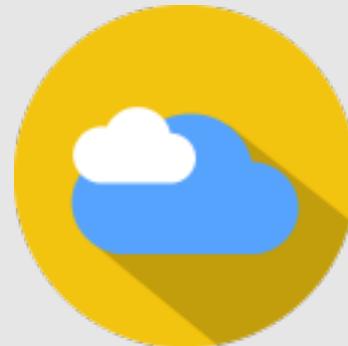


# SECTION 2

## Cloud Computing Fundamentals

# The Definition of Cloud Computing



# The Definition of Cloud Computing

---

On-demand,  
self-service

Broad network  
access

Resource  
pooling



Gmail



The Internet



Dropbox



Salesforce.com

Rapid  
elasticity



Measured  
service



Amazon Web Services



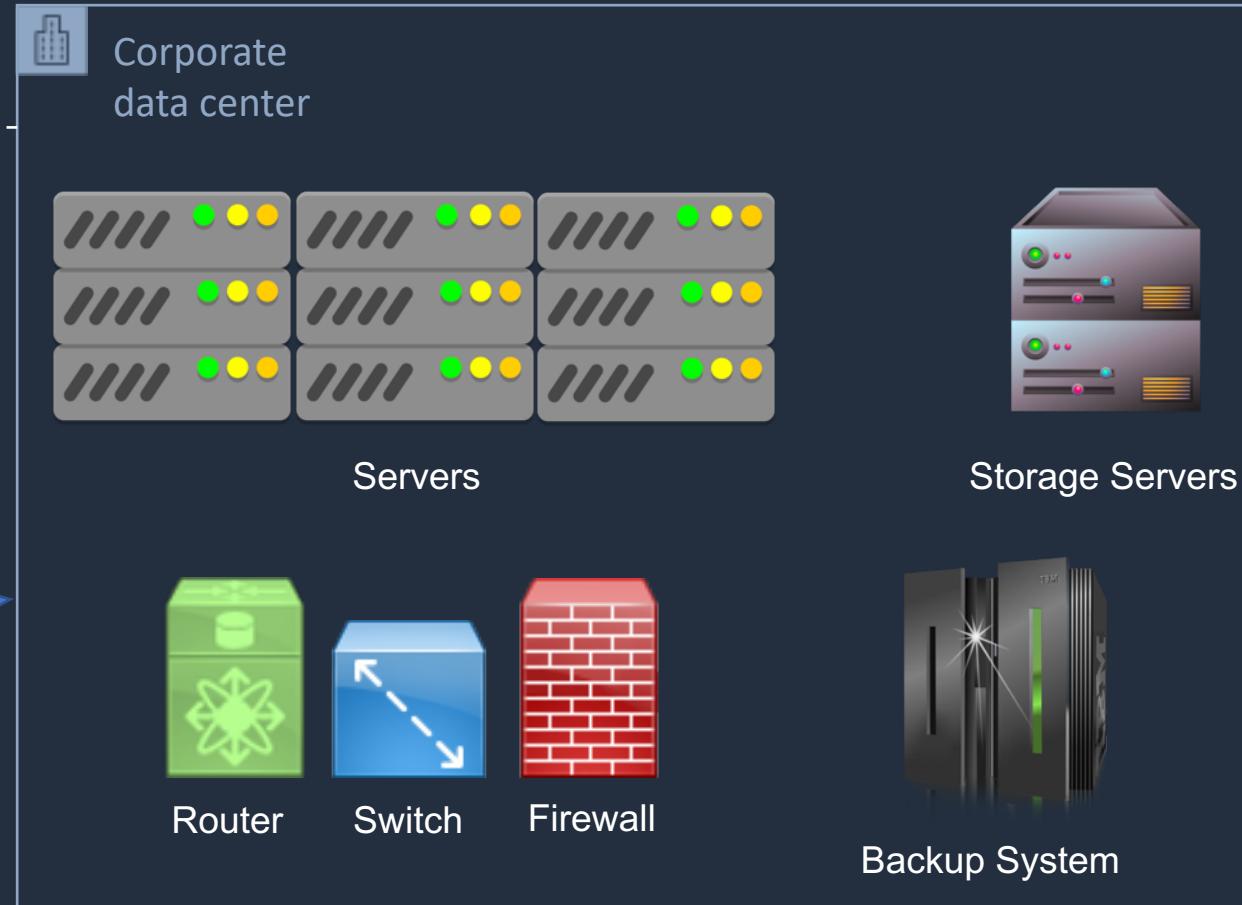
# Comparing Cloud Computing to Traditional IT



# Traditional IT / Legacy IT



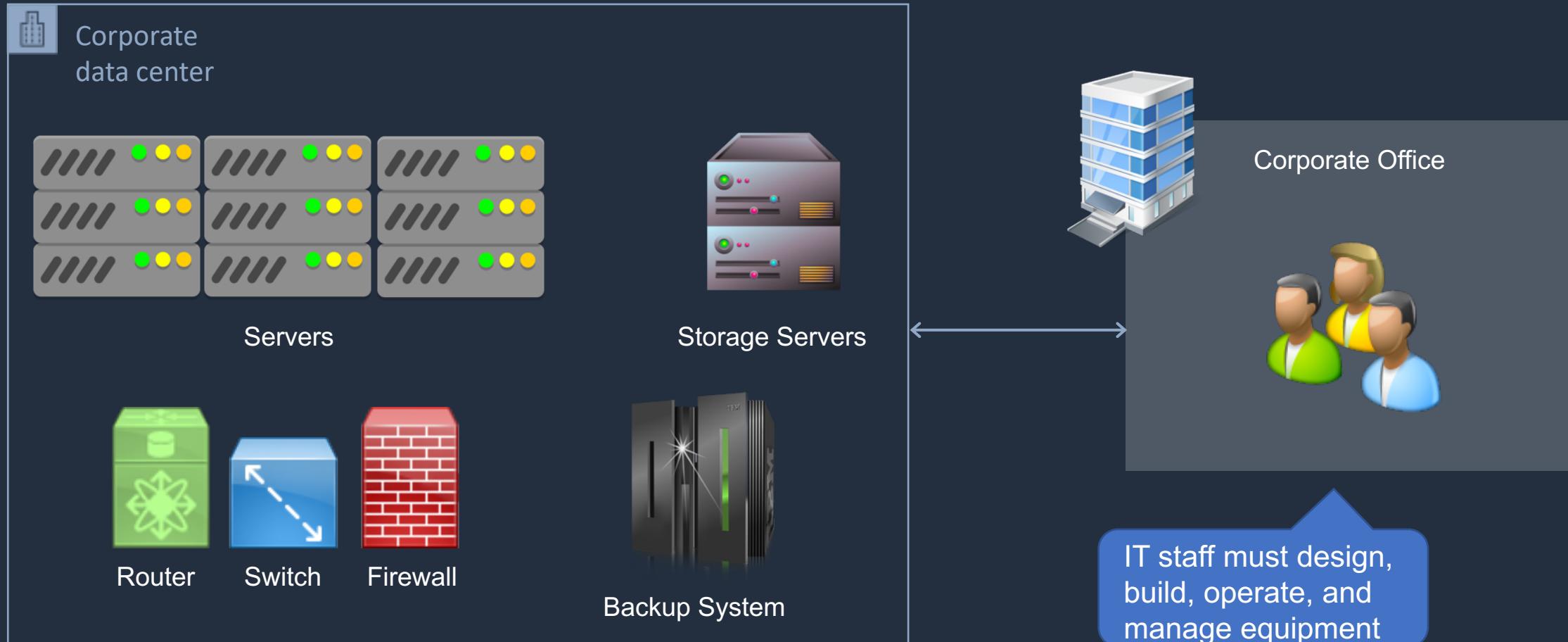
This model is very capital intensive



A company typically leases space in a data center, or may own the whole building

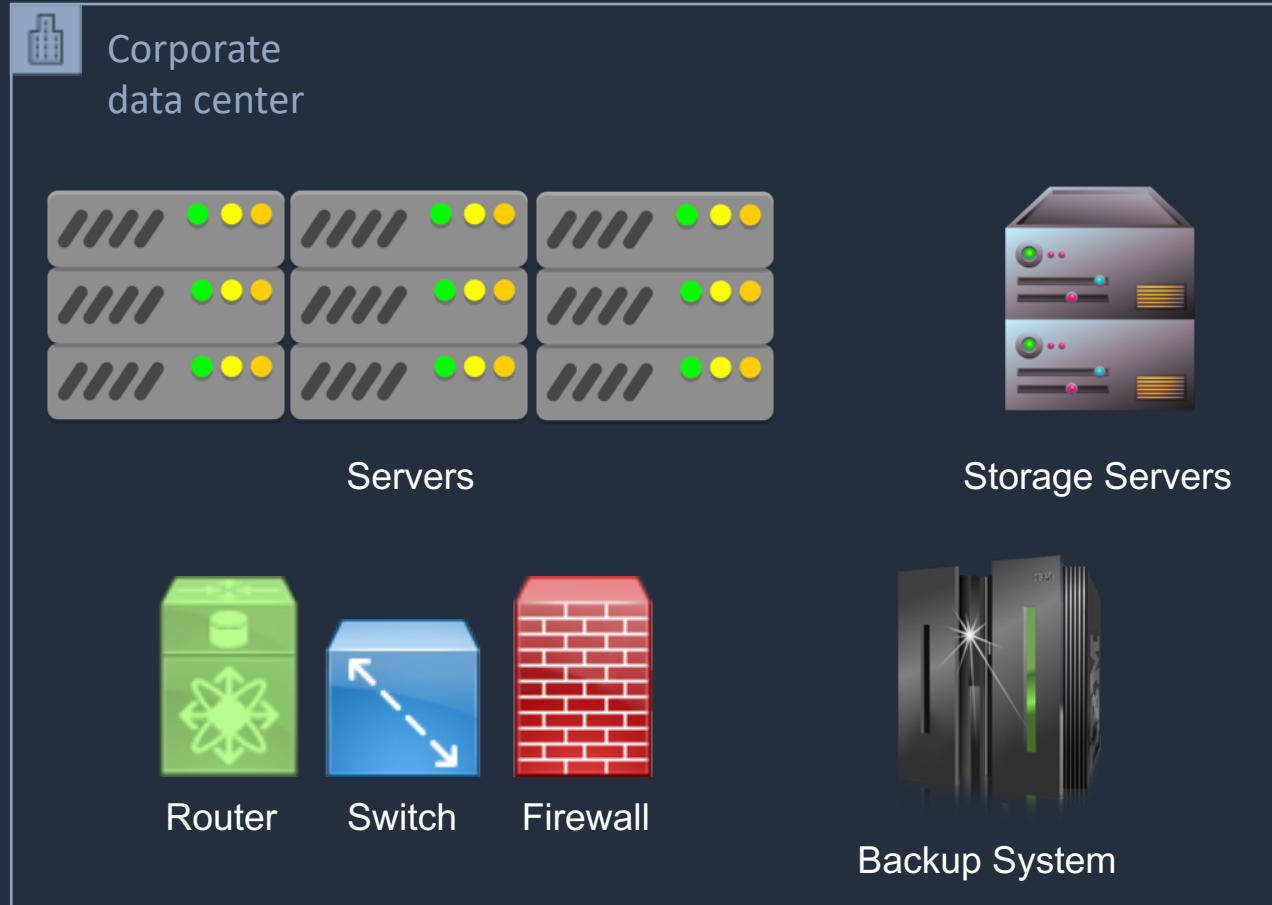
The IT equipment is owned by the company\*

# Traditional IT / Legacy IT



# Traditional IT / Legacy IT

---



## Costs:

- Data center building
- Data center security
- Physical IT hardware
- Software licensing costs
- Maintenance contracts
- Power
- Internet connectivity
- Staff wages (design, build, operations, maintenance)

# Cloud vs Traditional IT

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## Cloud Computing

On-demand, self-service

Broad network access

Resource pooling

Rapid elasticity

Measured service

## Traditional IT

Requires human involvement

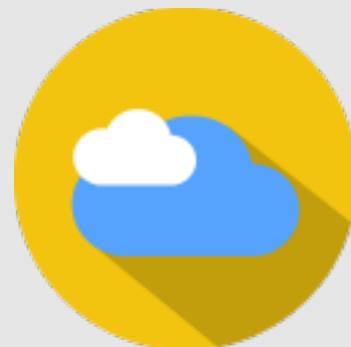
Internal accessibility, limited public presence

Single-tenant, can be virtualized

Limited scalability

Usage is not typically measured

# Cloud Computing Deployment Models

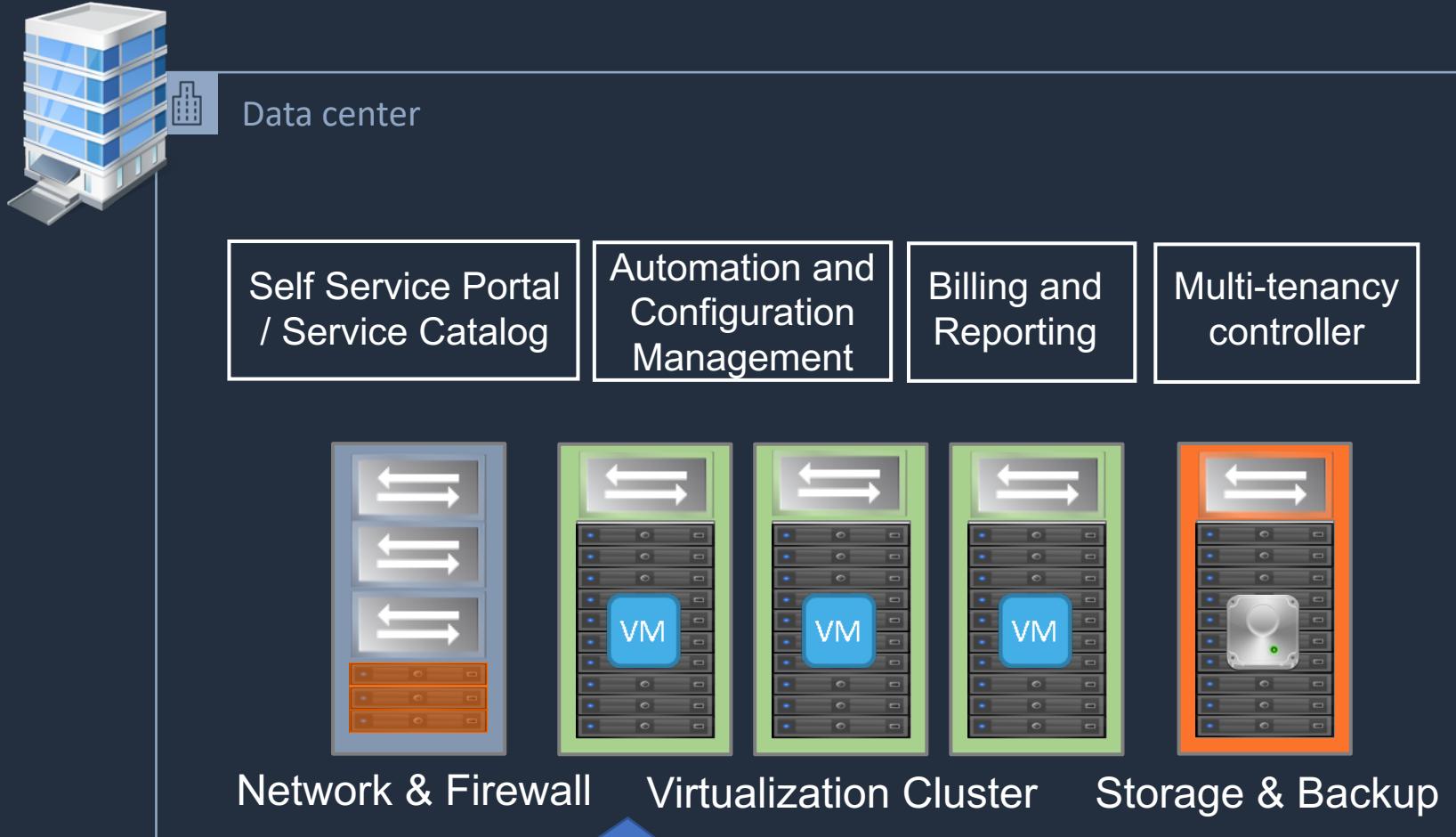


# Cloud Computing Deployment Models

---

Name	Description	Examples
<b>Private Cloud</b>	An enterprise deploys their own infrastructure and applications into their own data center	VMware, Microsoft, RedHat, OpenStack
<b>Public Cloud</b>	The IT services that you consume are hosted and delivered from a third-party and accessed over the Internet	AWS, Microsoft Azure, Google Cloud Platform
<b>Hybrid Cloud</b>	A combination of on-premises, private cloud, and public cloud services are consumed	
<b>Multicloud</b>	Usage of two or more public clouds at a time, and possibly multiple private clouds	

# Private Cloud



Cloud management  
software layer

## Benefits

- Complete control of the entire stack
- Security – in a few cases, organizations may need to keep all or some of their applications and data in house

You build and manage the  
cloud deployment

# Public Cloud

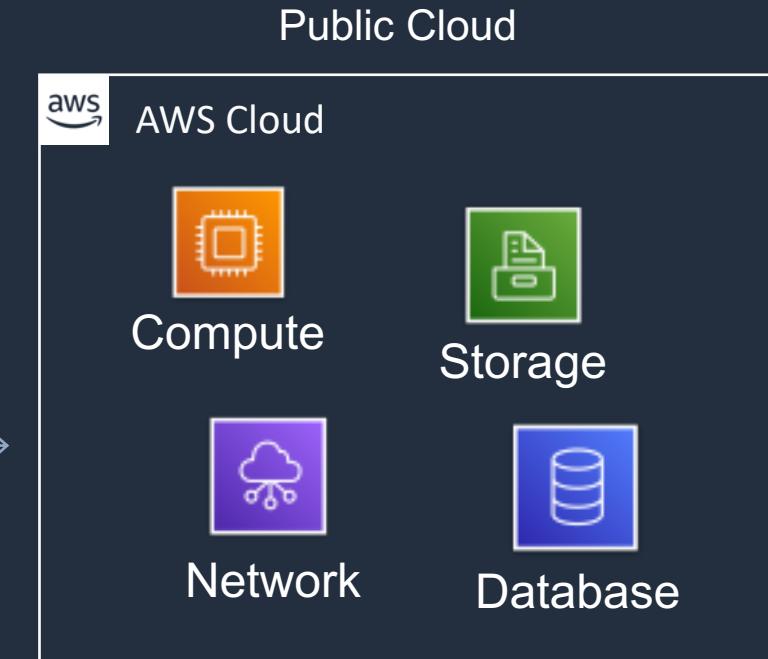
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## Benefits:

- Variable expense, instead of capital expense
- Economies of scale
- Massive elasticity



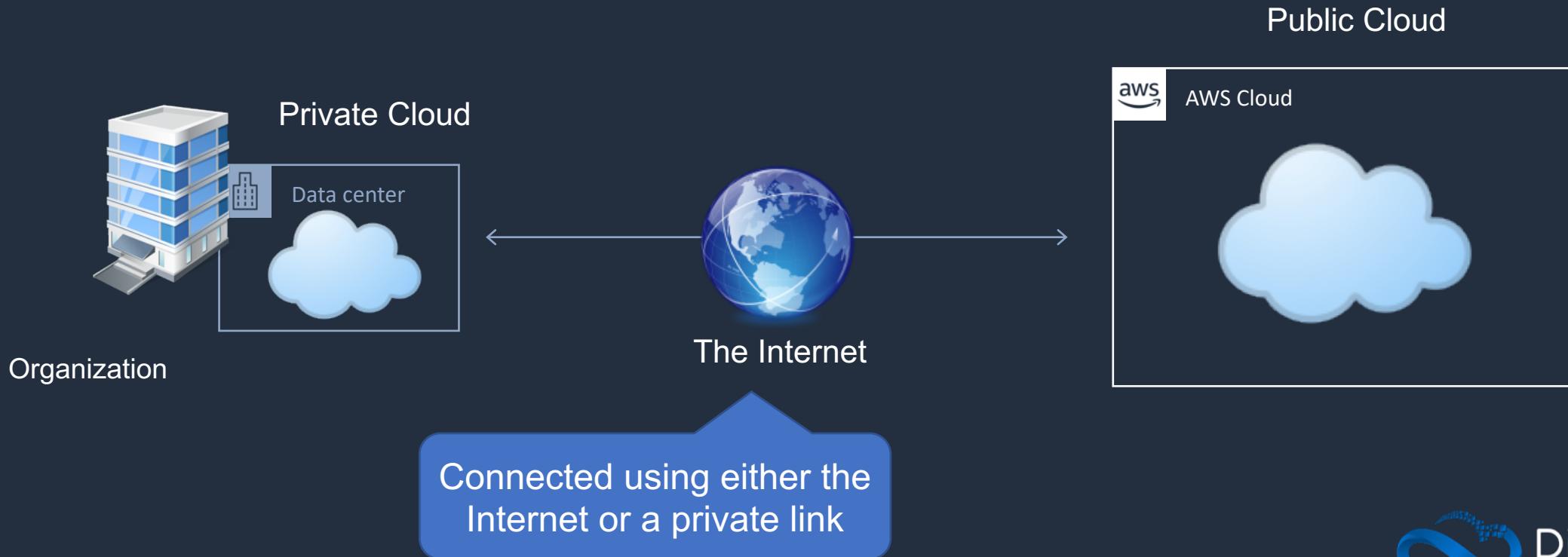
Connected using either the  
Internet or a private link



# Hybrid Cloud

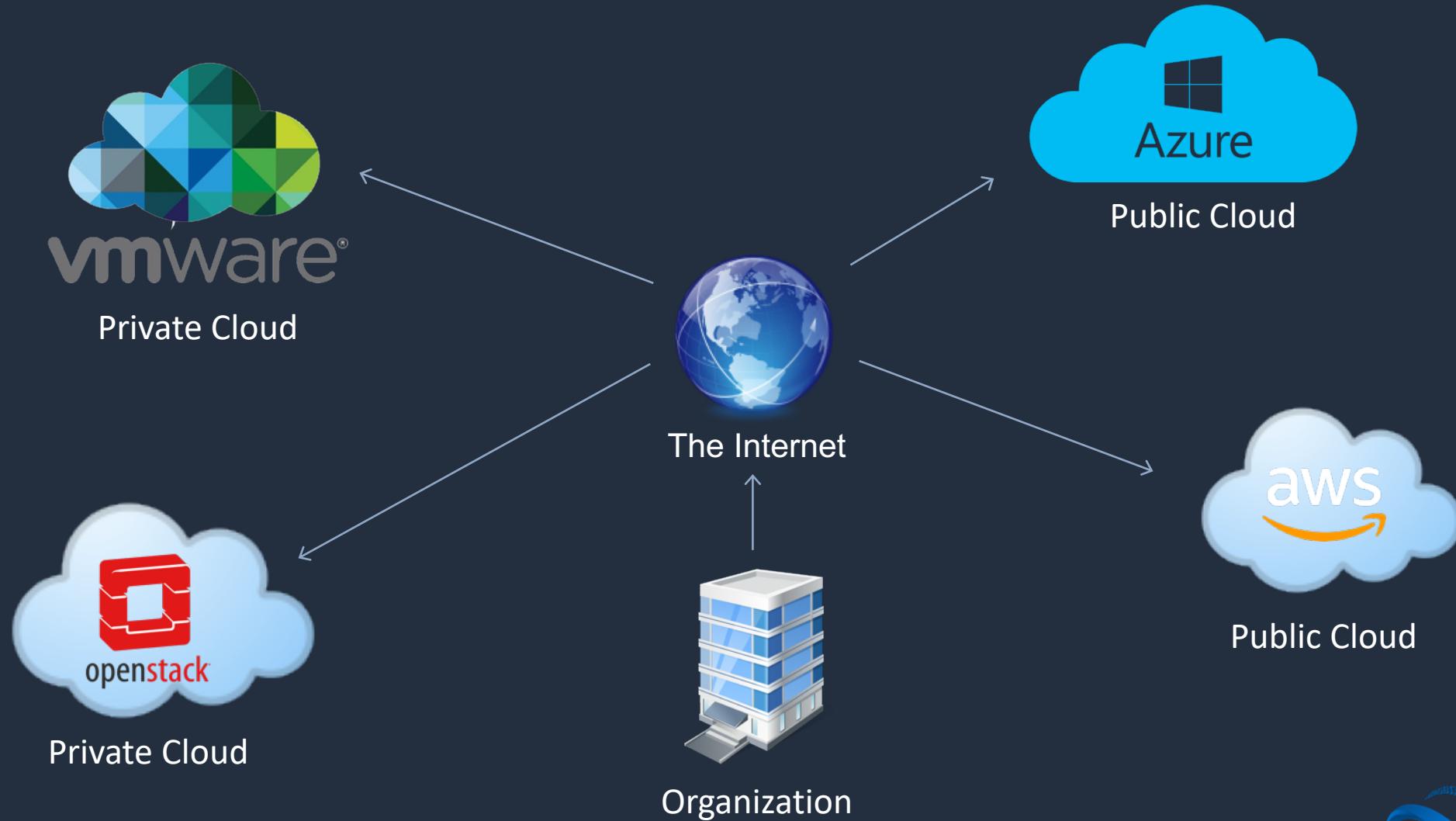
## Benefits:

- Allows companies to keep the critical applications and sensitive data in a traditional data center environment or private cloud
- Take advantage of public cloud resources like SaaS, for the latest applications, and IaaS, for elastic virtual resources
- Facilitates portability of data, apps and services and more choices for deployment models



# Multicloud

---



# Cloud Computing Service Models: IaaS, PaaS, SaaS

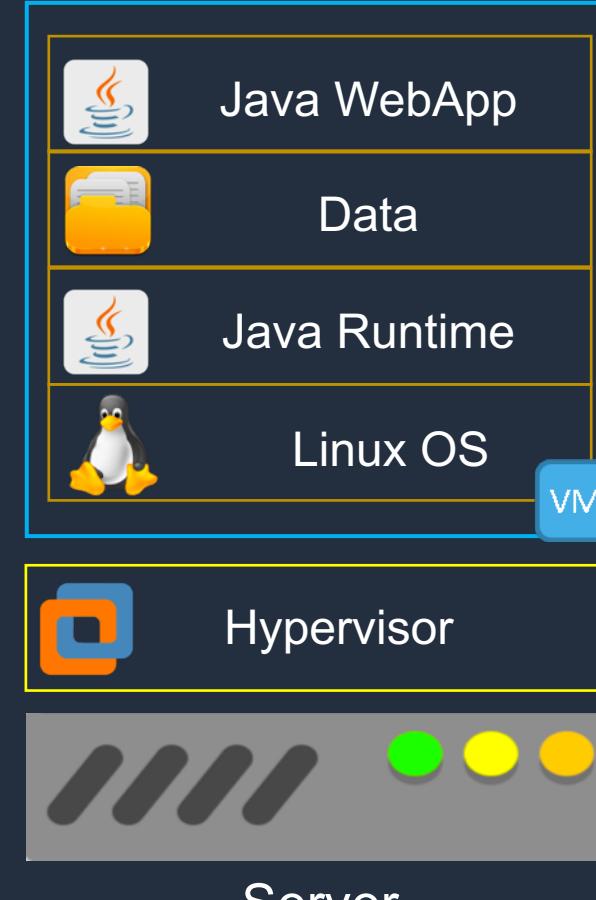


# Private Cloud

---



Managed  
by you



A private cloud must also include self-service, multi-tenancy, metering, and elasticity

# Infrastructure as a Service (IaaS)

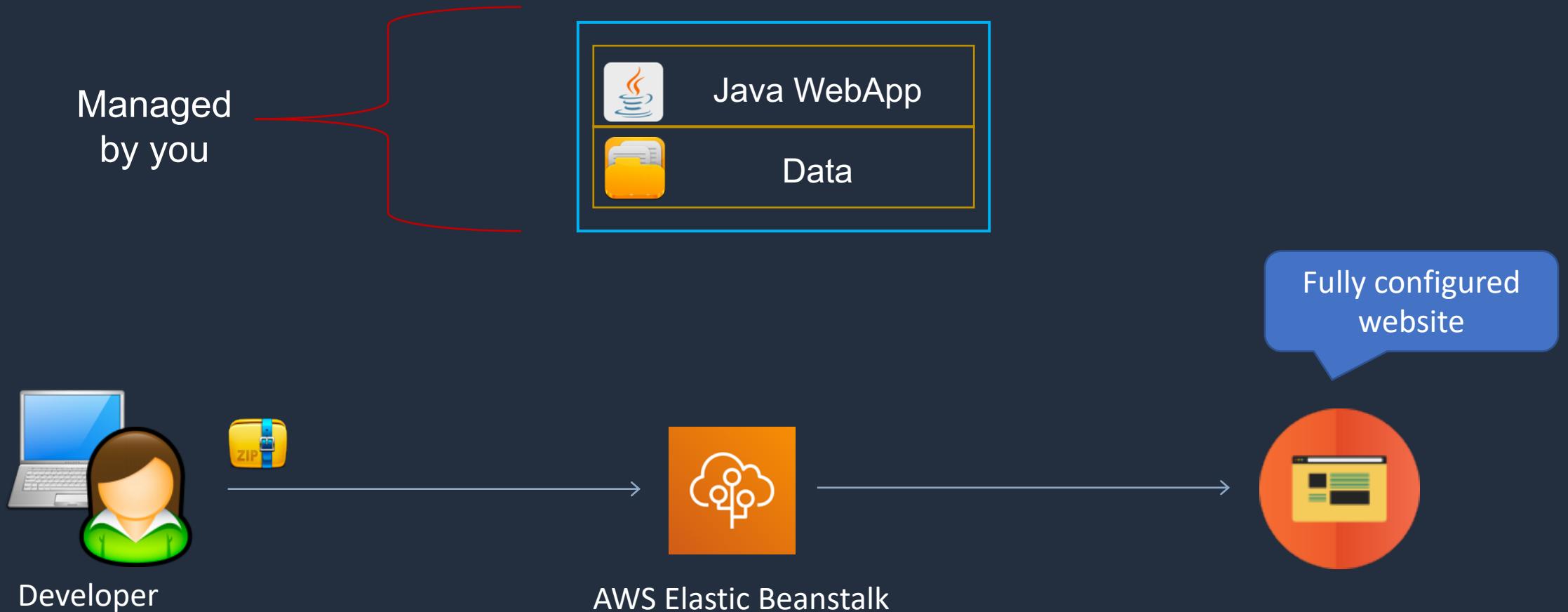
---

Managed  
by you



# Platform as a Service (PaaS)

---



# Software as a Service (SaaS)

---

Managed  
by you



Java WebApp

Pure consumption  
model

# Cloud Service Models: Comparison

Private



IaaS



PaaS



You simply upload your code/data to create your application

SaaS



You simply consume the service - little responsibility + little control

Hypervisor



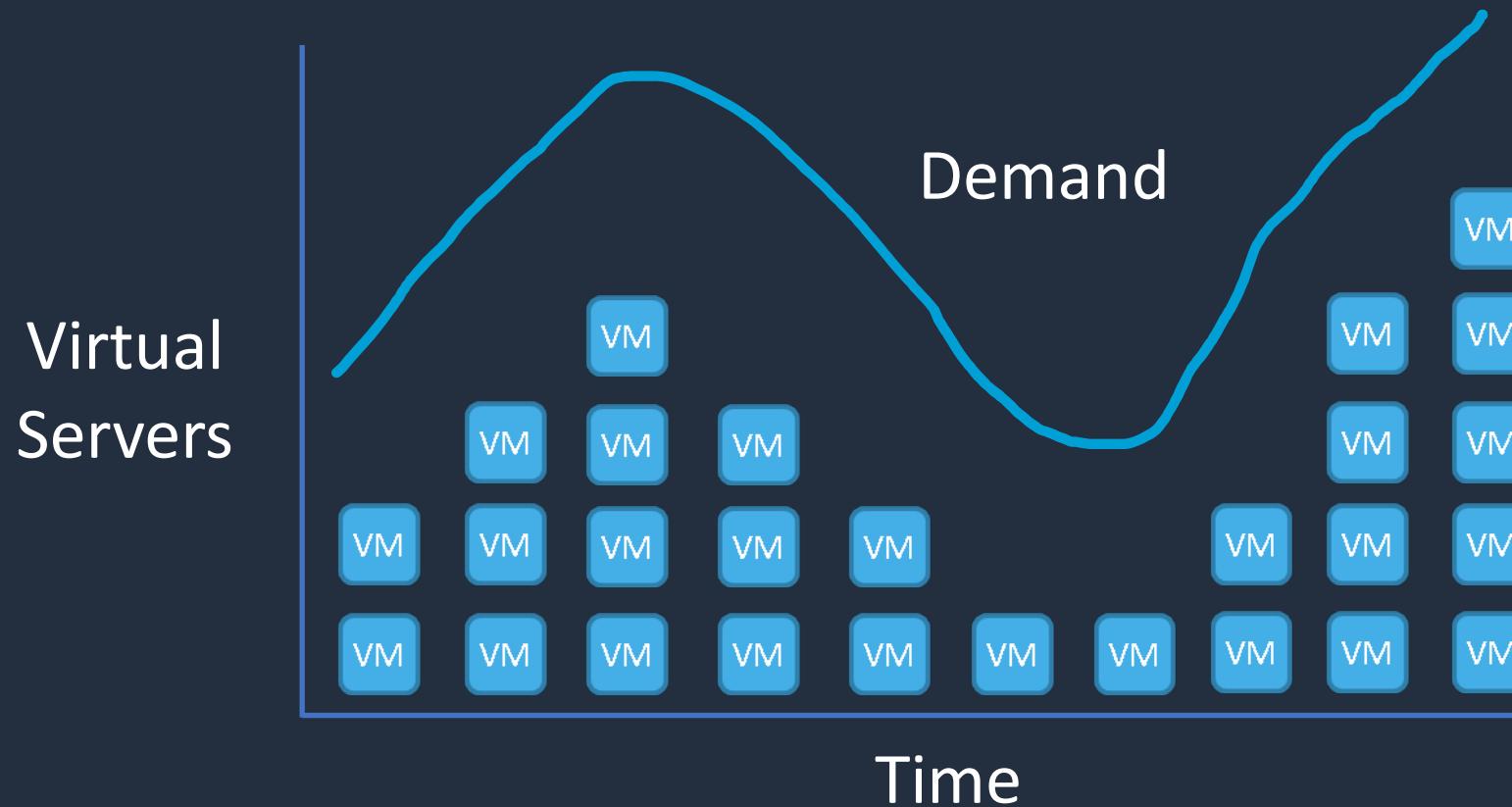
You manage everything - greater responsibility + greater control

# Scalability and Elasticity



# Elastically Scaling based on Demand

---



# Types of Elasticity

---

---

Compute:  
Scaling OUT



Compute:  
Scaling UP



Database:  
Scaling OUT



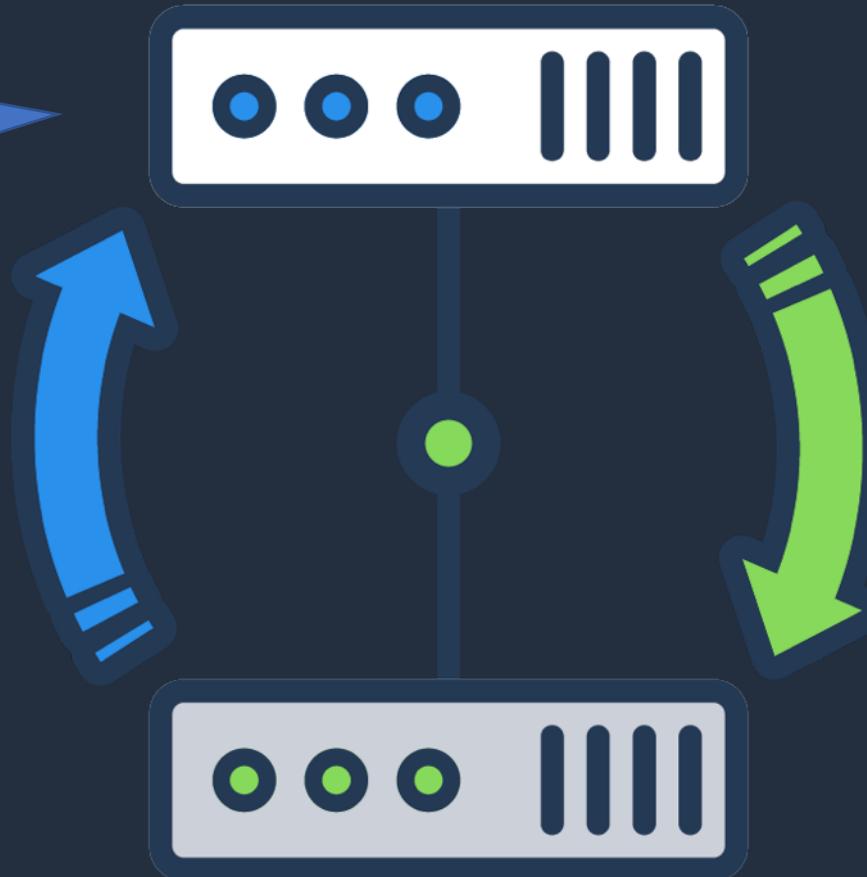
# High Availability and Fault Tolerance



# High Availability

---

If one instance fails,  
the application  
automatically fails  
over



High availability is  
expressed in agreed  
uptime, e.g. 99.99%

# Fault Tolerance

---

Redundant components allow the system to continue to operate



The system may fail if there is no built-in redundancy

# SECTION 3

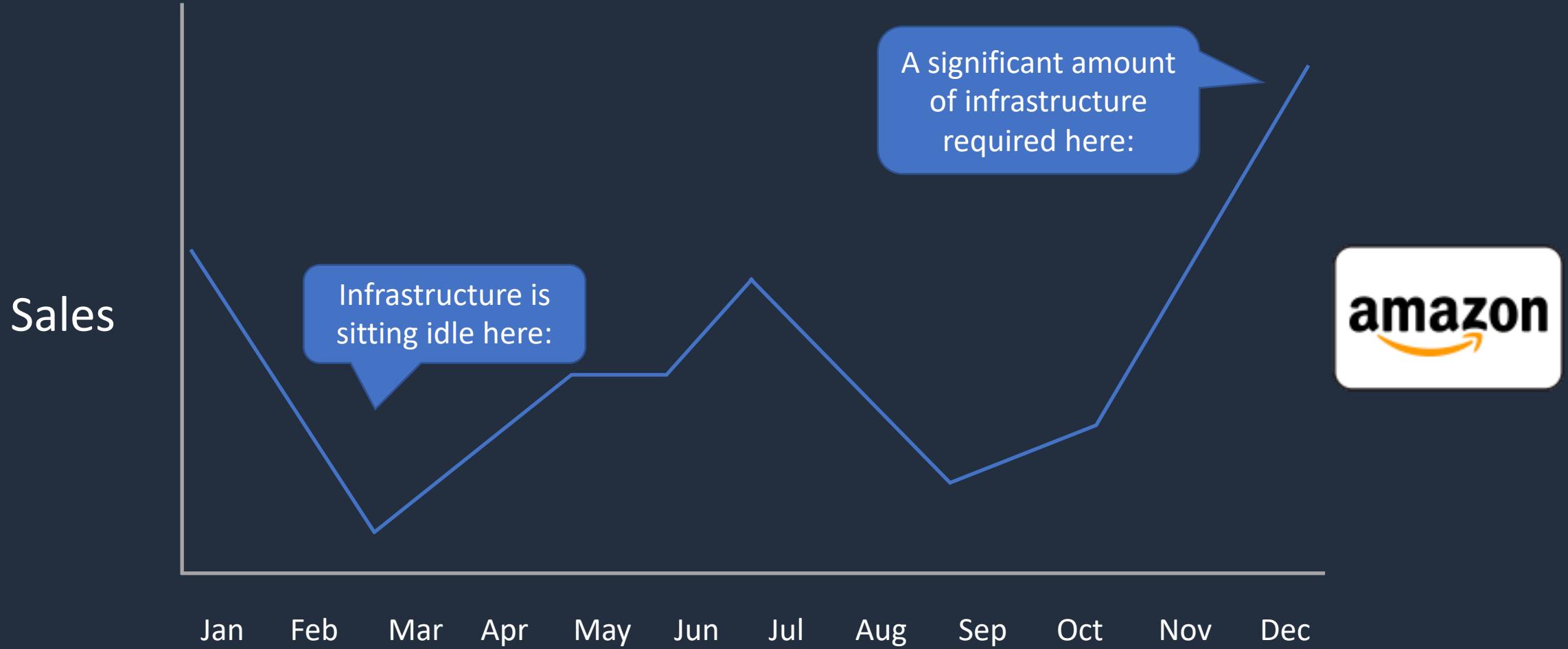
## Introduction to Amazon Web Services (AWS)

# Overview of Amazon Web Services (AWS)



# The Amazon.com Problem

---



# Amazon Web Services (AWS)

---

Charge for  
services based  
on usage

24 Regions  
around the  
world

Subsidiary  
of Amazon



Services are  
offered on-  
demand

Hyperscale  
Public Cloud  
Provider

# Categories of Services (just a few)..

---



Compute



Machine Learning



Storage



Database



Analytics



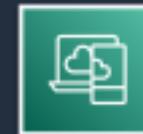
Many more categories  
and over 200 services



Media Services



Networking



End User Computing



Internet of Things

# Gartner Magic Quadrant 2020

---

Evaluated as the leader in the 2020 Gartner Magic Quadrant for Cloud Infrastructure and Platform Services

AWS has been the leader for 10 years in a row!

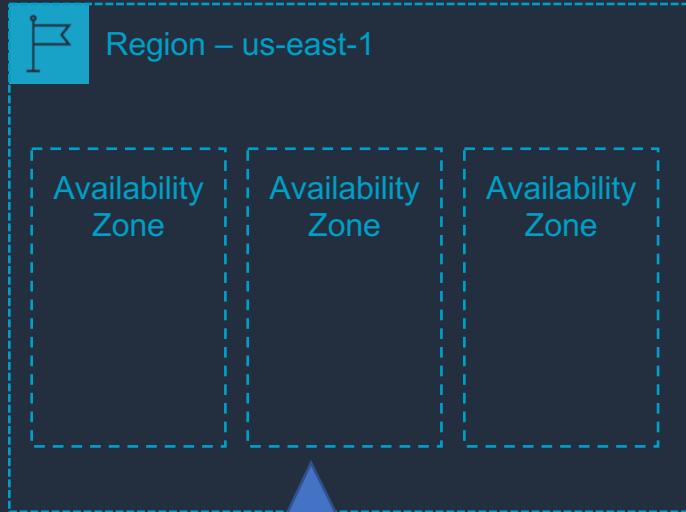


In Q1 2020, AWS exceeded \$10 billion in quarterly revenue for the first time

# AWS Global Presence

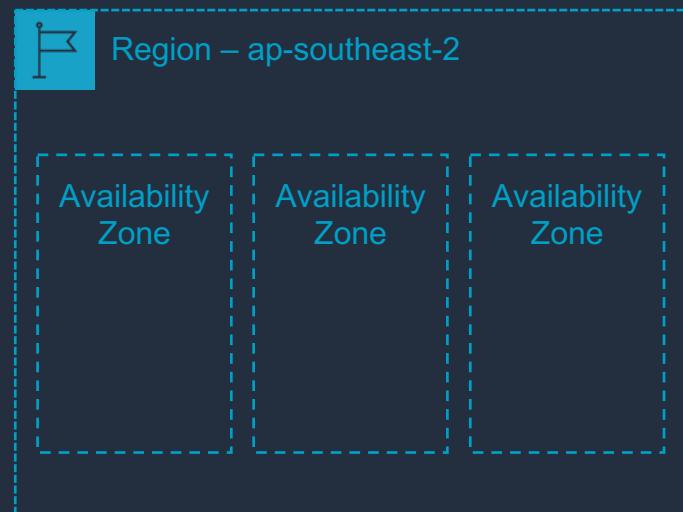
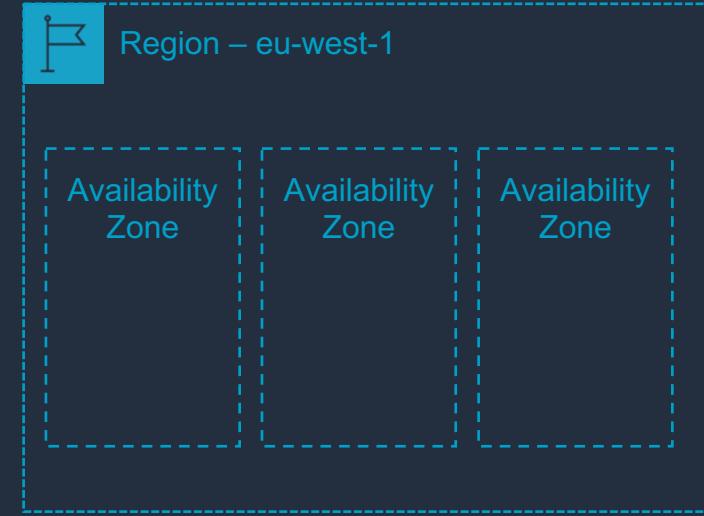


# AWS Global Infrastructure

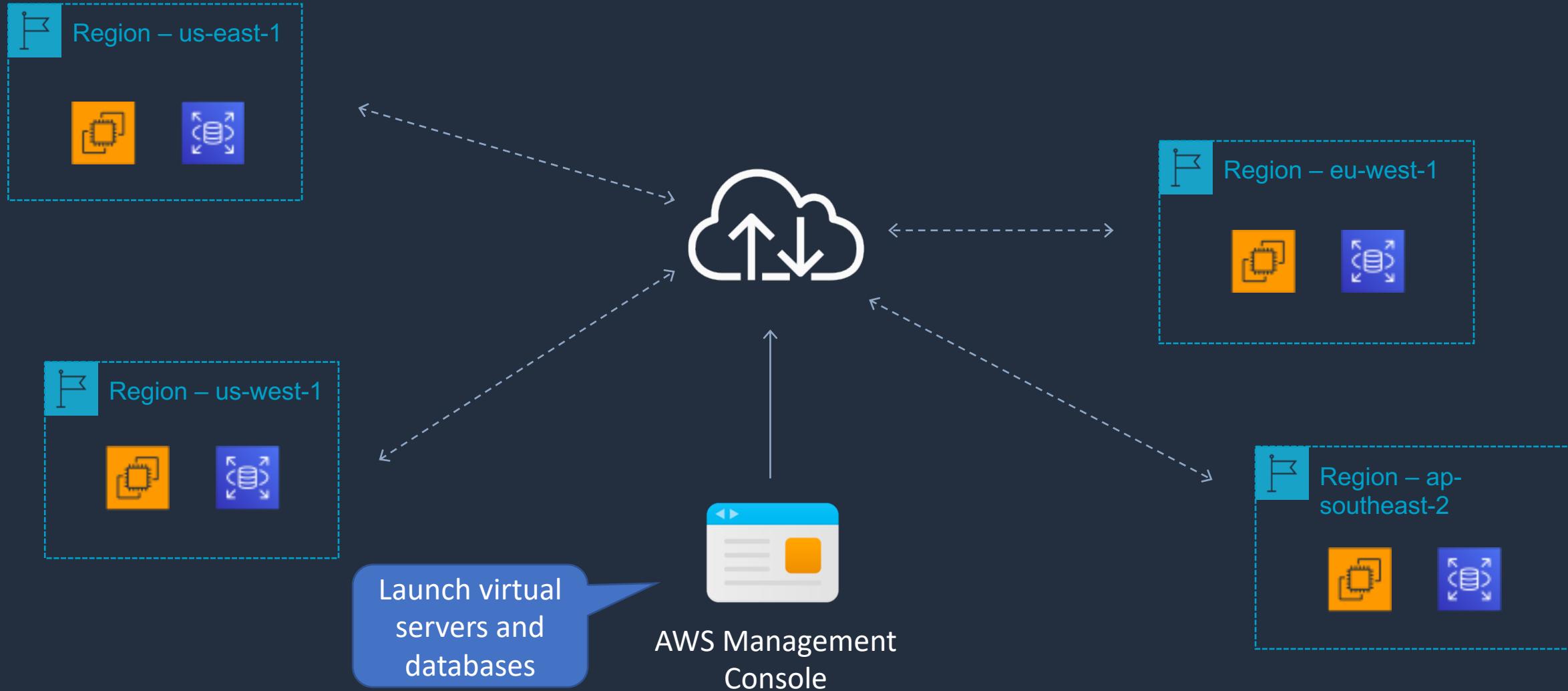


Every region is connected via a high bandwidth, fully redundant network

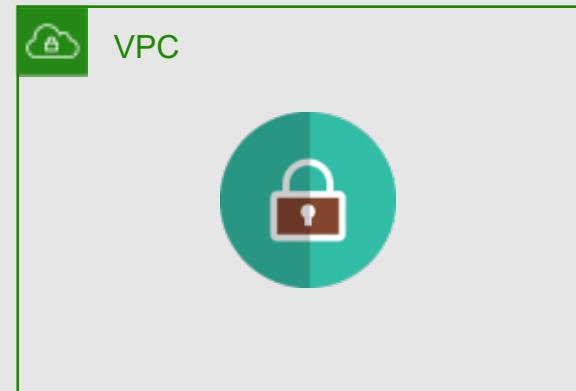
A central white cloud icon with a double-headed vertical arrow inside it is positioned between the two region diagrams. Dashed arrows point from the cloud icon towards each of the two regions, illustrating the interconnected nature of the AWS global infrastructure.



# Deploying Services Globally

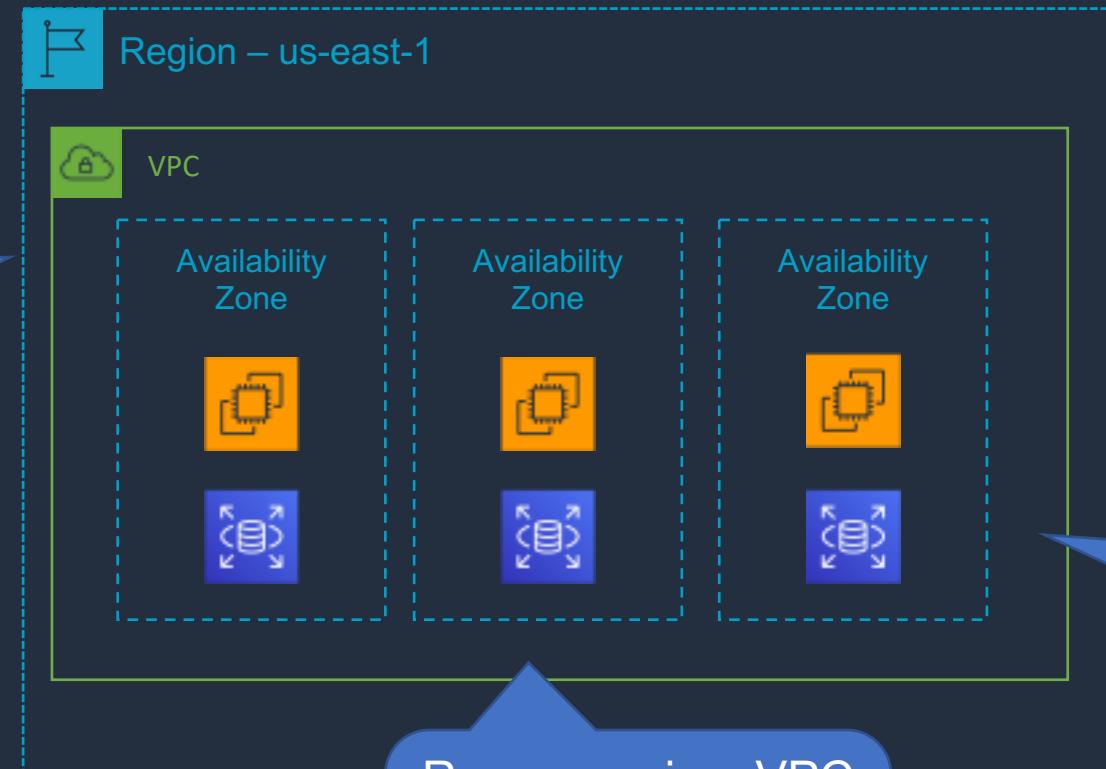


# AWS Network Topology



# Amazon Virtual Private Cloud (VPC)

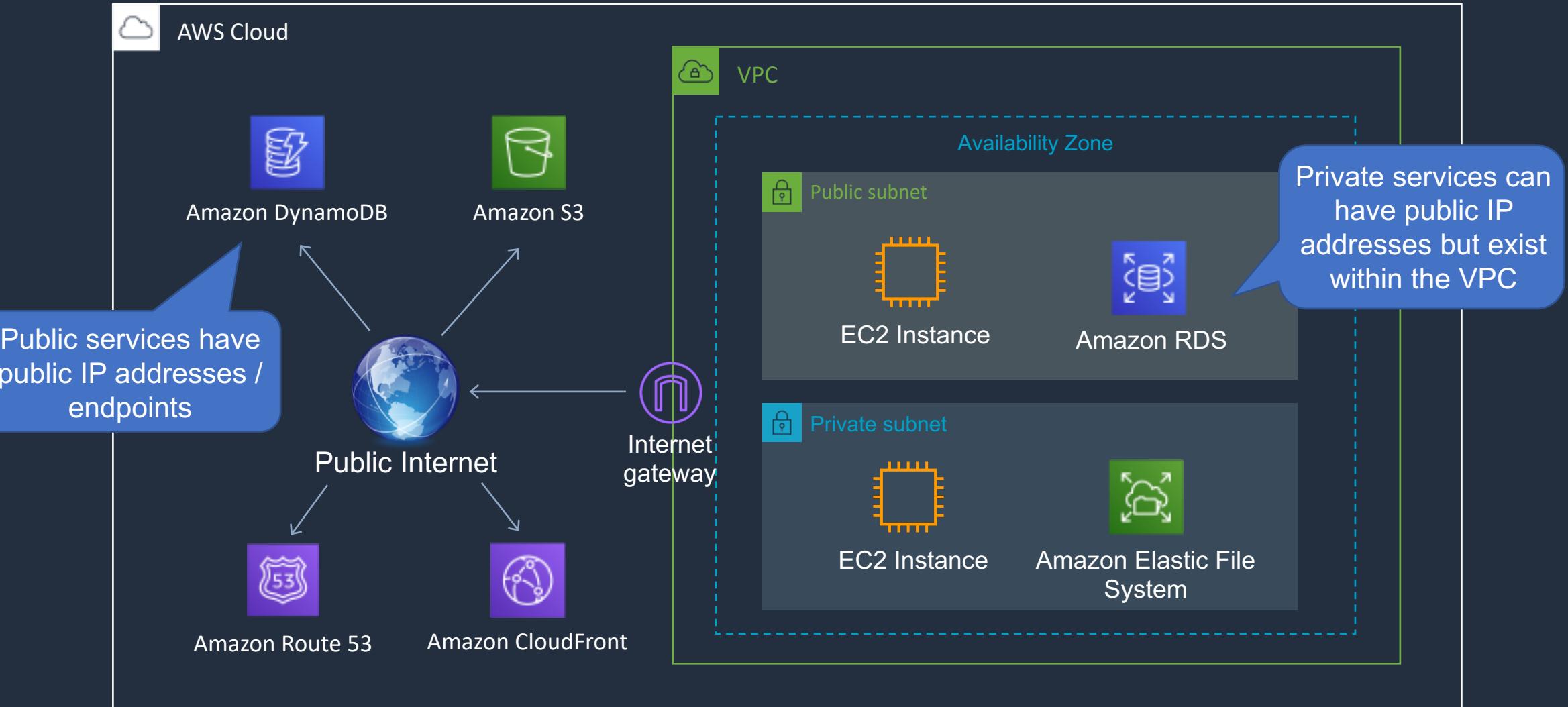
A VPC is a logically isolated portion of the AWS cloud within a region



Resources in a VPC can be fully private or they can be publicly accessible

You can launch AWS resources into your VPC

# AWS Public and Private Services



# AWS Pricing Models and SLAs



# The Fundamentals of AWS Pricing

---

## Compute



Amount of resources such as CPU and RAM and duration

## Storage



Quantity of data stored

## Outbound Data Transfer

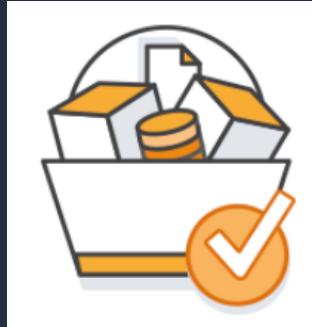


Quantity of data that is transferred out from all services

# How you pay for AWS

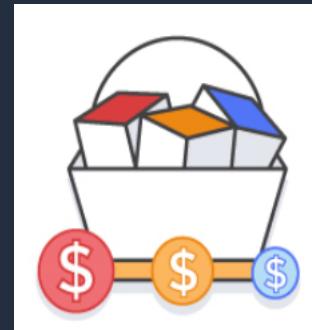
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## Pay-as-you-go



No commitment; pure pay-as-you-go with no contracts or termination fees

## Save when you reserve



Reserve capacity for 1 or 3 years for a substantial discount (up to 75%)

## Pay less by using more



Some pricing is tiered, if you use more you pay less per unit

# Navigating the AWS Management Console



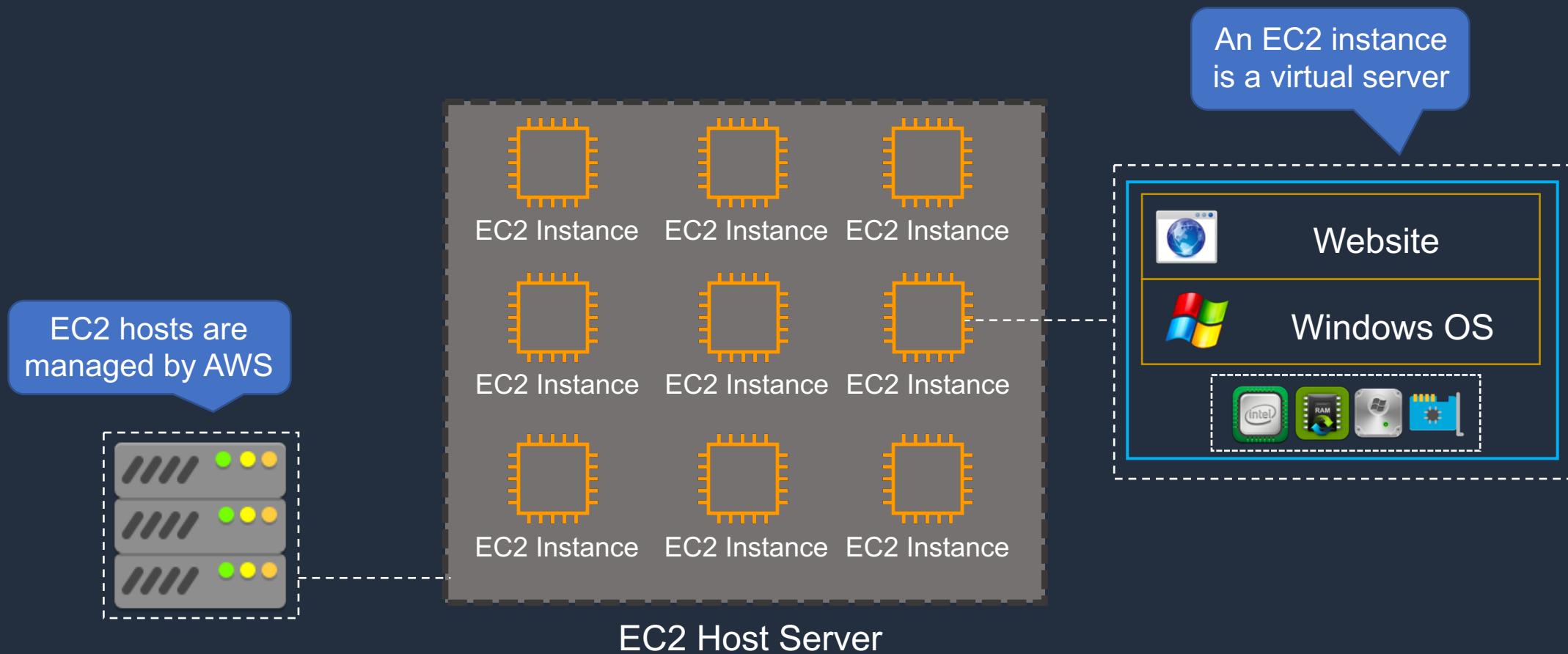
# SECTION 4

## Introduction to Key AWS Services

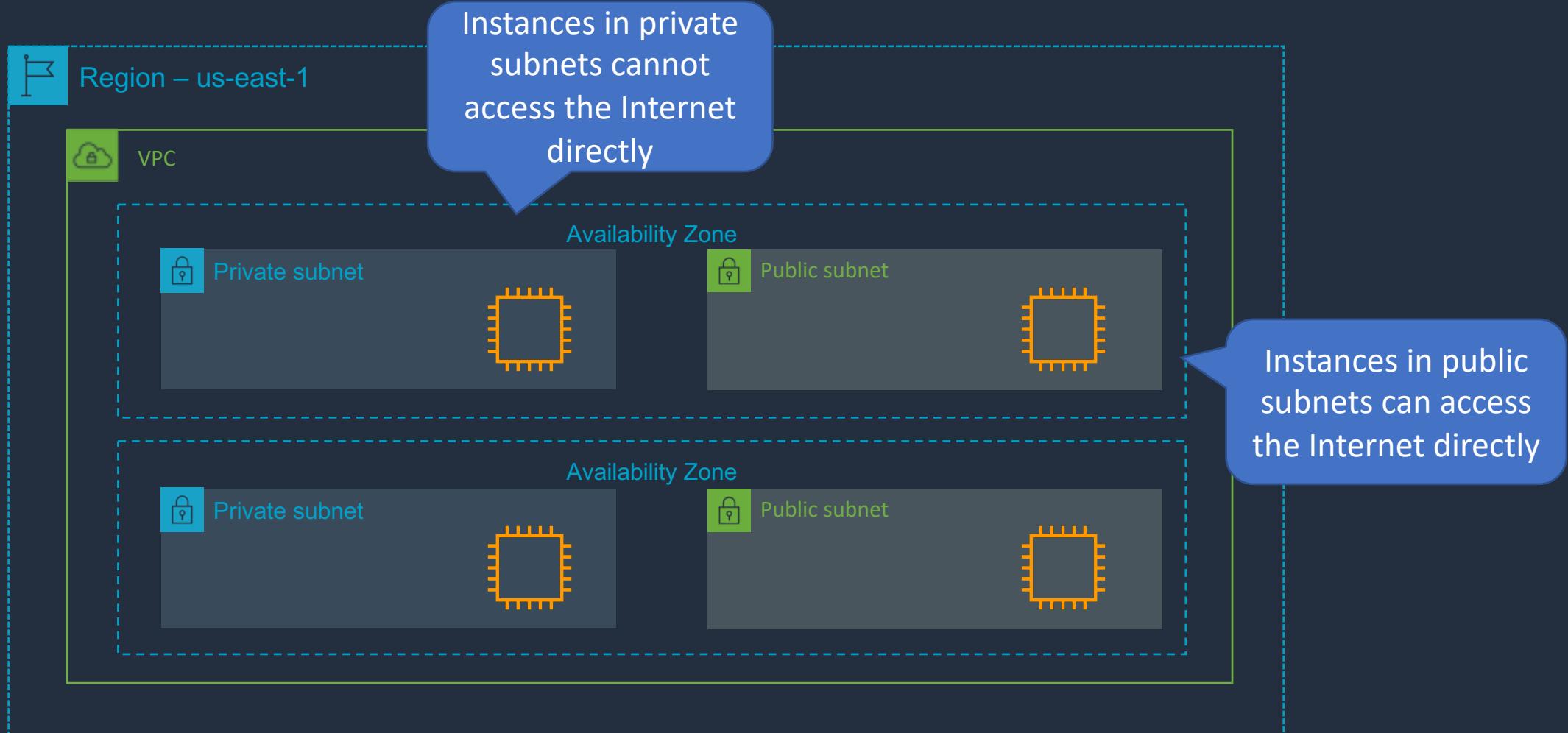
# AWS Compute



# Amazon Elastic Compute Cloud (EC2)



# Amazon EC2



# Business Benefits of Amazon EC2

---

- Secure, scalable virtual servers in the cloud
- Web service interface to easily deploy servers:
  - Using the AWS Management Console
  - Programmatically using the API or Command Line Interface (CLI)
- Several pricing options, including:
  - On-Demand
  - Reserved
  - Spot Instances
- SLA with monthly uptime percentage of at least 99.99%
- Options for automatic scaling and high availability

# Amazon EC2 Demo



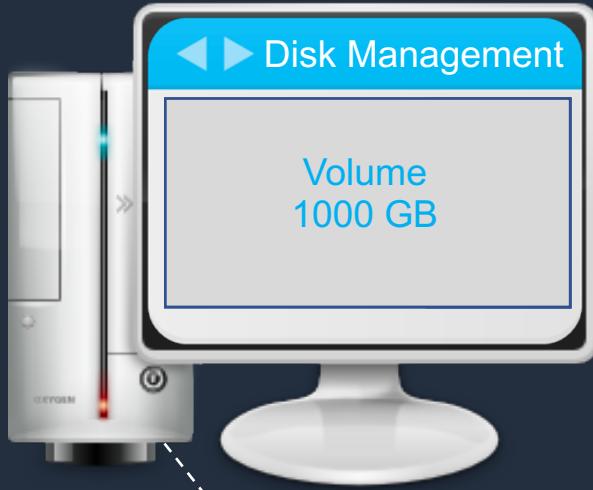
# AWS Storage



# Different Types of Cloud Storage

The OS sees volumes that can be partitioned and formatted

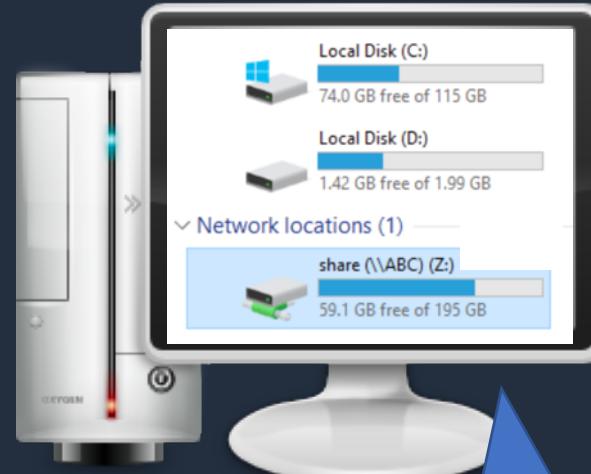
Block Storage



The OS reads/writes at the block level. Disks can be internal, or network attached

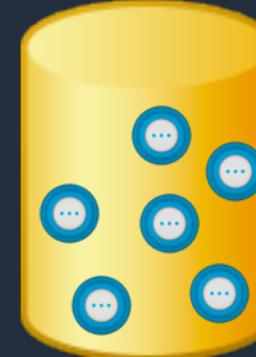
A filesystem can be shared by many users

File Storage



Massively scalable, low cost

Object Storage



There is no hierarchy of objects in the container

Object Storage Container

Uses a REST API

# AWS Services & Use Cases

---

## Block Storage



Amazon Elastic Block  
Store

### Use Cases:

- Use by Amazon EC2 instances
- Relational and Non-relational databases
- Enterprise applications
- Containerized applications
- Big data analytics
- File systems

## File Storage



Amazon Elastic File  
System

### Use Cases:

- Corporate home directories
- Corporate shared directories
- Bid data analytics
- Lift & shift enterprise applications
- Web serving
- Content management

## Object Storage



Amazon Simple  
Storage Service

### Use Cases :

- Websites
- Mobile applications
- Backup and archiving
- IoT devices
- Big data analytics

# Business Benefits

---

## Block Storage



Amazon Elastic Block  
Store

### Benefits:

- High performance block storage
- Multiple tiers of performance
- Elastic (can grow/shrink)
- Resilience/redundancy
- Automated lifecycle management

## File Storage



Amazon Elastic File  
System

### Benefits:

- Shared network file system
- Can connect many instances
- Scales to petabytes
- Multiple storage classes
- Elastic (can grow/shrink)
- Highly available/durable

## Object Storage



Amazon Simple  
Storage Service

### Benefits:

- Very low-cost object storage
- Extremely high durability (99.99999999%)
- Multiple storage classes
- Automated lifecycle management

# Amazon S3 Demo

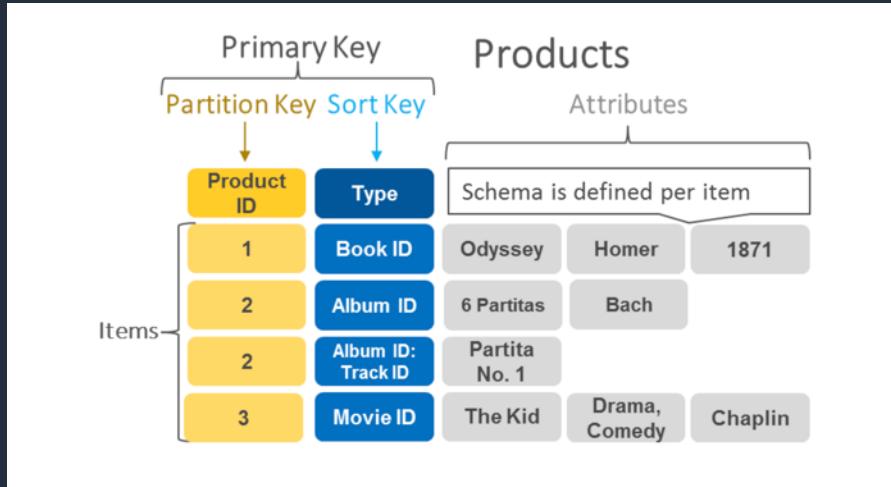


# AWS Databases



# Different Types of Database

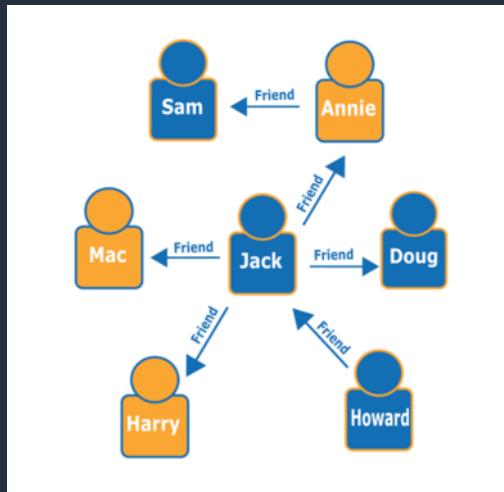
Key-value (non-relational) – e.g. Amazon DynamoDB



Relational – e.g. Amazon RDS

EmployeeID	FirstName	LastName	JobRole	Location
00001	Paul	Peterson	Senior Developer	Sydney
00002	Kaleigh	Annette	Assistant Manager	Brisbane
00003	Carl	Wood	Sales Support	Sydney
00004	Vinni	Jones	Customer Services	Melbourne
00005	Stefanie	Howard	IT Architect	Brisbane

Graph – e.g. Amazon Neptune



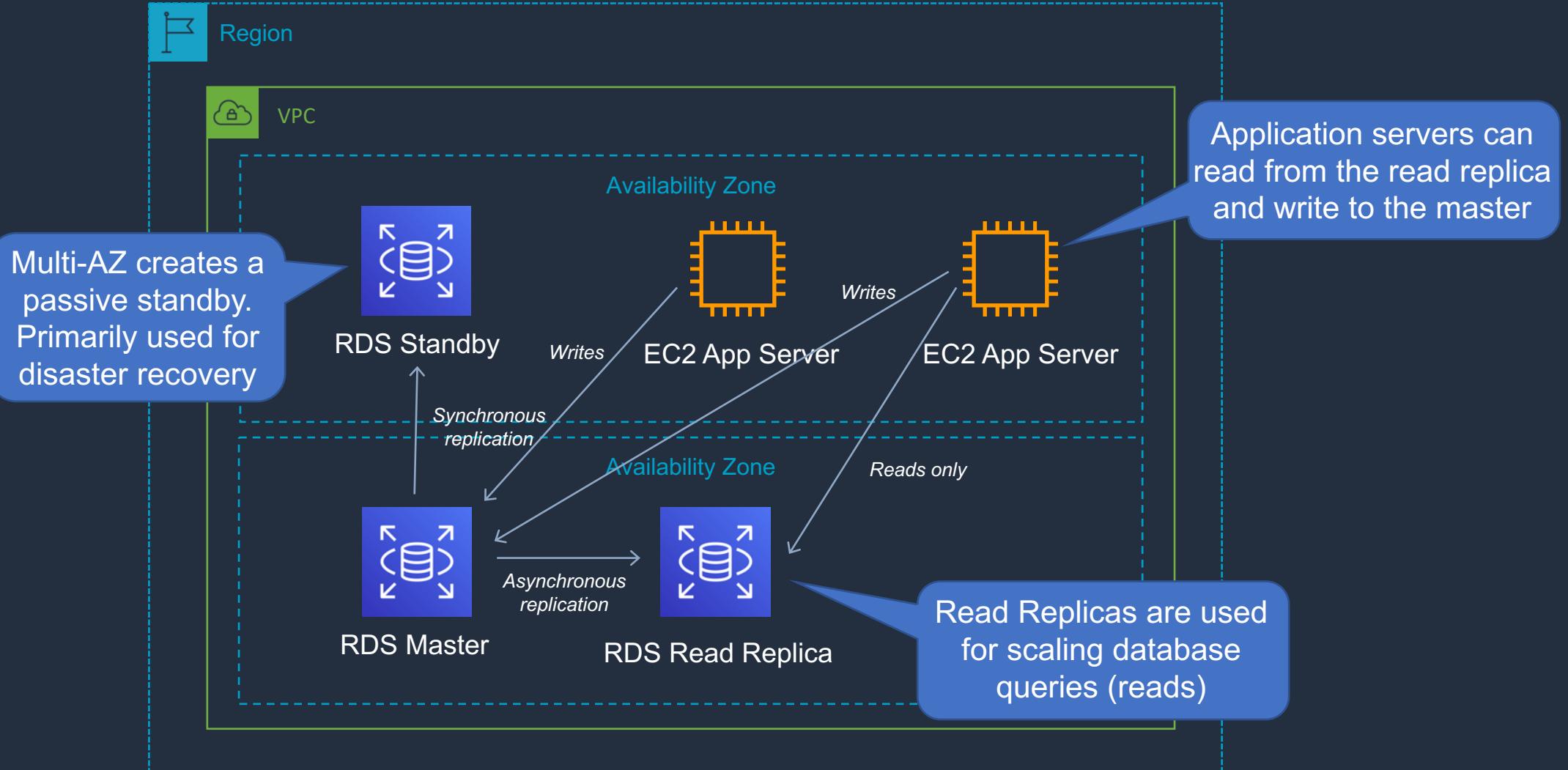
Document – e.g. MongoDB

```
JSON
1 [
2   {
3     "year": 2013,
4     "title": "Turn It Down, Or Else!",
5     "info": {
6       "directors": ["Alice Smith", "Bob Jones"],
7       "release_date": "2013-01-18T00:00:00Z",
8       "rating": 6.2,
9       "genres": ["Comedy", "Drama"],
10      "image_url": "http://ia.media-imdb.com/images/N/09ERWAU7FS797A37LUBHN09AMUP908RLlo5JF90EWR7LJKQ7@-_V1_SX400_.jpg",
11      "plot": "A rock band plays their music at high volumes, annoying the neighbors.",
12      "actors": ["David Matthewman", "Jonathan G. Neff"]
13    }
14  },
15  {
16    "year": 2015,
17    "title": "The Big New Movie",
18    "info": {
19      "plot": "Nothing happens at all.",
20      "rating": 0
21    }
22 }
```

Popular relational database examples:

- Microsoft SQL Server
- MySQL
- Oracle
- PostgreSQL
- DB2
- SAP HANA

# Amazon Relational Database Service (RDS)



# Business Benefits of AWS Databases

---

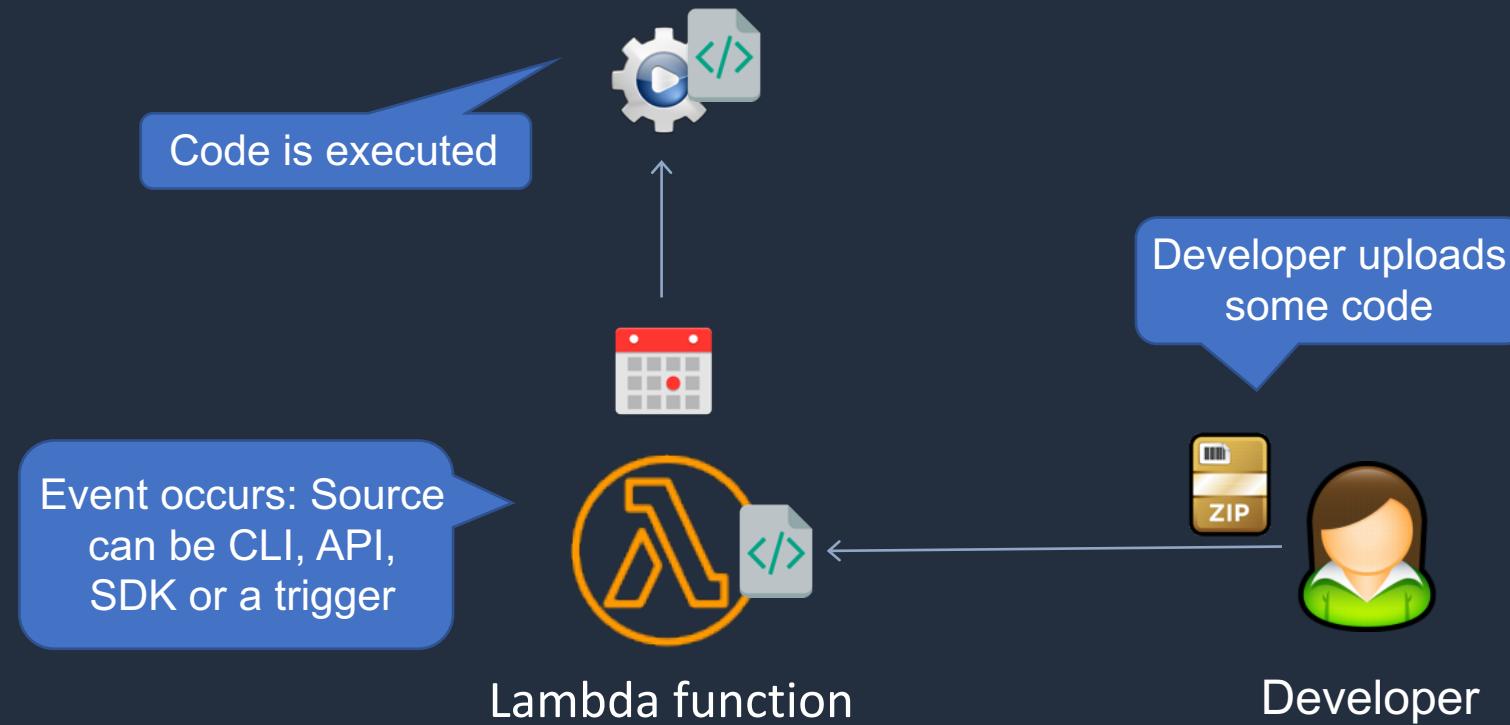
- Simple deployment for a variety of cloud databases
- Cost-efficient and resizable
- Managed database service (database patch management, OS updates etc.)
- Simple setup for disaster recovery
- Highly available and durable

# Serverless

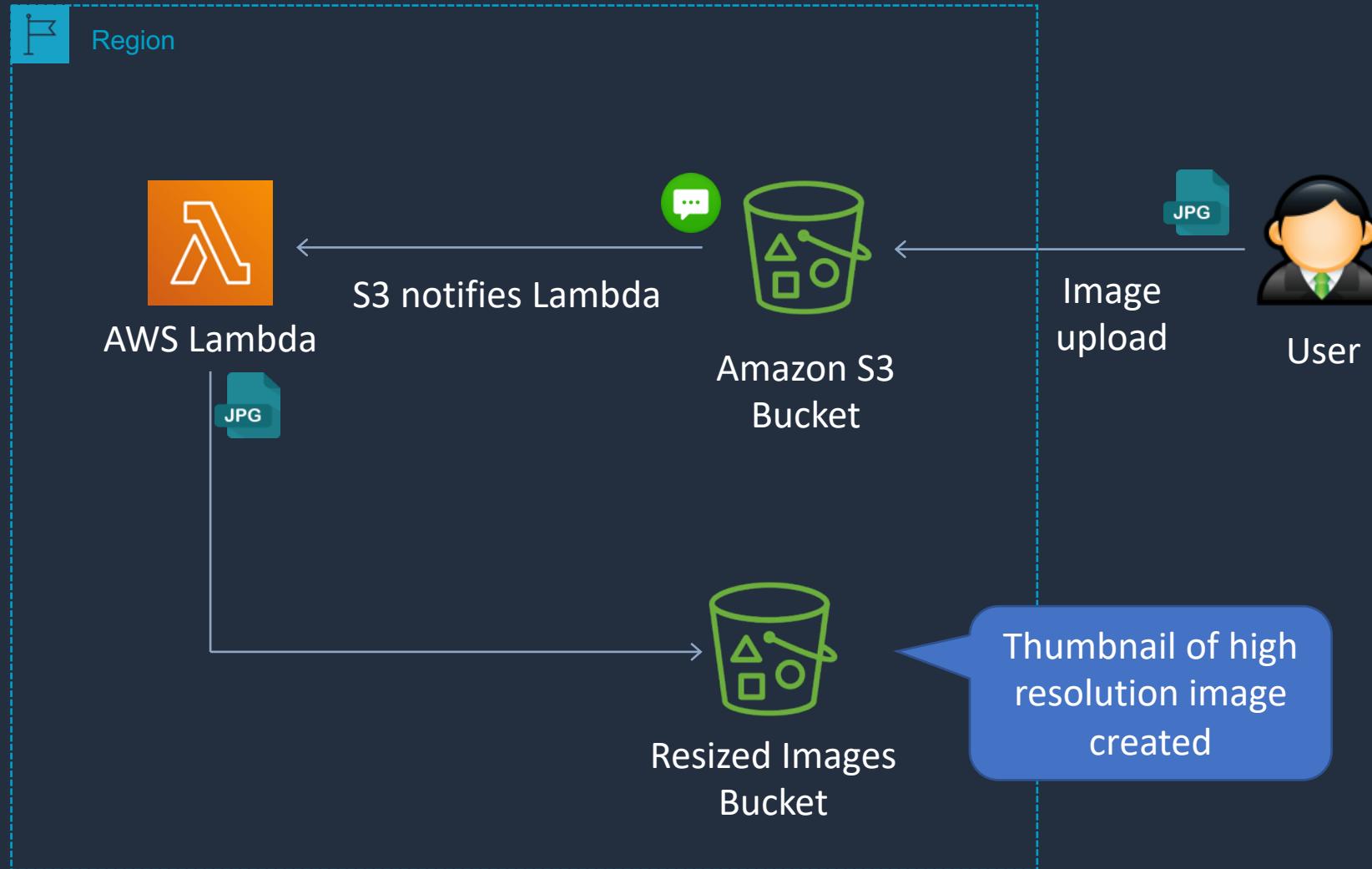


# AWS Lambda

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# Example Serverless Application



# Business Benefits of Serverless Applications

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- No servers to manage = lower operational costs
- Scales automatically



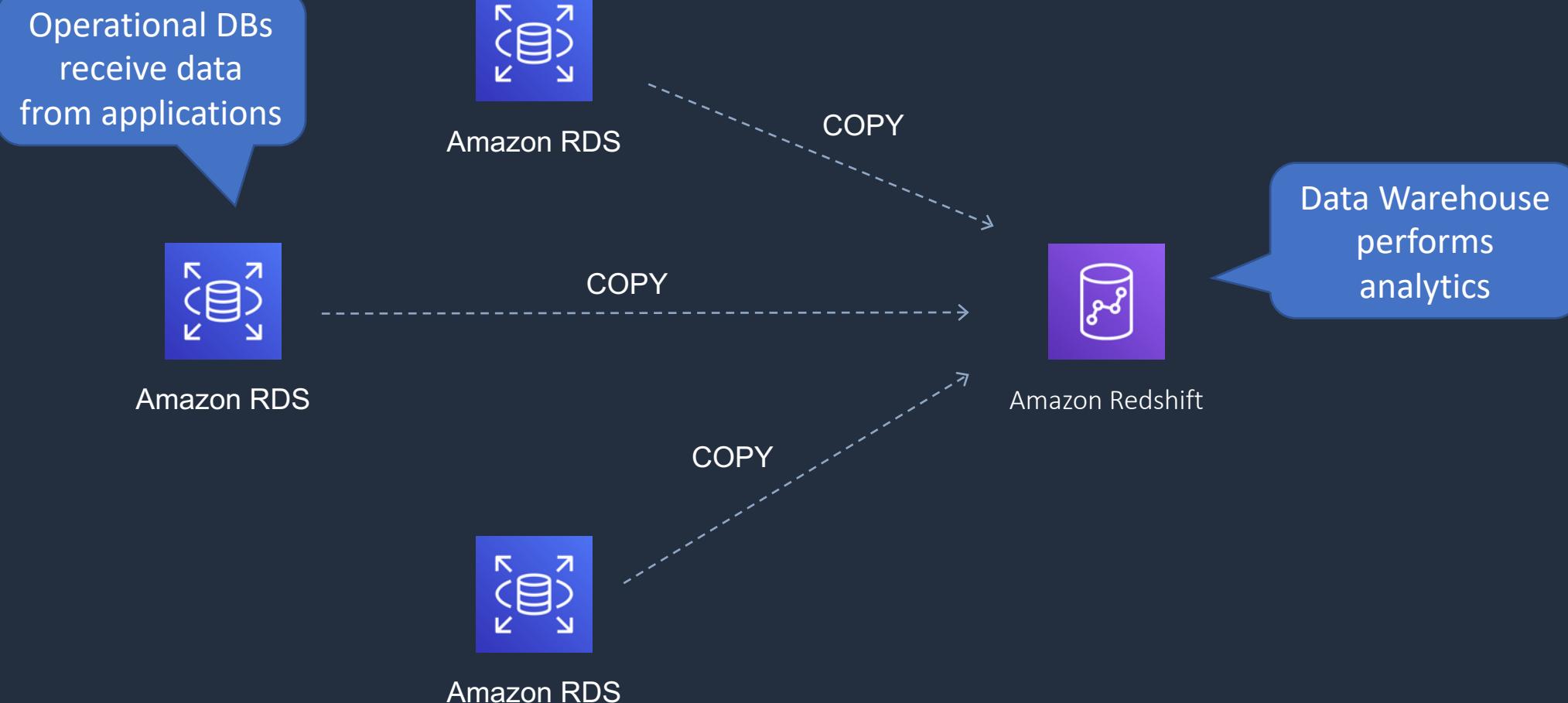
- Only pay for actual running time of code
- Can be extremely low cost

# Analytics / Machine Learning

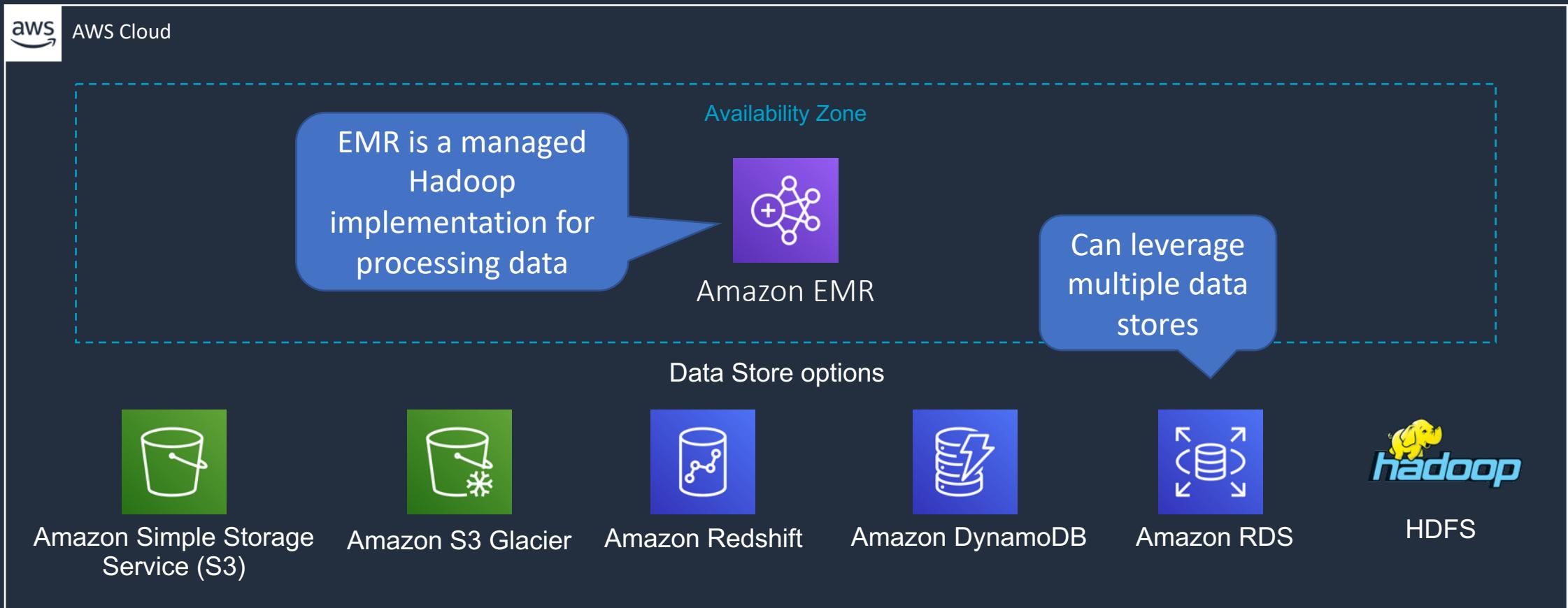


# Amazon RedShift

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# Amazon Elastic Map Reduce (EMR)



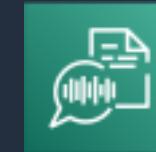
# Machine Learning

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Amazon Textract



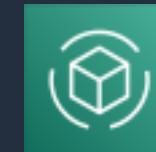
Amazon Transcribe



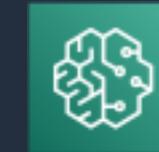
Amazon Translate



Amazon Polly



TensorFlow on AWS



Amazon SageMaker

# AWS Rekognition

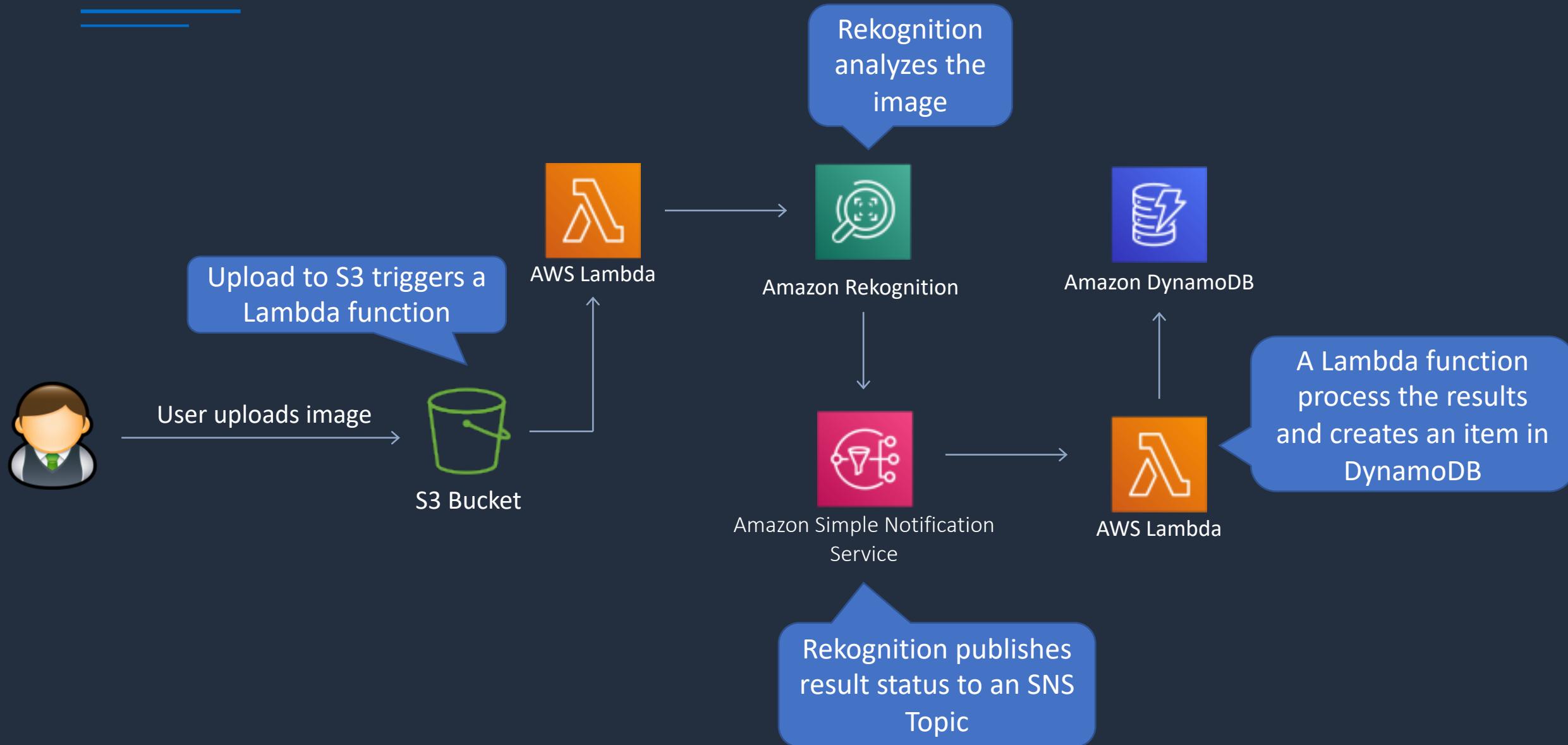
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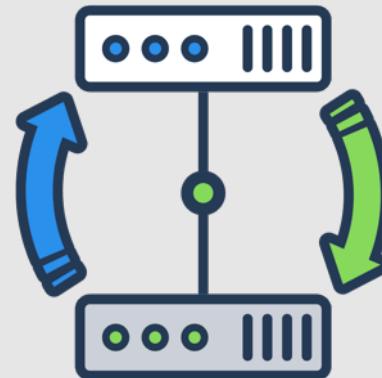
Celebrity recognition



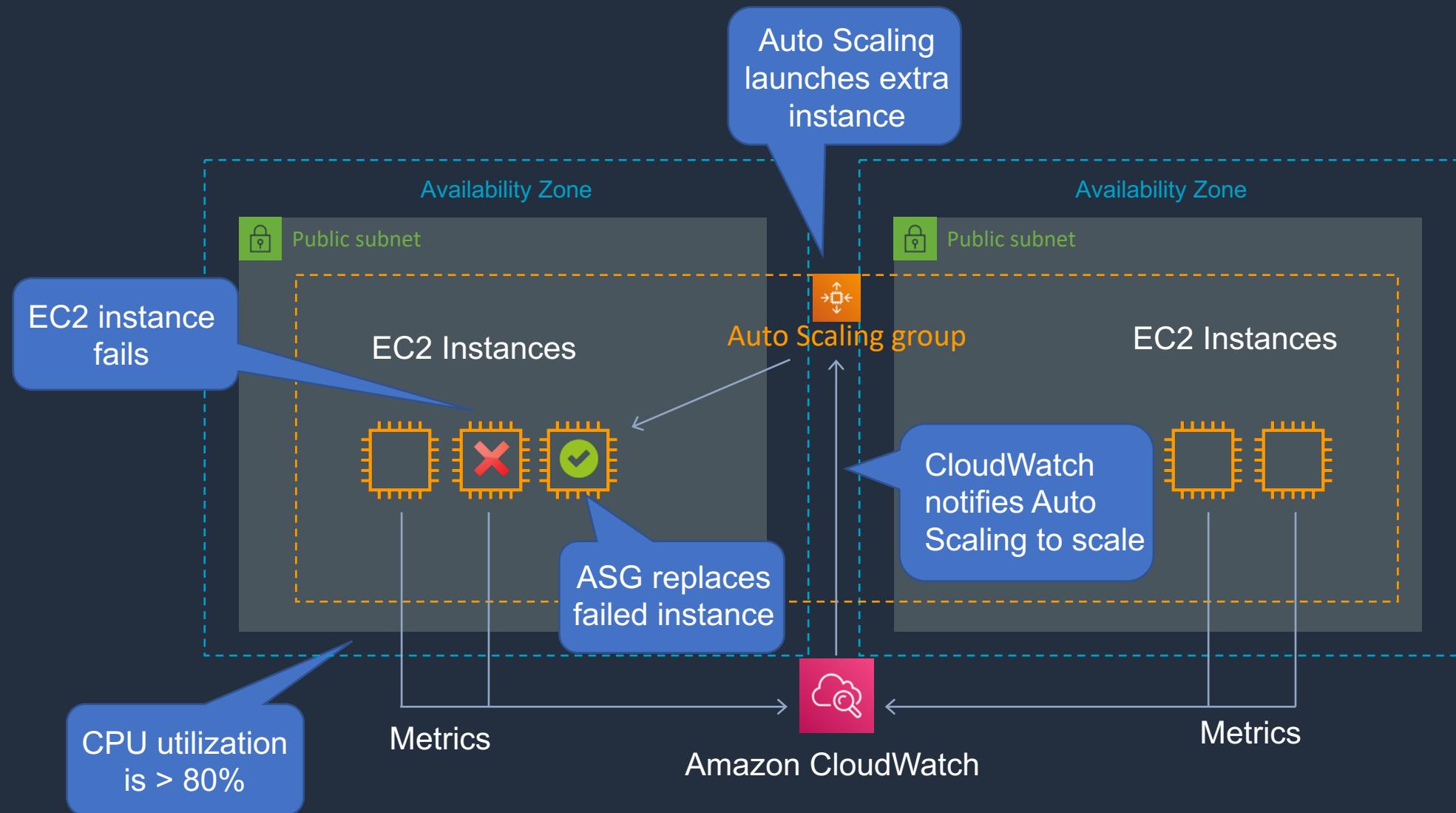
# Example Serverless Solution Architecture



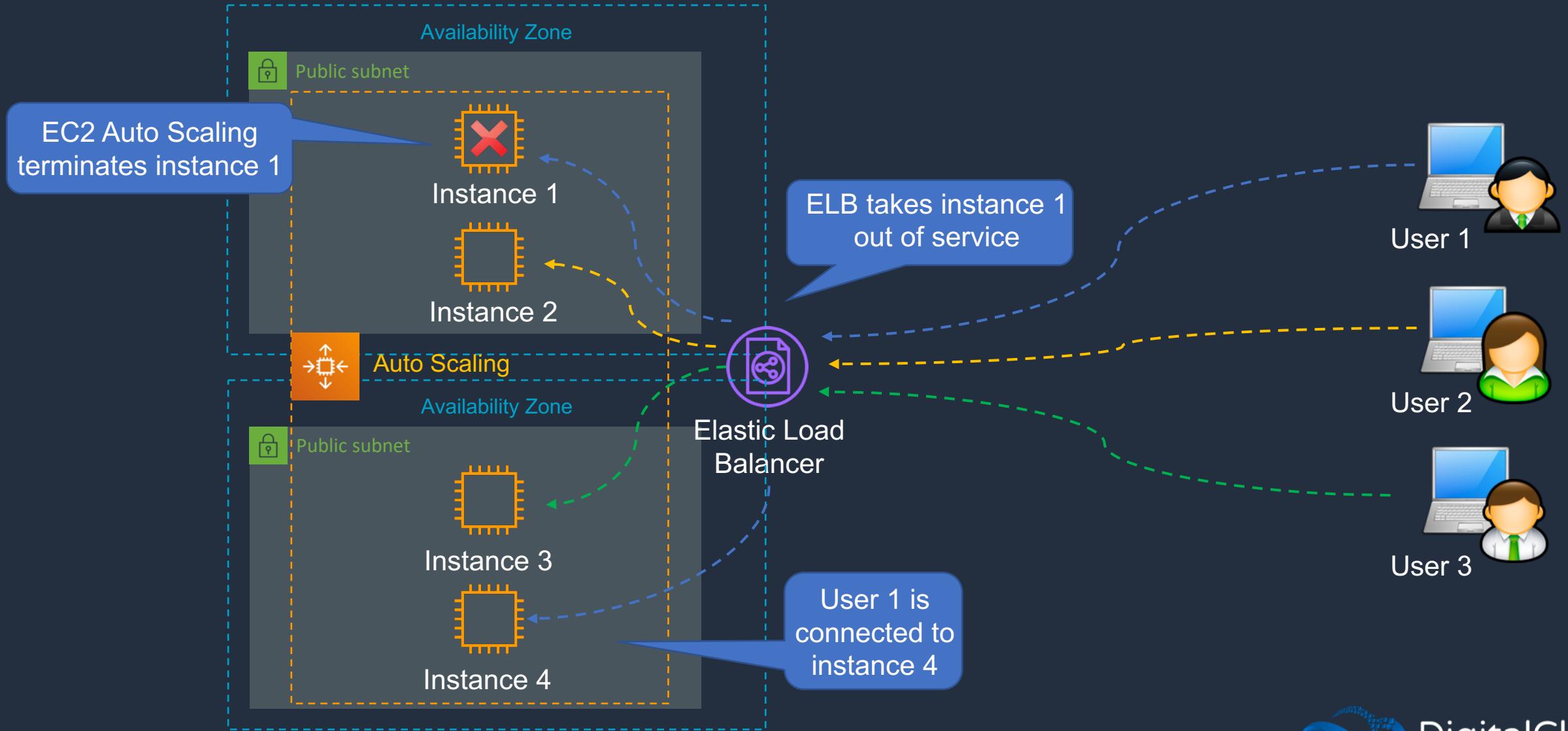
# Building HA/FT Applications on AWS



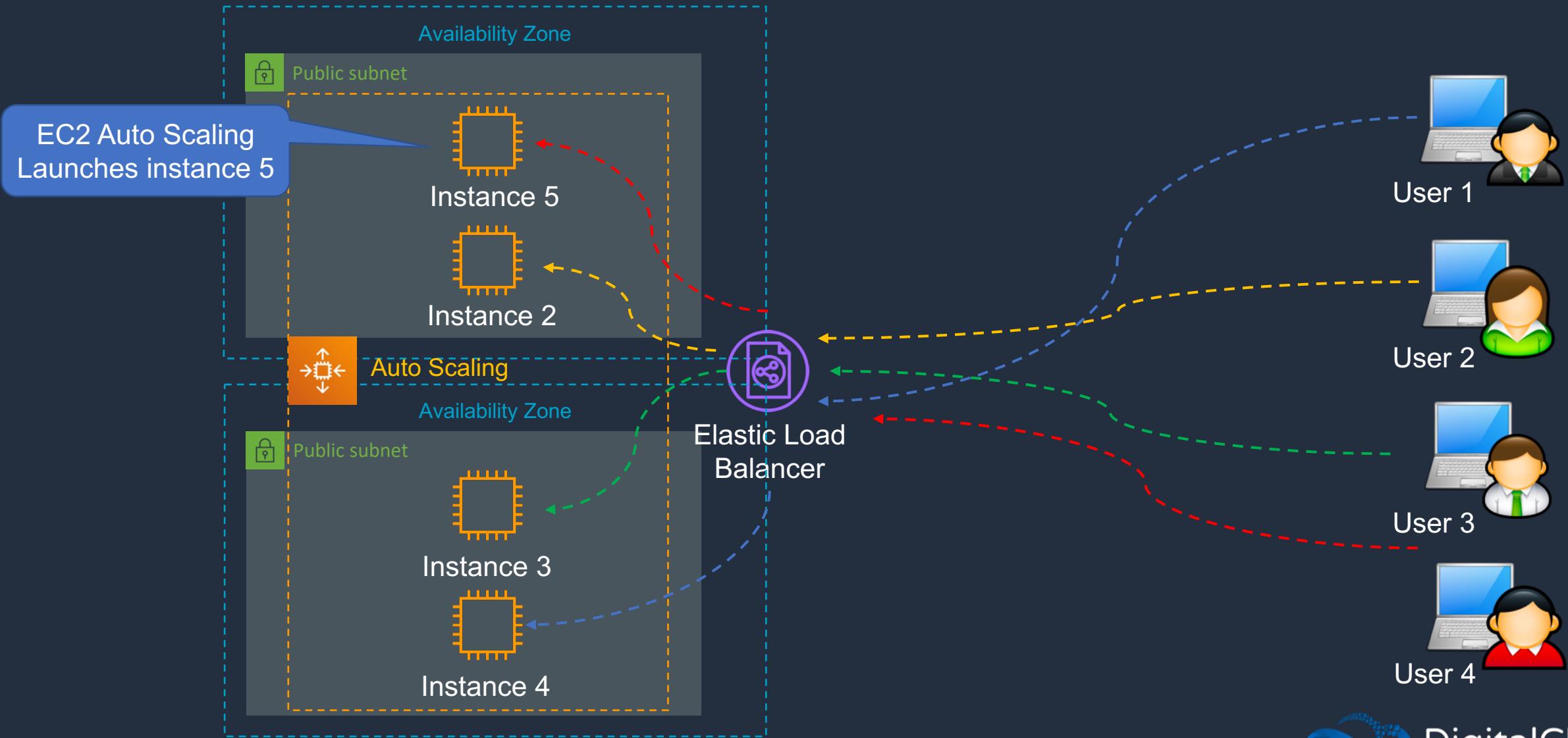
# Amazon EC2 Auto Scaling



# High Availability and Fault Tolerance



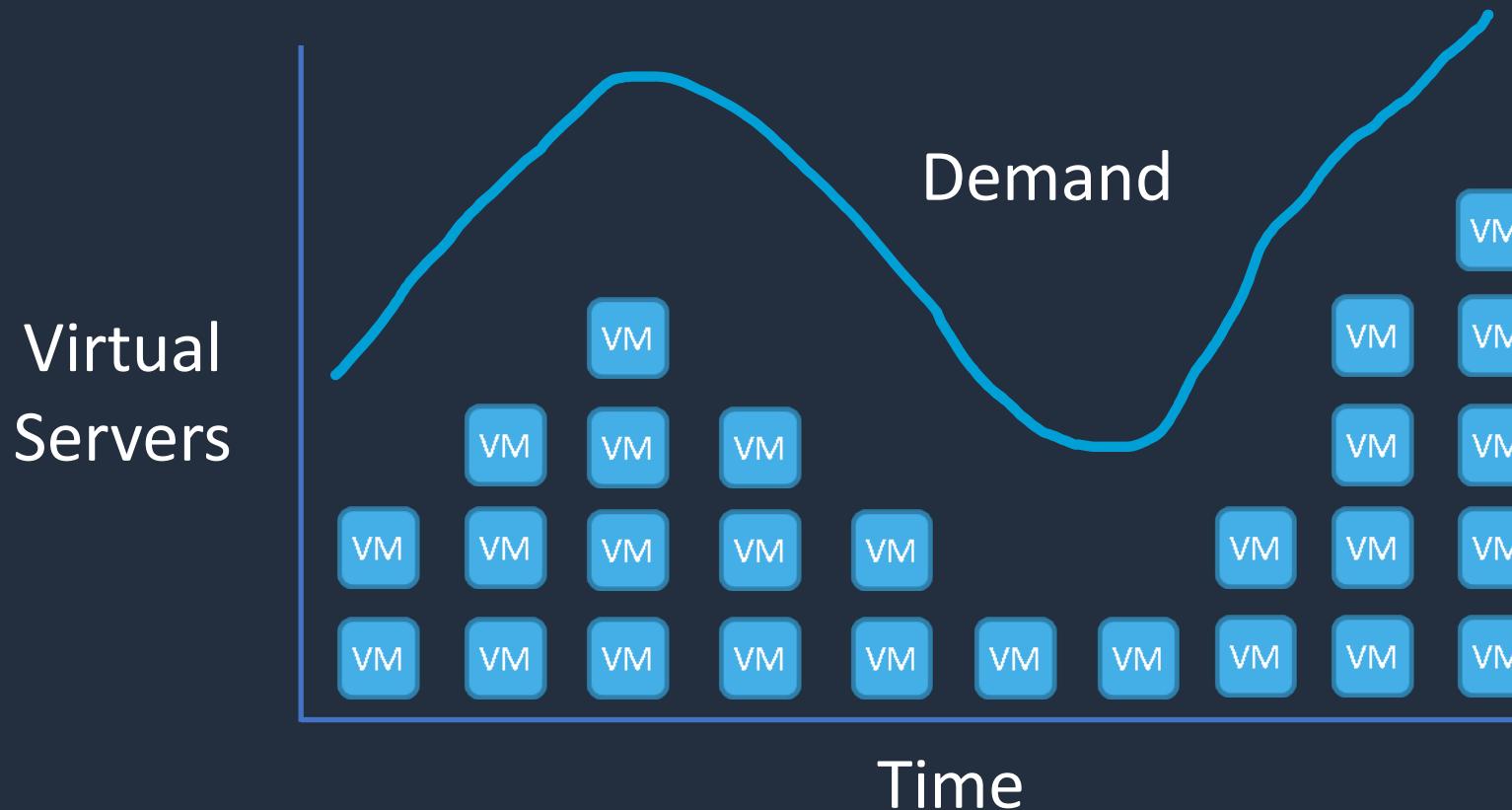
# High Availability and Fault Tolerance



# Business Benefits of this Architecture

---

- Applications can automatically scale based on actual load



# Business Benefits of this Architecture

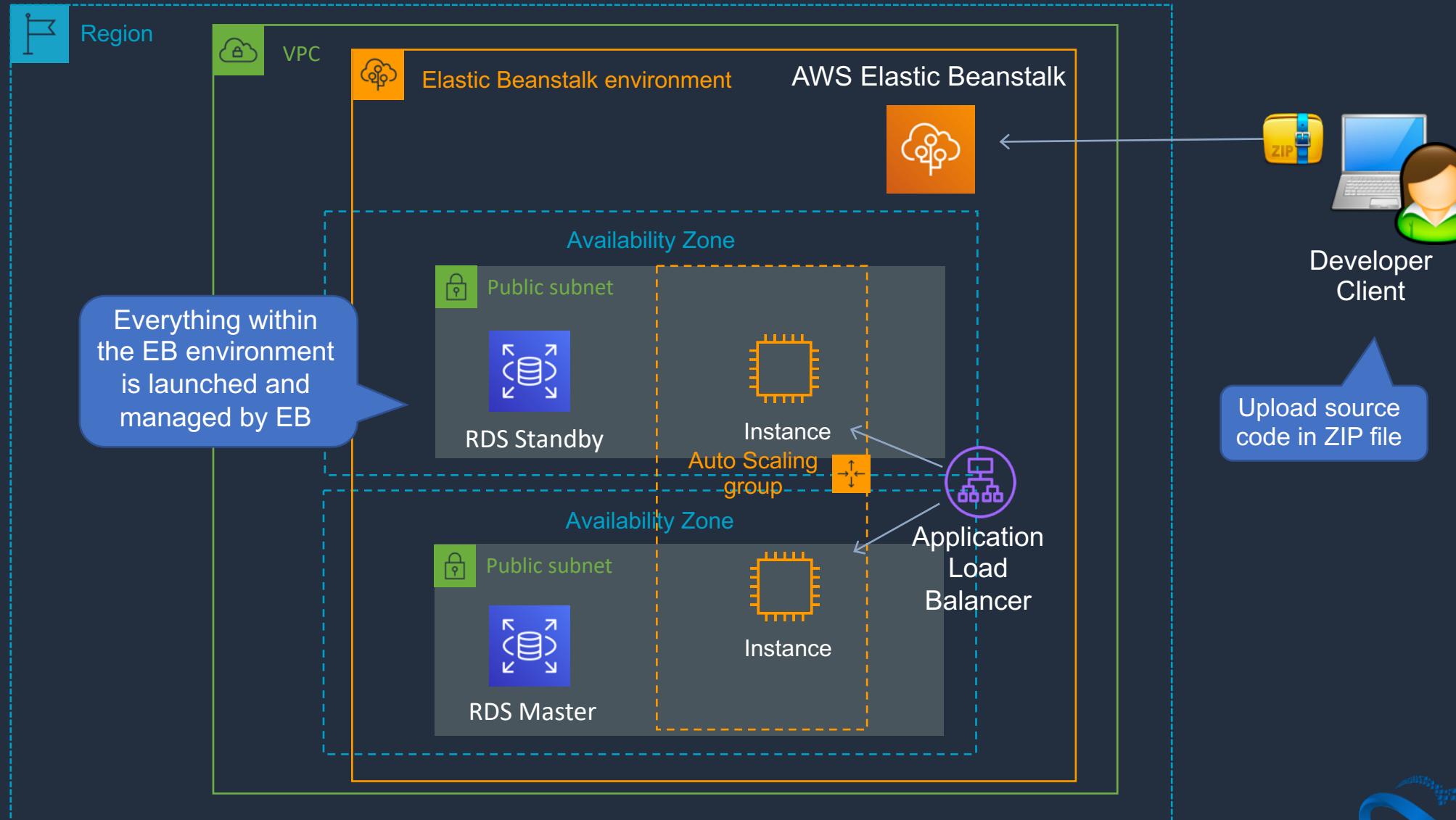
---

- Automatic recovery from system failures
- Users are automatically directed to healthy servers

# Automation on AWS



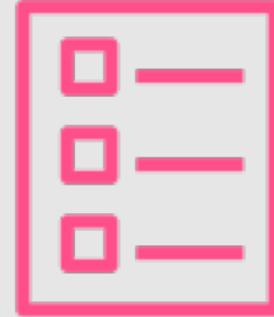
# Amazon Elastic Beanstalk



# Amazon Elastic Beanstalk Demo



# Infrastructure as Code - AWS CloudFormation



# AWS CloudFormation

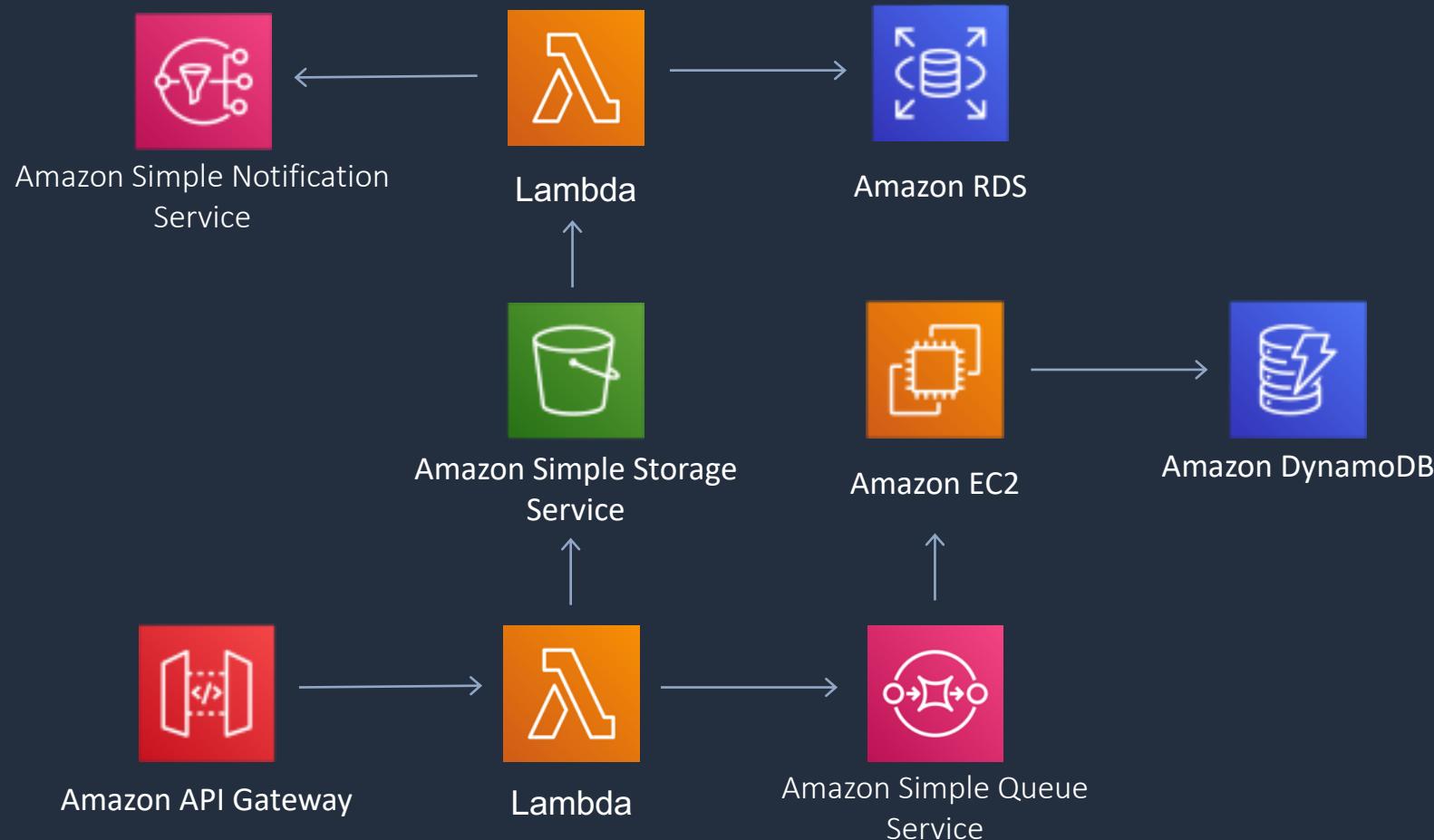
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# AWS CloudFormation

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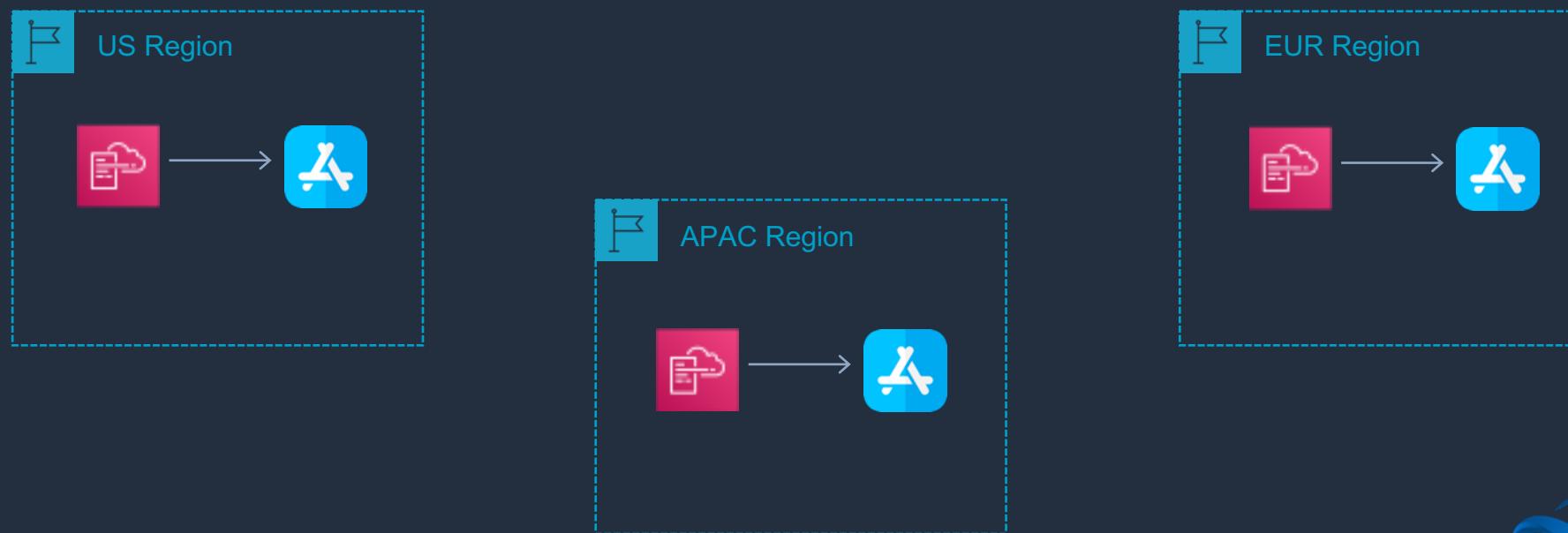


# AWS CloudFormation

template1 

Choose template language:  JSON  YAML

```
1 {  
2   "AWSTemplateFormatVersion": "2010-09-09",  
3   "Description": "AWS CloudFormation Sample Template LAMP_Single_Instance: Create a LAMP stack using a single EC2 instance and a local MySQL database for storage. This template demonstrates using th  
4   "Parameters": {  
5     "KeyName": {  
6       "Description": "Name of an existing EC2 KeyPair to enable SSH access to the instance",  
7       "Type": "AWS::EC2::KeyPair::KeyName",  
8       "ConstraintDescription": "must be the name of an existing EC2 KeyPair."  
9     },  
10    "DBName": {  
11      "Default": "MyDatabase",  
12      "Description": "MySQL database name",  
13      "Type": "String",  
14      "MinLength": "1",  
15      "MaxLength": "64",  
16      "AllowedPattern": "[a-zA-Z][a-zA-Z0-9]*",  
17      "ConstraintDescription": "must begin with a letter and contain only alphanumeric characters."  
18    }  
19  }  
20 }
```



# SECTION 5

## The Business Case for Cloud

# The Key Business Benefits of Cloud Computing



# The 6 Advantages of Cloud Computing

---

## 1. Trade capital expense for variable expense

CAPEX



Purchase servers



Tax deductible over depreciation lifetime

OPEX



Pay as you go



Tax deductible in same year

# The 6 Advantages of Cloud Computing

## 2. Benefit from massive economies of scale



# The 6 Advantages of Cloud Computing

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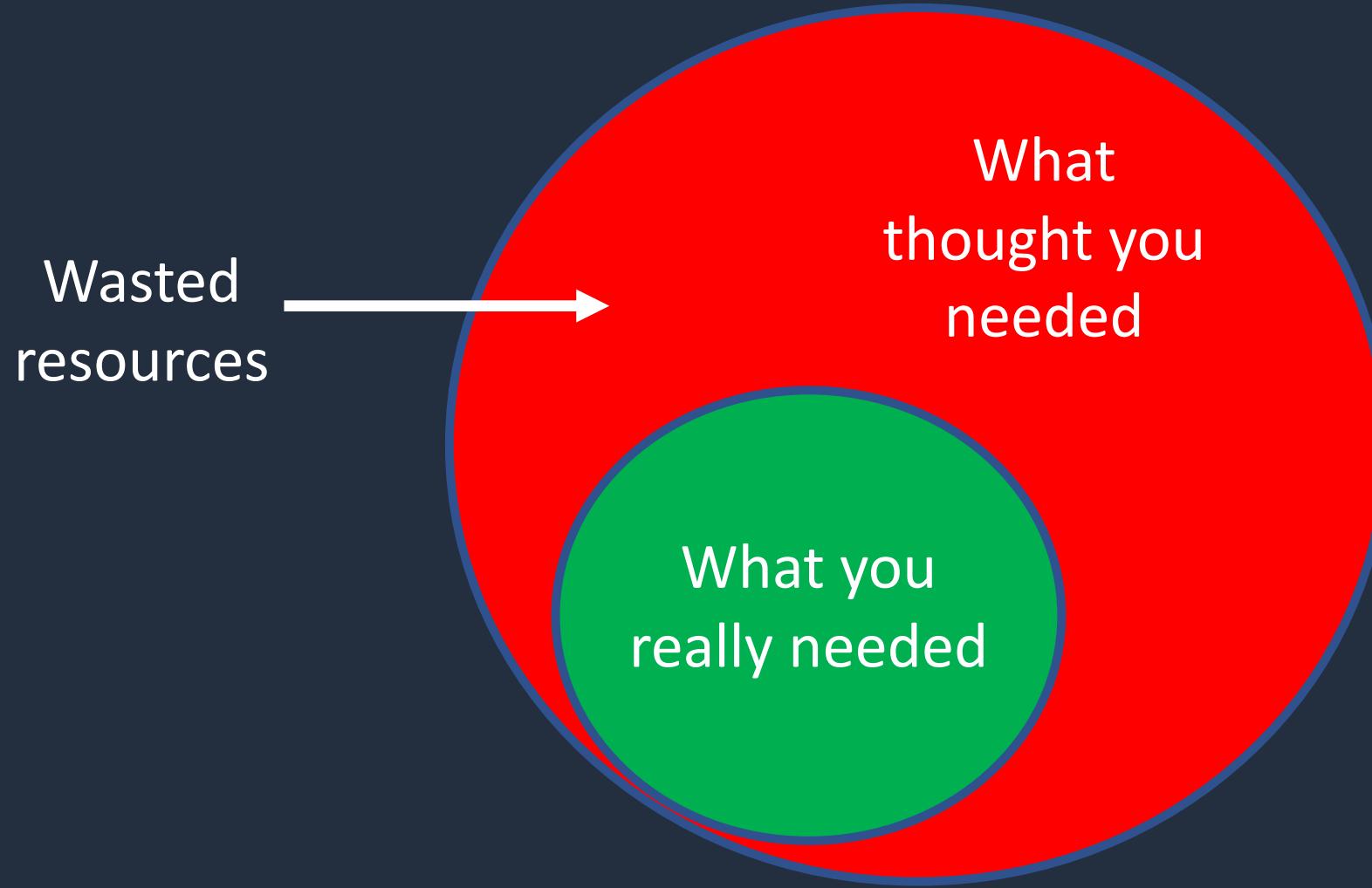
## 2. Benefit from massive economies of scale

- Aggregated usage across hundreds of thousands of customers = lower variable costs for customers

# The 6 Advantages of Cloud Computing

---

## 3. Stop guessing capacity



# The 6 Advantages of Cloud Computing

---

## 4. Increase speed and agility



Speed = deploy resources easily and quickly



Agility = react to change; speed to market

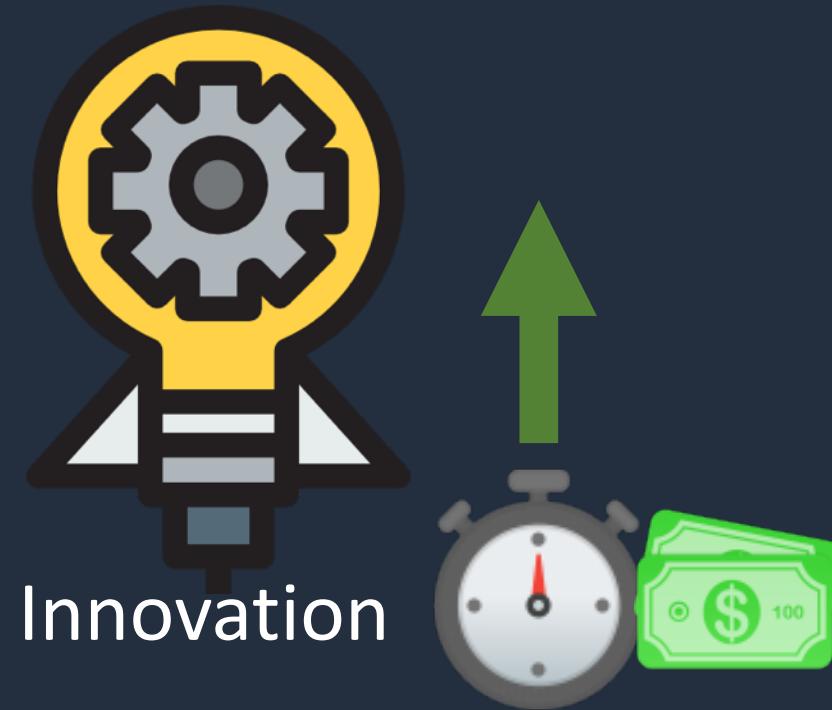
# The 6 Advantages of Cloud Computing

---

## 5. Stop spending money running and maintaining data centers



Data Center  
Management



Innovation

# The 6 Advantages of Cloud Computing

---

## 6. Go global in minutes



# Enterprise use cases for AWS Cloud Services



# Email

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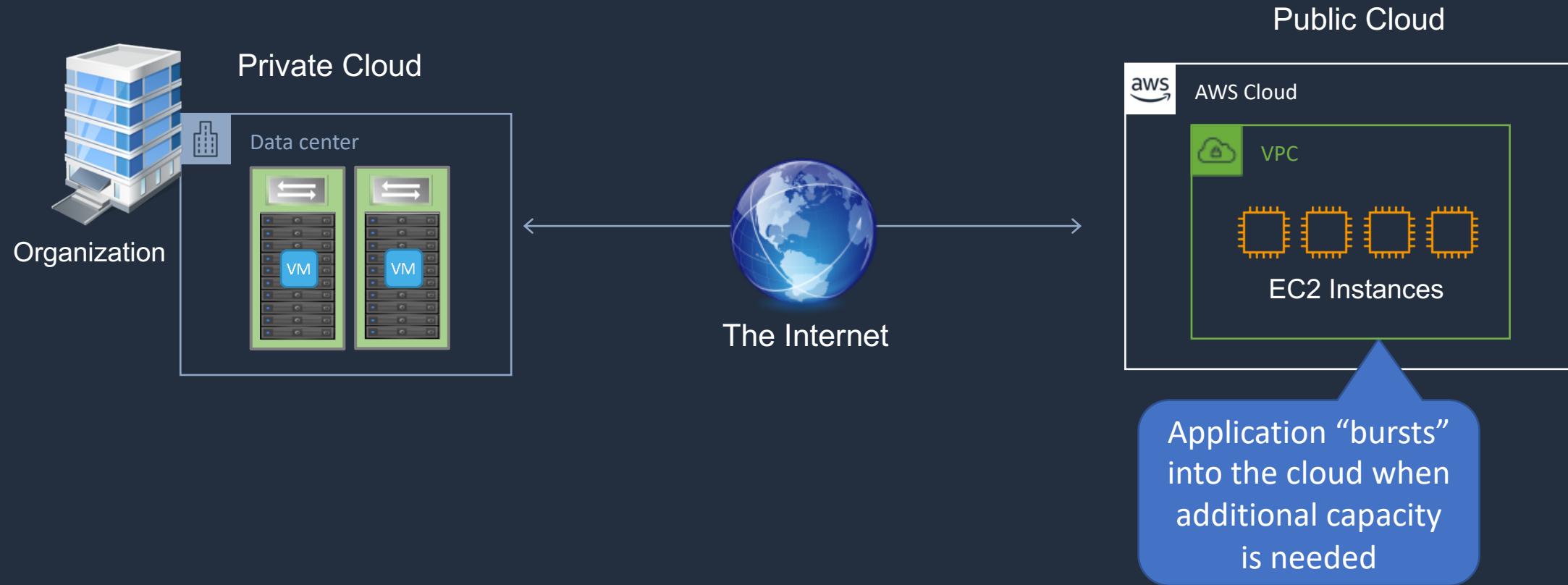


Gmail



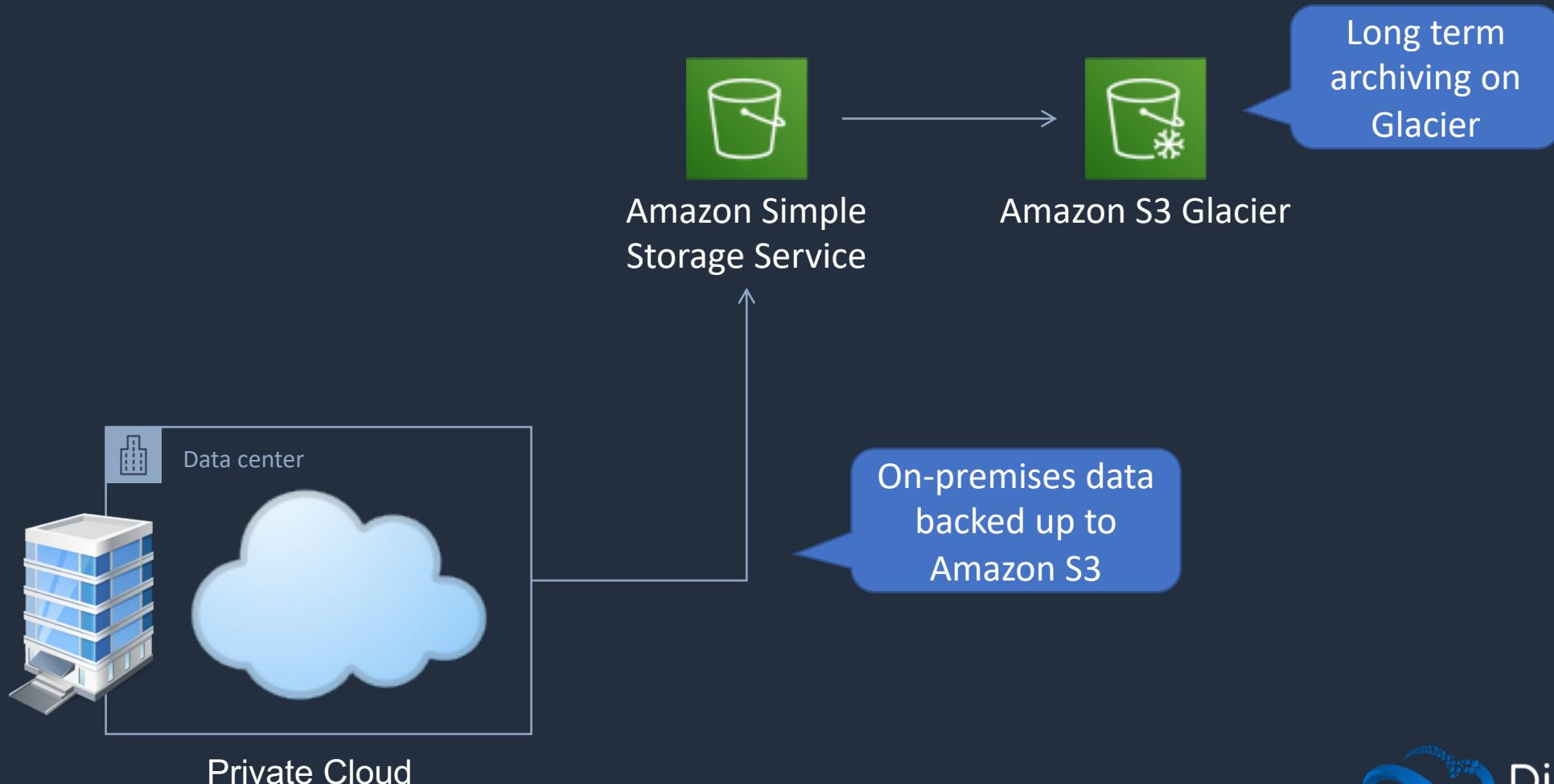
# Cloud Bursting

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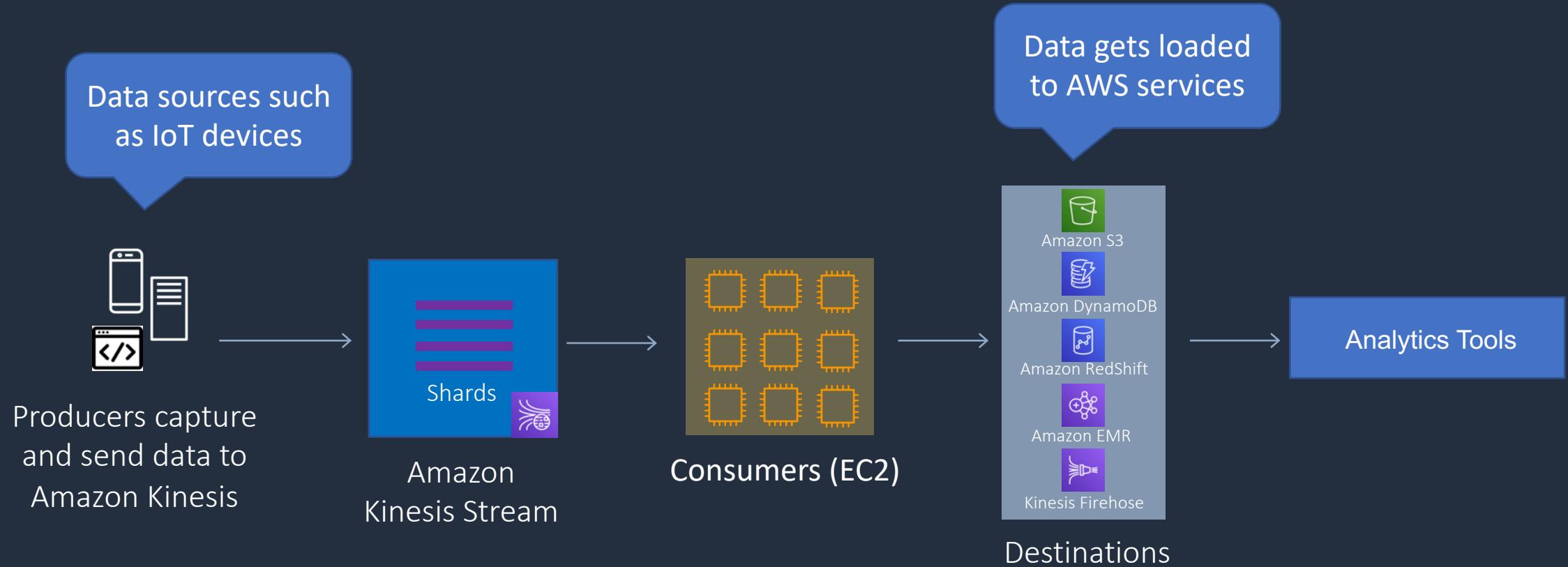


# Storage and Backup / Archiving

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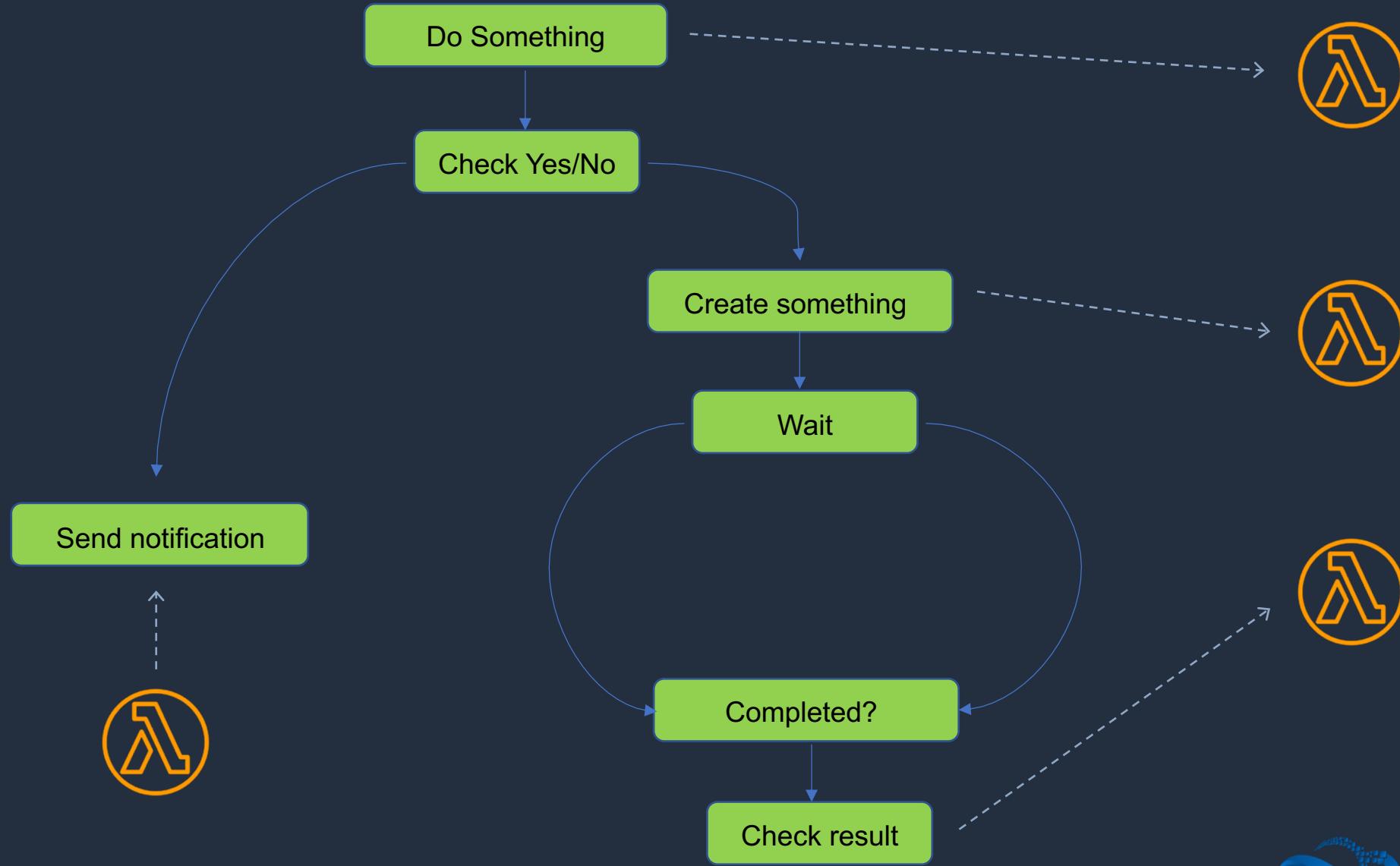


# Streaming Data & Analytics



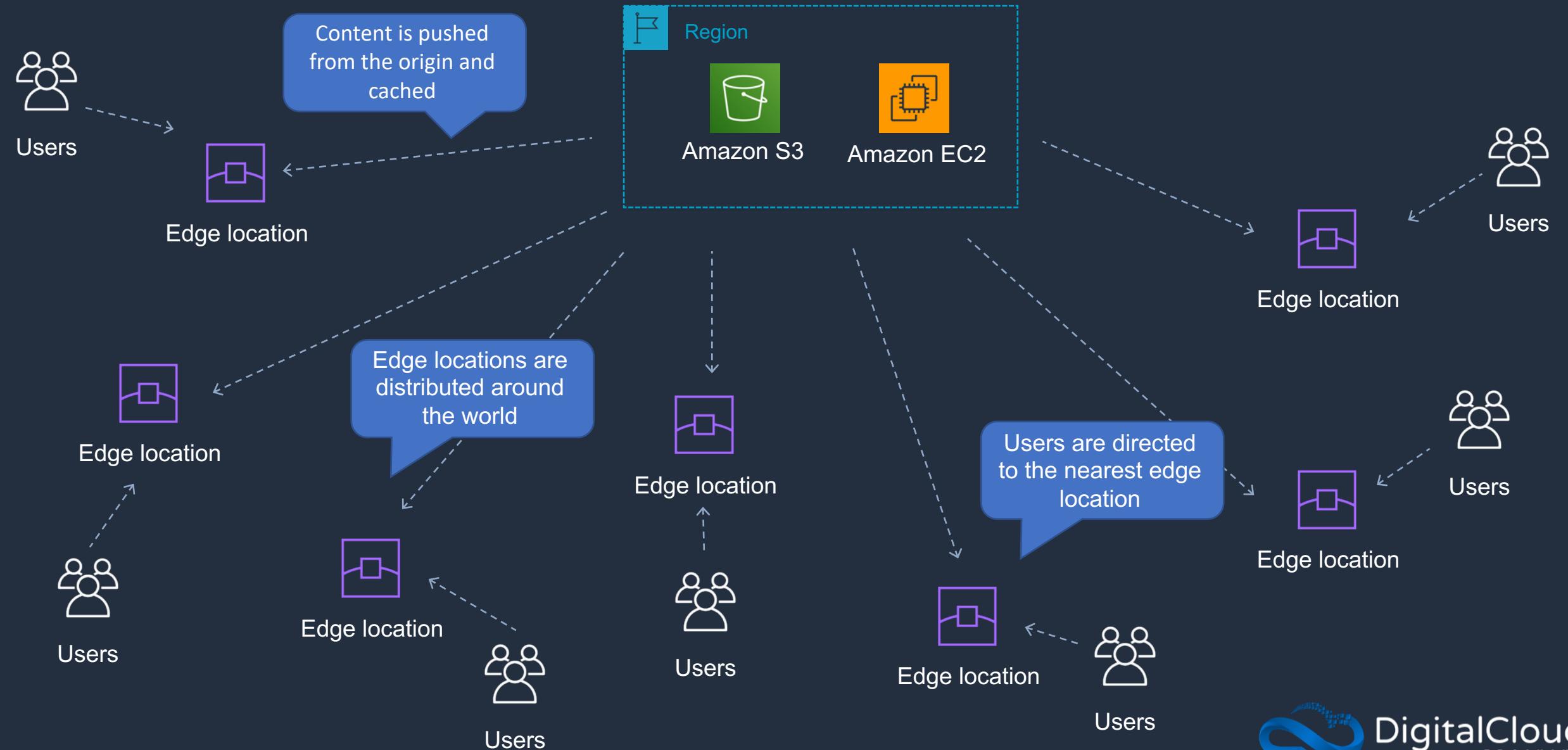
# Serverless Workflows

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# Audio and Video Streaming

## CloudFront Origins



# Building a Business case for Cloud



# Building a Business Case for Cloud

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1) Benefits and Options

2) Cost evaluation

3) Migration Method

# Building a Business Case for Cloud

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## 1. Benefits and Options

- What are the business objectives for moving to cloud?
- Consider business benefits as well as technology benefits
- Consider people, process, and technology:
  - People – current skill sets, retraining, hiring...
  - Process – affects on business processes...
  - Technology – migration, refactoring, legacy...
- Evaluate different cloud providers, deployment models and service models

# Building a Business Case for Cloud

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## 2. Cost evaluation

- Total cost of ownership analysis (TCO)
- Determine on-premises costs and cloud costs
- Include:
  - Data center costs
  - Servers, storage, networking etc..
  - Backup / recovery
  - Licensing
  - Staff costs
  - Maintenance costs

# Building a Business Case for Cloud

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## 3. Migration Method

- What tools are available?
- Consider the “6 Rs” for each application:
  1. Rehosting (aka lift & shift)
  2. Replatforming – e.g. SQL to RDS
  3. Repurchasing – move to a different product
  4. Refactoring / rearchitecting
  5. Retire
  6. Retain

# Establishing costs: The AWS Pricing calculator



# SECTION 6

## Migrating to the AWS Cloud

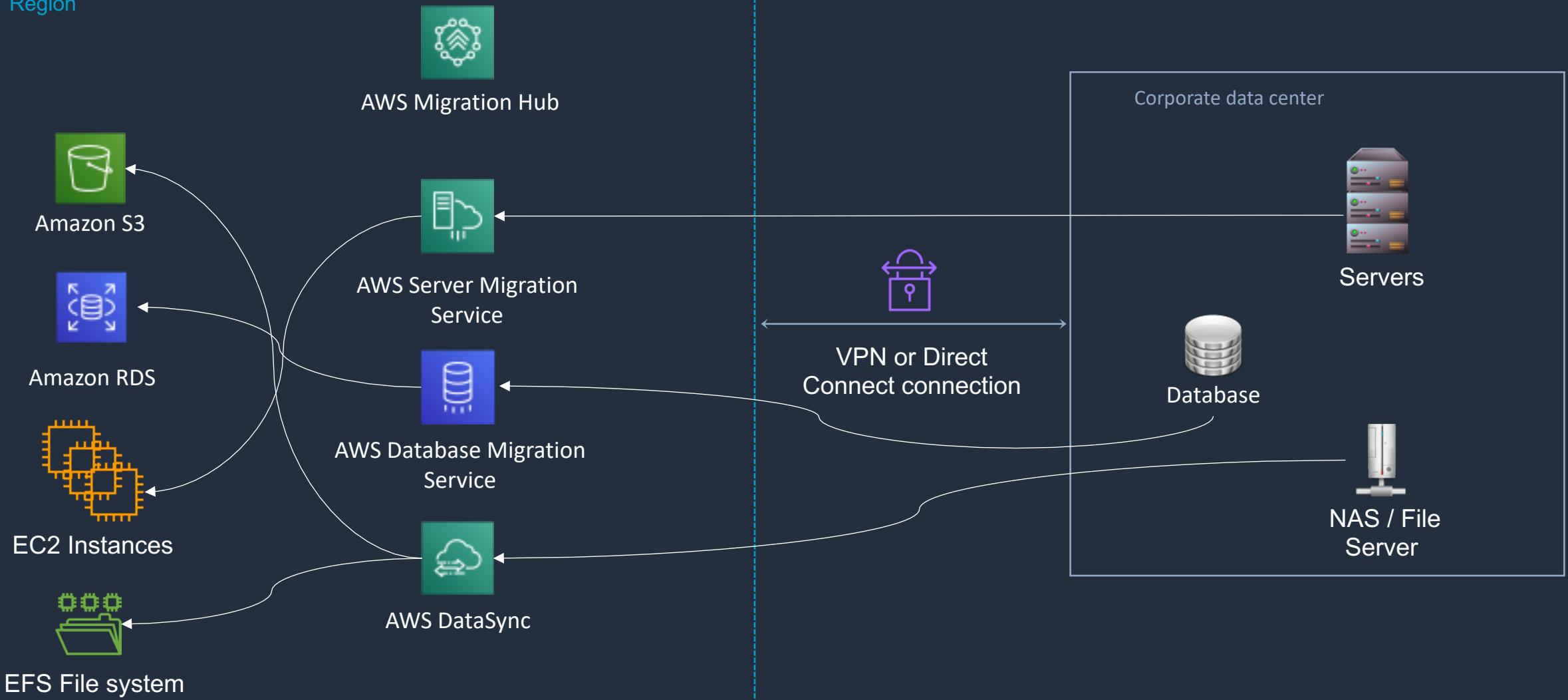
# AWS Migration Tools



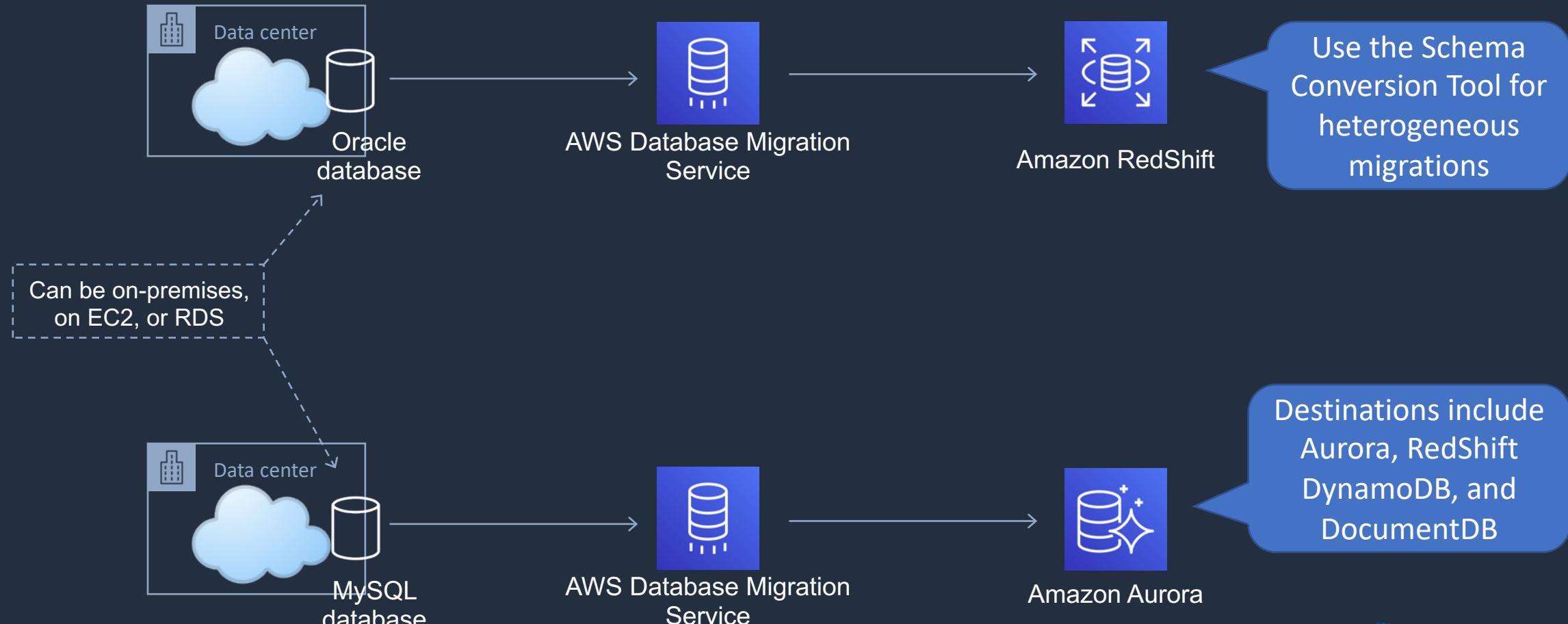
# AWS Migration Tools



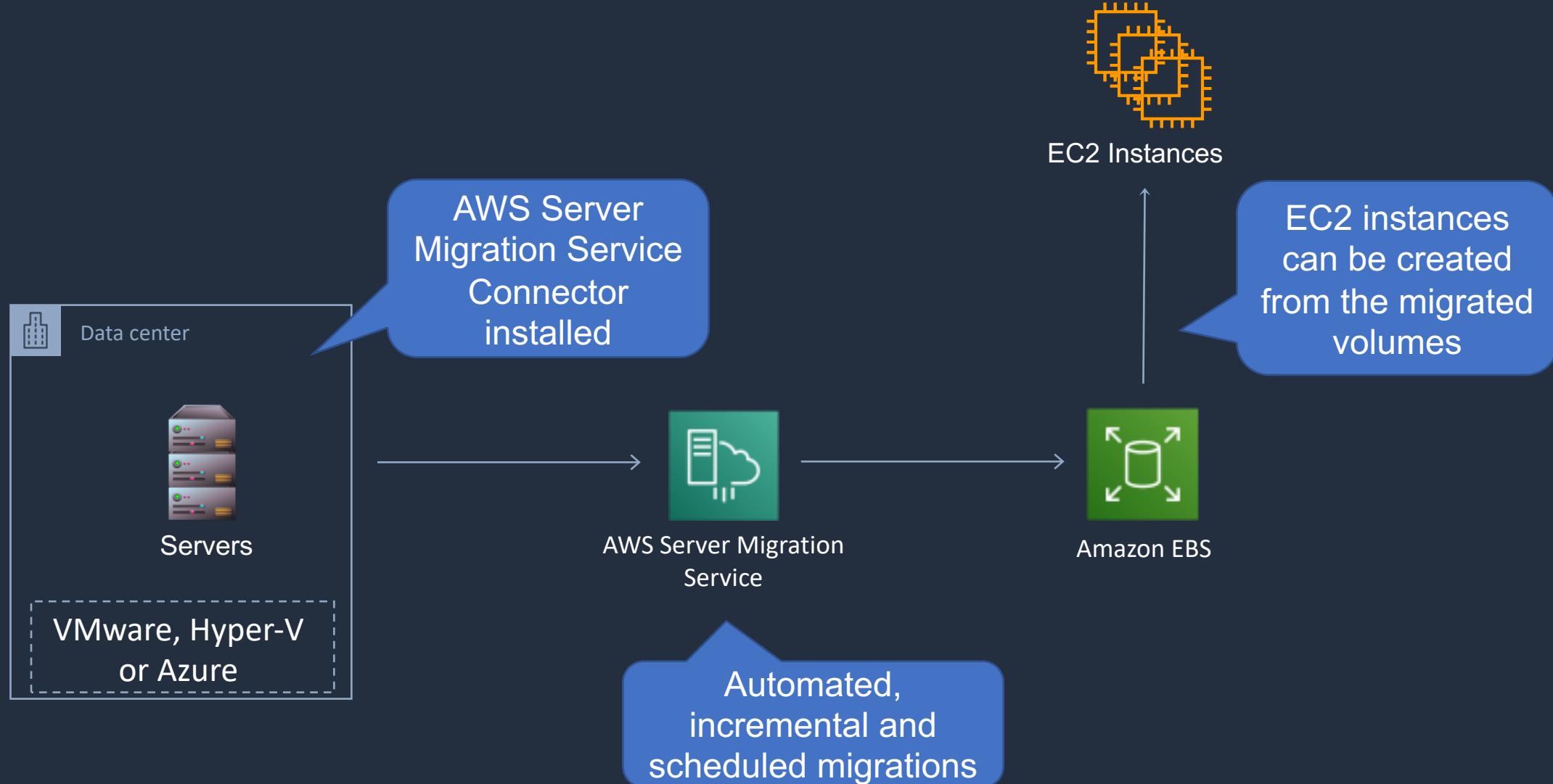
Region



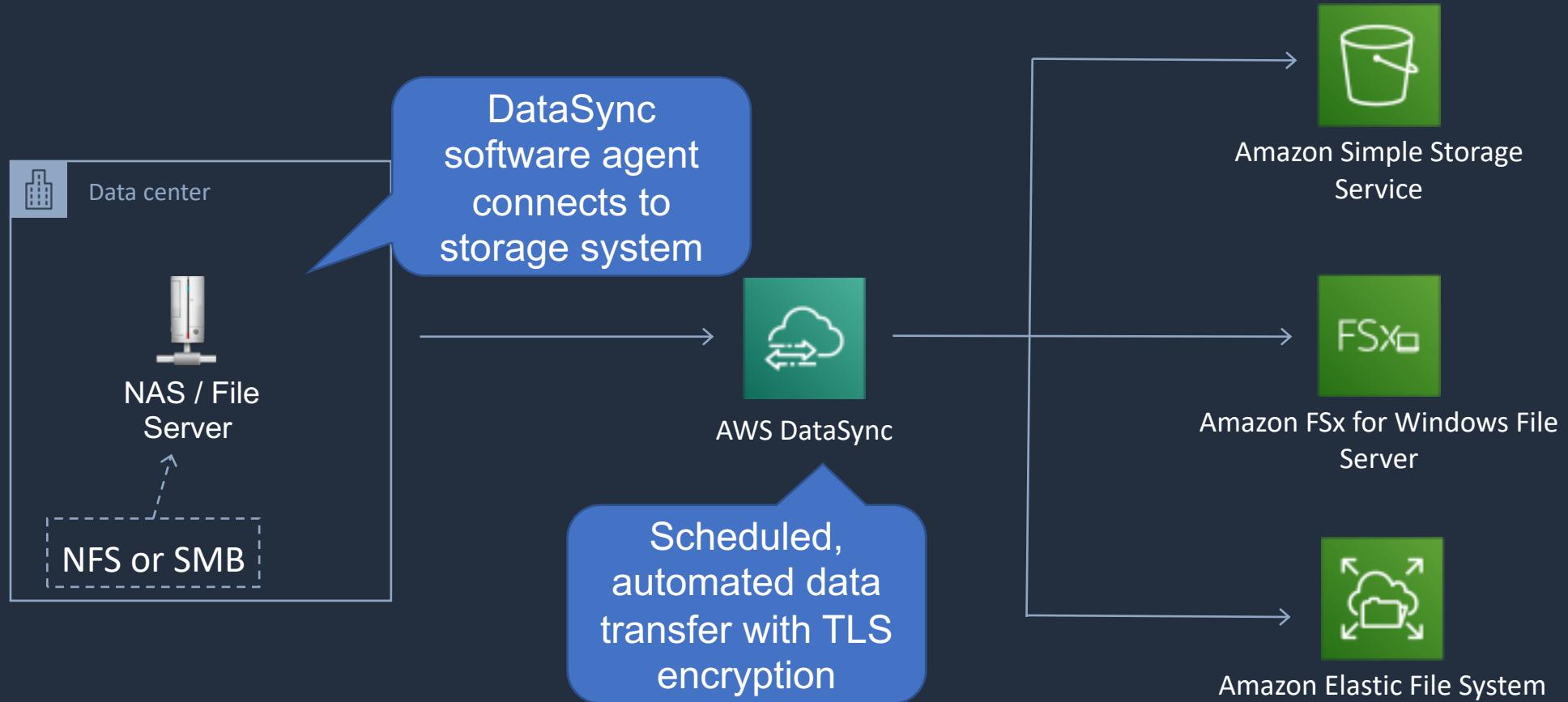
# AWS Database Migration Service (DMS)



# AWS Server Migration Service (SMS)



# AWS DataSync



# AWS Snowball and Snowmobile

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AWS Snowball

Use for moving TB of data into AWS



AWS Snowmobile

Use for moving PB of data into AWS

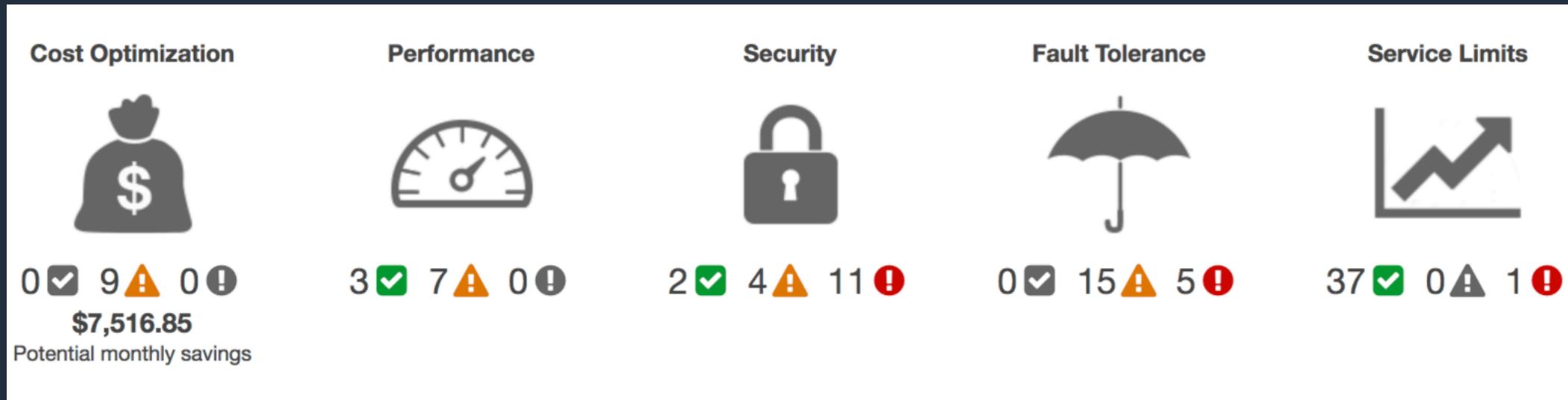
# AWS Trusted Advisor



# AWS Trusted Advisor

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- Provides real-time guidance for provisioning according to AWS best practices



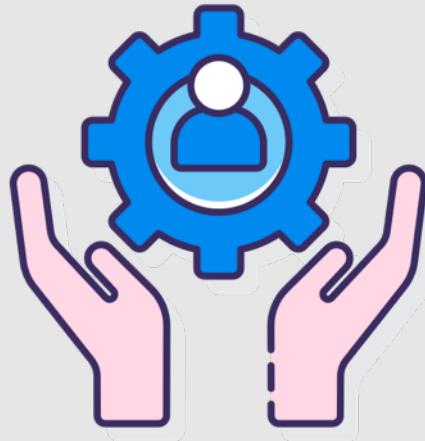
# AWS Trusted Advisor



# SECTION 7

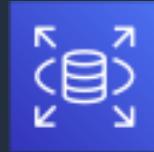
## Managing and Operating in the Cloud

# Higher-Level Managed Services



# Higher-level Managed Services

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Amazon RDS

- Managed OS and database



Amazon Simple  
Storage Service

- Fully managed storage



AWS Lambda

- Fully managed compute

# Benefits of Managed Services

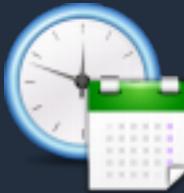
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- Free up your staff to focus on value-add activities



- Reduce costs for operational activities



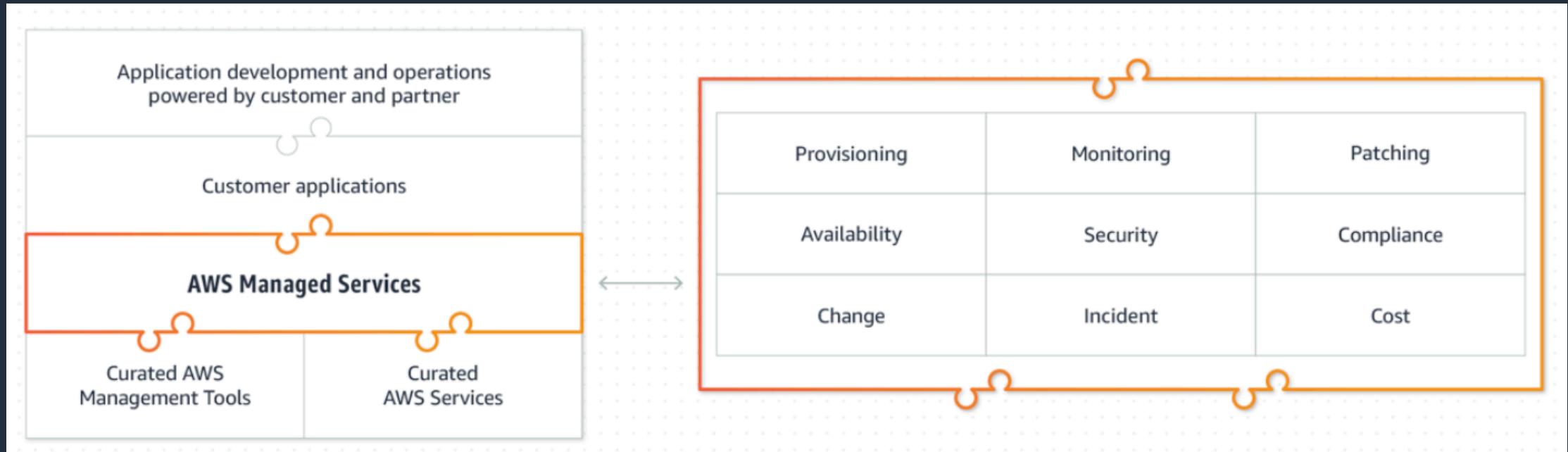
- Minimize downtime



- Efficiency and security

# AWS Managed Services

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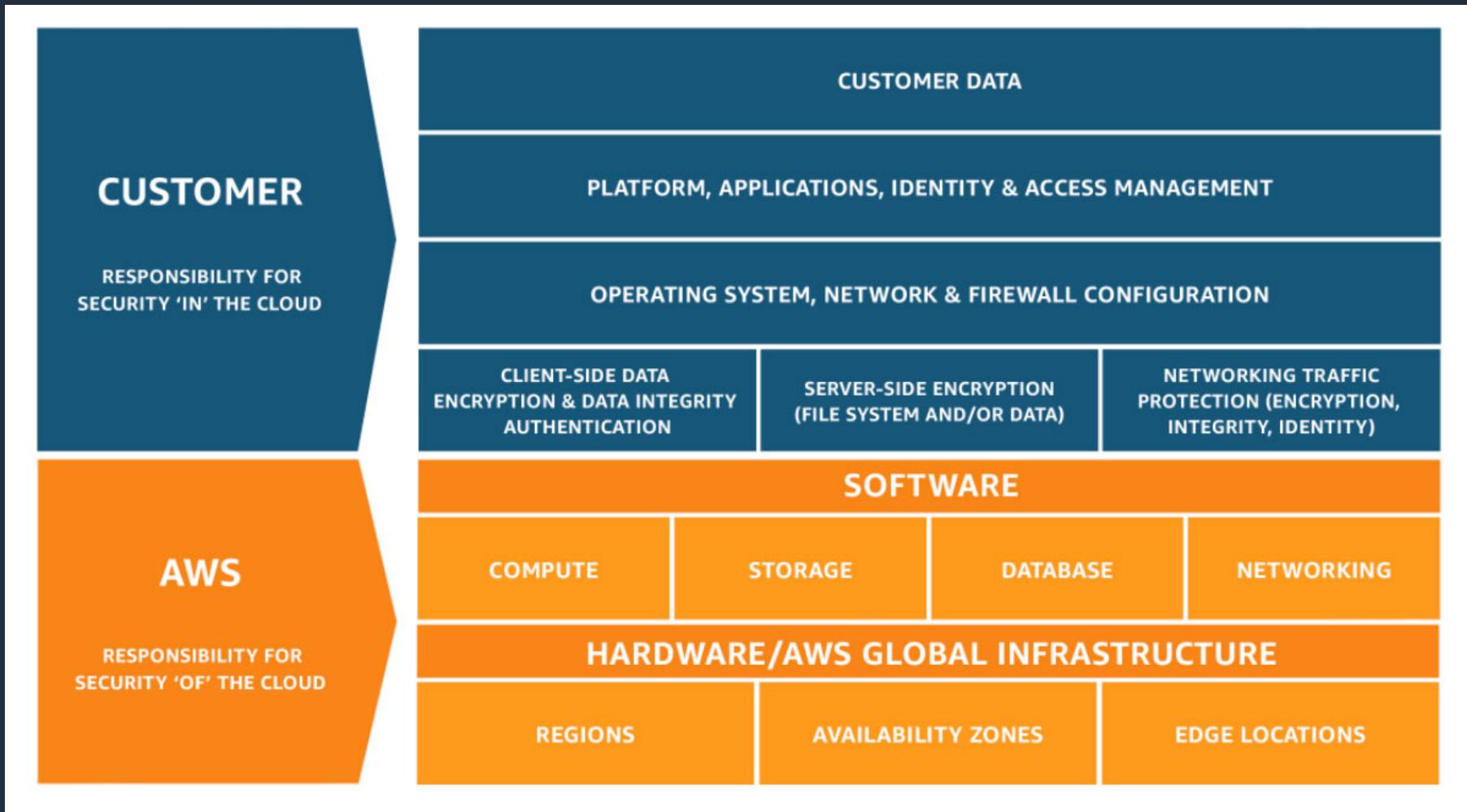


# Security in the AWS Cloud



# The Shared Responsibility Model

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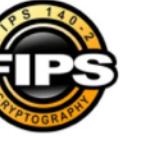


# Compliance Programs - Global

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 <b>CSA</b> Cloud Security Alliance Controls	 <b>ISO 9001</b> International Organization for Standardization	 <b>ISO 27001</b> International Organization for Standardization	 <b>ISO 27017</b> International Organization for Standardization	 <b>ISO 27018</b> International Organization for Standardization
 <b>PCI DSS Level 1</b> Payment Card Standards	 <b>SOC 1</b> Audit Controls Report	 <b>SOC 2</b> Security, Availability, & Confidentiality Report	 <b>SOC 3</b> General Controls Report	

# Compliance Programs - Americas

				
<b>CJIS</b> Criminal Justice Information Services	<b>DoD SRG</b> DoD Data Processing	<b>FedRAMP</b> Government Data Standards	<b>FERPA</b> Educational Privacy Act	<b>FIPS</b> Government Security Standards
				
<b>FISMA</b> Federal Information Security Management	<b>GxP</b> Quality Guidelines and Regulations	<b>HIPAA</b> Protected Health Information	<b>HITRUST CSF</b> Health Information Trust Alliance Common Security Framework	<b>ITAR</b> International Arms Regulations
				
<b>MPAA</b> Protected Media Content	<b>NIST</b> National Institute of Standards and Technology	<b>PIPEDA</b> Canada's Federal Private Sector Privacy Legislation	<b>SEC Rule 17a- 4(f)</b> Financial Data Standards	<b>VPAT / Section 508</b> Accessibility Standards

# AWS Security and Compliance Services

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Category	Use cases	AWS service
Identity & access management	Securely manage access to services and resources	 <a href="#">AWS Identity &amp; Access Management (IAM)</a>
	Cloud single-sign-on (SSO) service	 <a href="#">AWS Single Sign-On</a>
	Identity management for your apps	 <a href="#">Amazon Cognito</a>
	Managed Microsoft Active Directory	 <a href="#">AWS Directory Service</a>
	Simple, secure service to share AWS resources	 <a href="#">AWS Resource Access Manager</a>
	Central governance and management across AWS accounts	 <a href="#">AWS Organizations</a>
Detection	Unified security and compliance center	 <a href="#">AWS Security Hub</a>
	Managed threat detection service	 <a href="#">Amazon GuardDuty</a>
	Analyze application security	 <a href="#">Amazon Inspector</a>
	Record and evaluate configurations of your AWS resources	 <a href="#">AWS Config</a>
	Track user activity and API usage	 <a href="#">AWS CloudTrail</a>
	Security management for IoT devices	 <a href="#">AWS IoT Device Defender</a>

# AWS Security and Compliance Services

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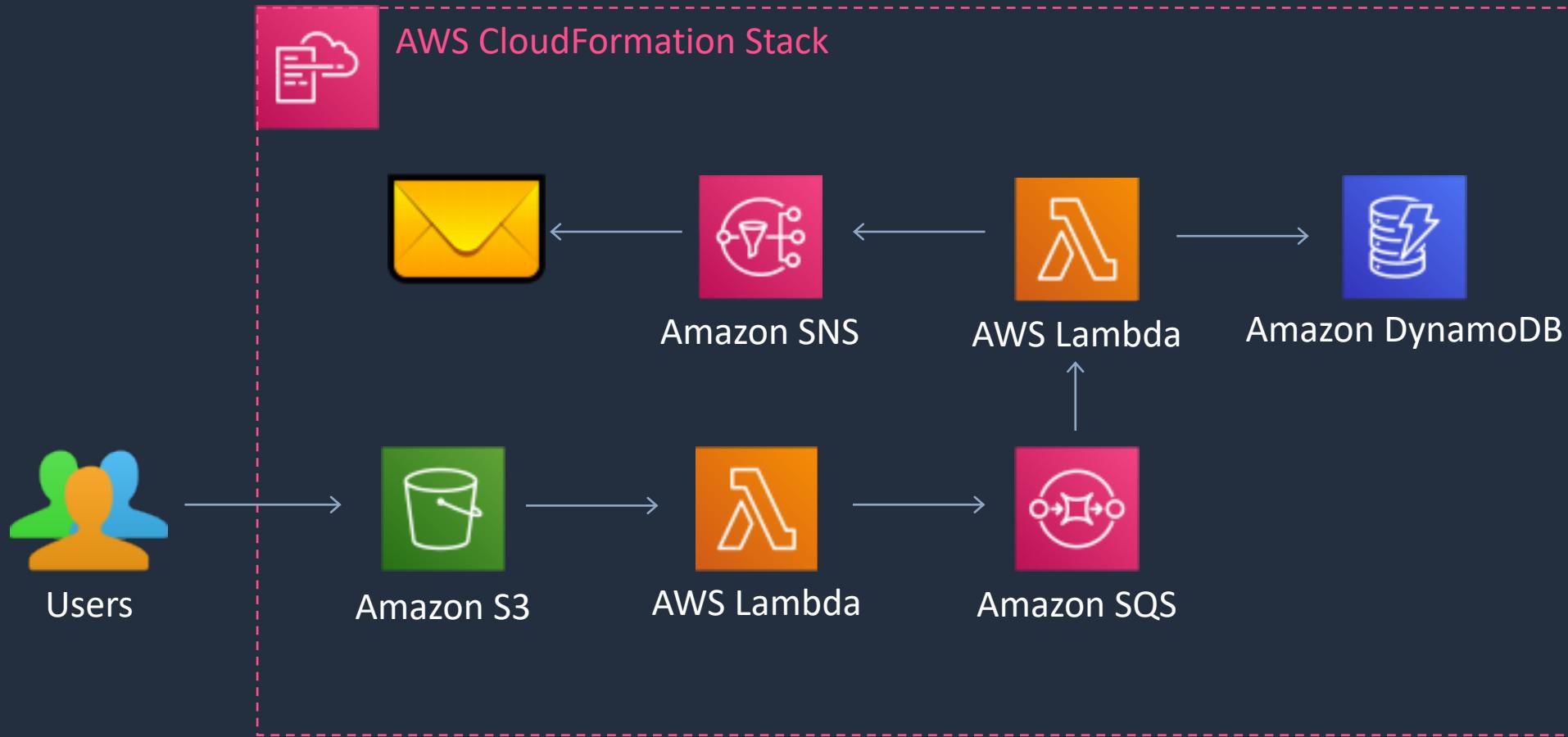
Category	Use cases	AWS service
Infrastructure protection	DDoS protection	 <a href="#">AWS Shield</a>
	Filter malicious web traffic	 <a href="#">AWS Web Application Firewall (WAF)</a>
	Central management of firewall rules	 <a href="#">AWS Firewall Manager</a>
Data protection	Discover and protect your sensitive data at scale	 <a href="#">Amazon Macie</a>
	Key storage and management	 <a href="#">AWS Key Management Service (KMS)</a>
	Hardware based key storage for regulatory compliance	 <a href="#">AWS CloudHSM</a>
	Provision, manage, and deploy public and private SSL/TLS certificates	 <a href="#">AWS Certificate Manager</a>
	Rotate, manage, and retrieve secrets	 <a href="#">AWS Secrets Manager</a>
Incident response	Investigate potential security issues	 <a href="#">Amazon Detective</a>
	Fast, automated, cost- effective disaster recovery	 <a href="#">CloudEndure Disaster Recovery</a>
Compliance	No cost, self-service portal for on-demand access to AWS' compliance reports	 <a href="#">AWS Artifact</a>

# Avoiding Lock-in



# Avoiding Lock-in

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# Avoiding Lock-in

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