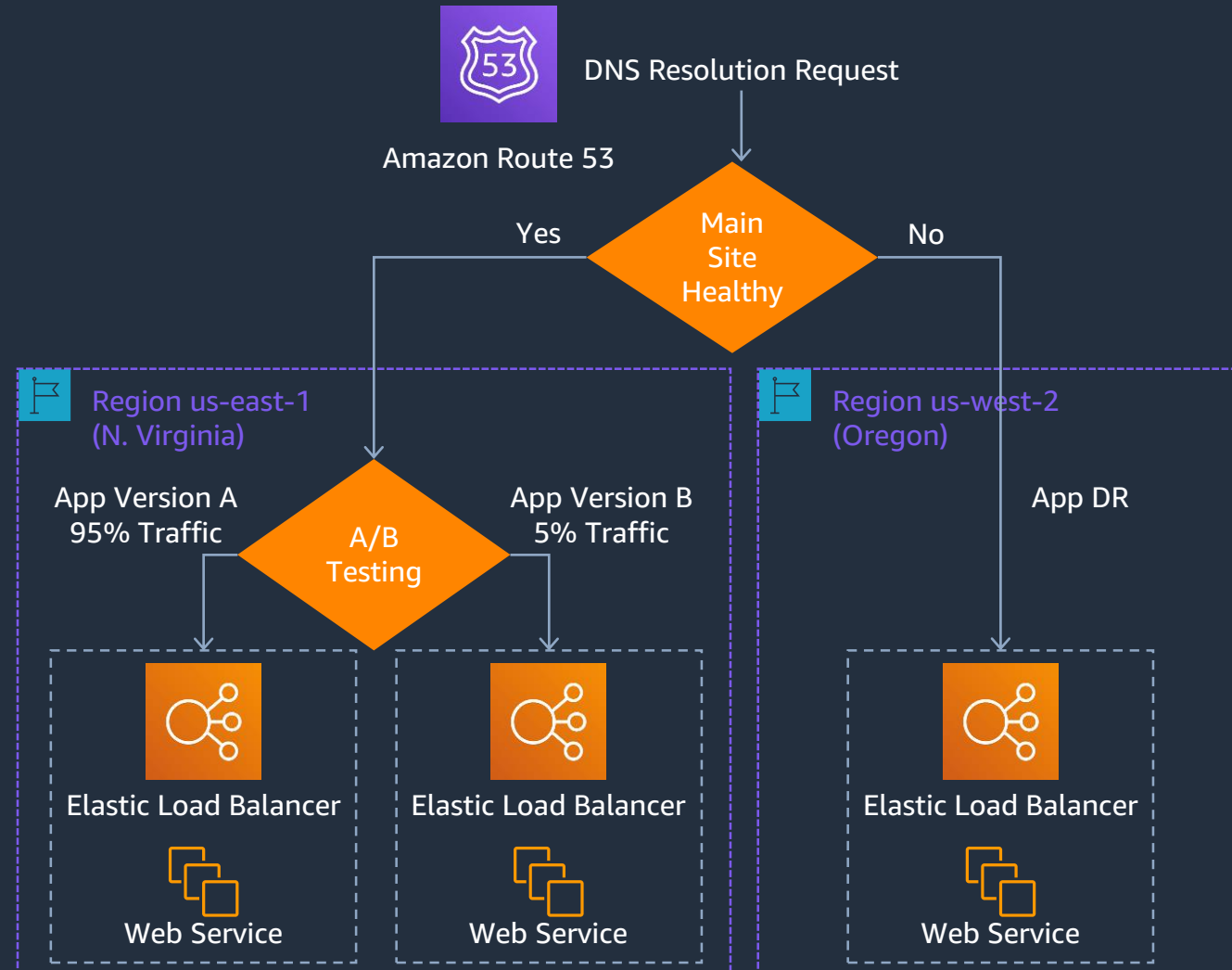
Private connectivity: AWS Direct Connect

- Dedicated network connection into the AWS backbone
- Dedicated connection (1,10 or 100 Gbps - multiple VIFs)
- AWS Partner Hosted Connection (50 Mbps to 10 Gbps, Single VIF)
 - CENIC + Internet2 Cloud Connect
- Consistent network performance
 - Dedicated bandwidth
 - Low latency

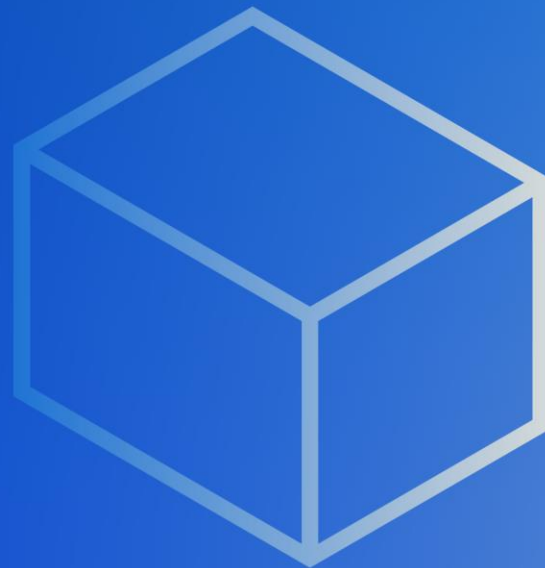


What about DNS? Amazon Route 53

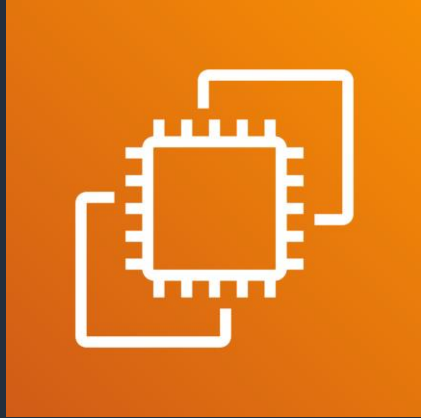
- AWS DNS service
- Domain registration
- Domain name resolution
- 100% availability SLA
- DNSSEC support
- Global routing:
 - Health Checks
 - DNS Failover
 - Methods: Latency, Geography, IP/CIDR, Weighted Round Robin and Multivalue answer
- Public and private DNS



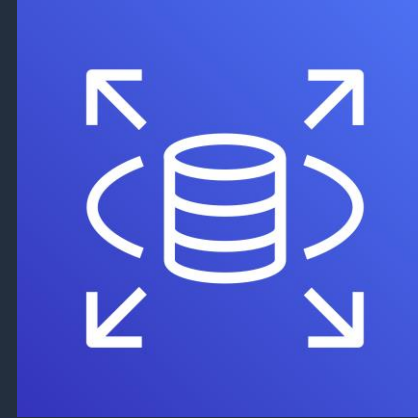
Relational databases in AWS



Relational databases in AWS



Self-managed using
Amazon EC2



As a managed service using
**Amazon Relational Database
Service (RDS)**

Amazon Relational Database Service



Amazon RDS

Supports a variety of database engines:

- SQL Server, Oracle, MySQL, PostgreSQL, MariaDB
- Amazon Aurora (MySQL or PostgreSQL compatible)

Fully managed - zero admin

- Automated installation, patching, and backups
- Encryption
- Push-button high availability, scaling & read replicas

Babelfish for Aurora PostgreSQL

- Run Microsoft SQL Server applications on PostgreSQL with little to no code change

If you host your database on-premises

App optimization

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

Power, HVAC, net



you



If you host your database on Amazon EC2

App optimization

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

Power, HVAC, net

you



BYOL for SQL
Server with
Software Assurance

OS installation

Server maintenance

Rack & stack

Power, HVAC, net



If you use Amazon RDS

App optimization

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

Power, HVAC, net

you



No BYOL for SQL Server

Scaling

High availability

Database backups

DB s/w patches

DB s/w installs

OS patches

OS installation

Server maintenance

Rack & stack

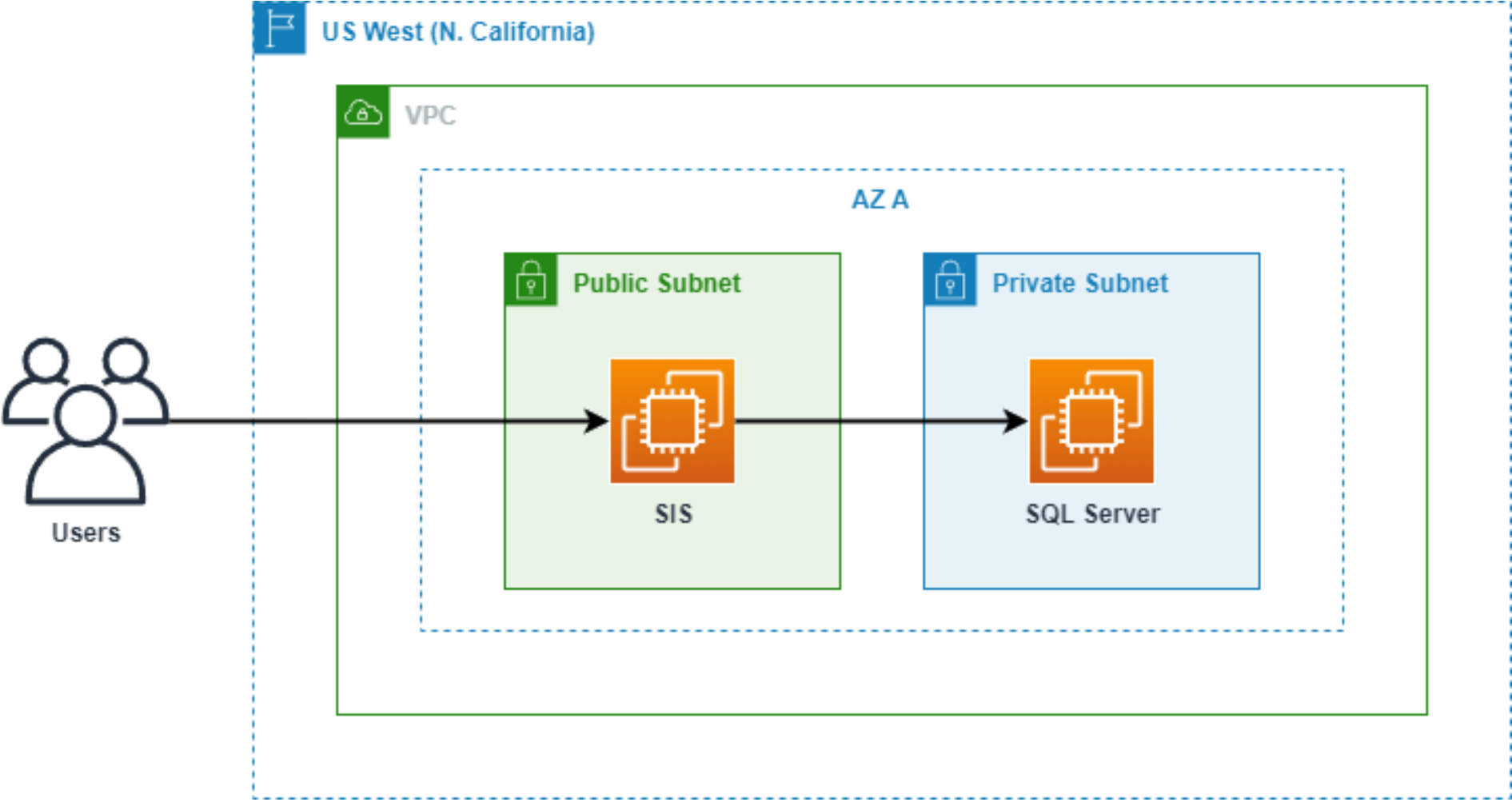
Power, HVAC, net



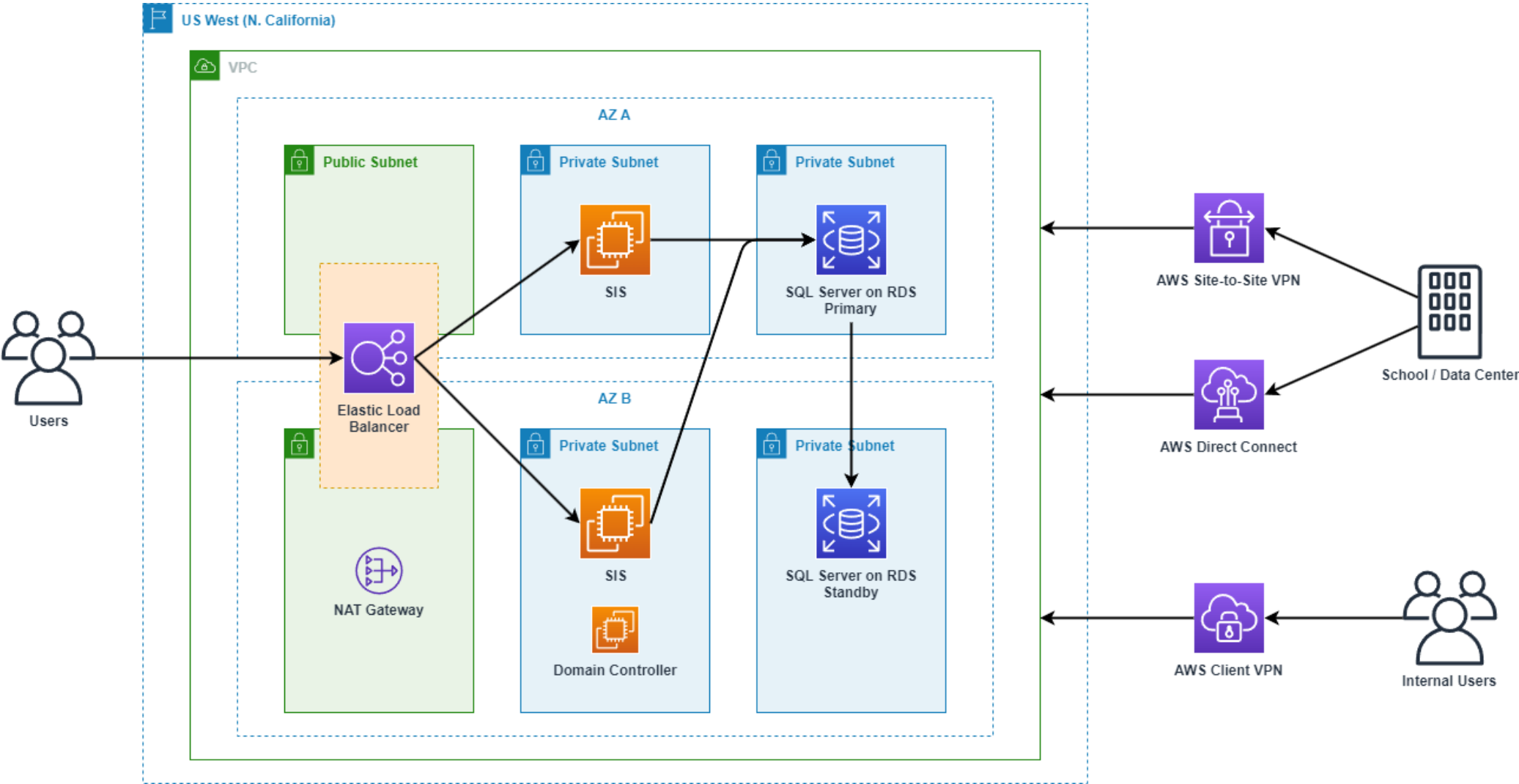
Example SIS architecture



Example SIS architecture



Let's make it better



Hands-on lab

kmccand.com



What else can cloud do for K12?

- Cybersecurity and ransomware mitigation
- Data interoperability and analytics
- Virtual desktops and application streaming
- Video management & streaming
- Artificial intelligence & machine learning
- Student safety
- And more!

Thank you!

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