



# Welcome to: AWSomeDay 2019

With Rick Hurst – Technical Architect



# Course Objectives

- Recognize terminology and concepts as they relate to the **AWS platform** and navigate the **AWS Management Console**.
- Understand the **foundational services**, including Amazon Elastic Compute Cloud (EC2), Amazon Virtual Private Cloud (VPC), Amazon Simple Storage Service (S3), and Amazon Elastic Block Store (EBS).
- Understand the **security** measures AWS provides and key concepts of AWS Identity and Access Management (IAM).
- Understand AWS **database** services, including Amazon DynamoDB and Amazon Relational Database Service (RDS).
- Understand AWS **management tools**, including Auto Scaling, Amazon CloudWatch, Elastic Load Balancing (ELB), and AWS Trusted Advisor.

# Module Layout

- **Module 1:** Introduction and History of AWS
- **Module 2:** Foundational Services – Amazon EC2, Amazon VPC, Amazon S3, Amazon EBS
  - Lab 1: Build your VPC and launch a web server
- **Module 3:** Security, Identity, and Access Management - IAM
- **Module 4:** Databases – Amazon DynamoDB and Amazon RDS
  - Lab 2: Build your database server and interact with it
- **Module 5:** AWS Elasticity and Management Tools – Auto Scaling, Elastic Load Balancing, Amazon CloudWatch, and AWS Trusted Advisor
  - Lab 3: Scale and load balance your application and monitor activity
- **Module 6:** Course Wrap-Up
- **Module 7:** Course Appendices



# Introduction and History of AWS

# Amazon History



1994: Jeff Bezos incorporated the company.



2005: Amazon Publishing was launched.



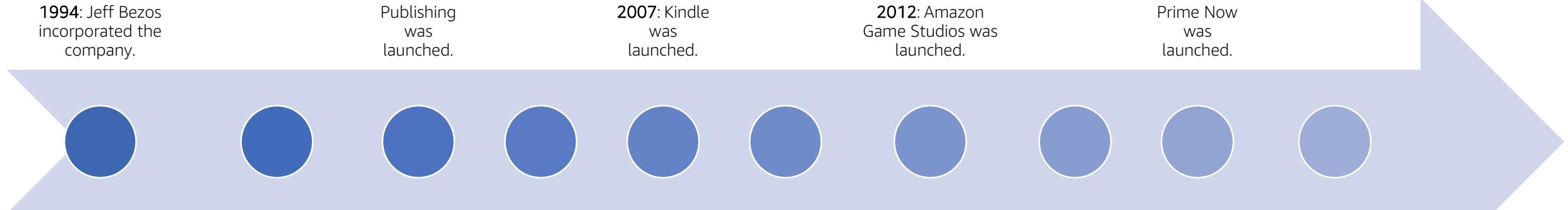
2007: Kindle was launched.



2012: Amazon Game Studios was launched.



2014: Amazon Prime Now was launched.



1995:  
Amazon.com  
launched its  
online bookstore.



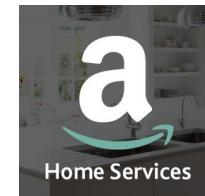
2006:  
Amazon  
Web Services  
(AWS) was  
launched.



2011:  
Amazon  
Fresh was  
launched.



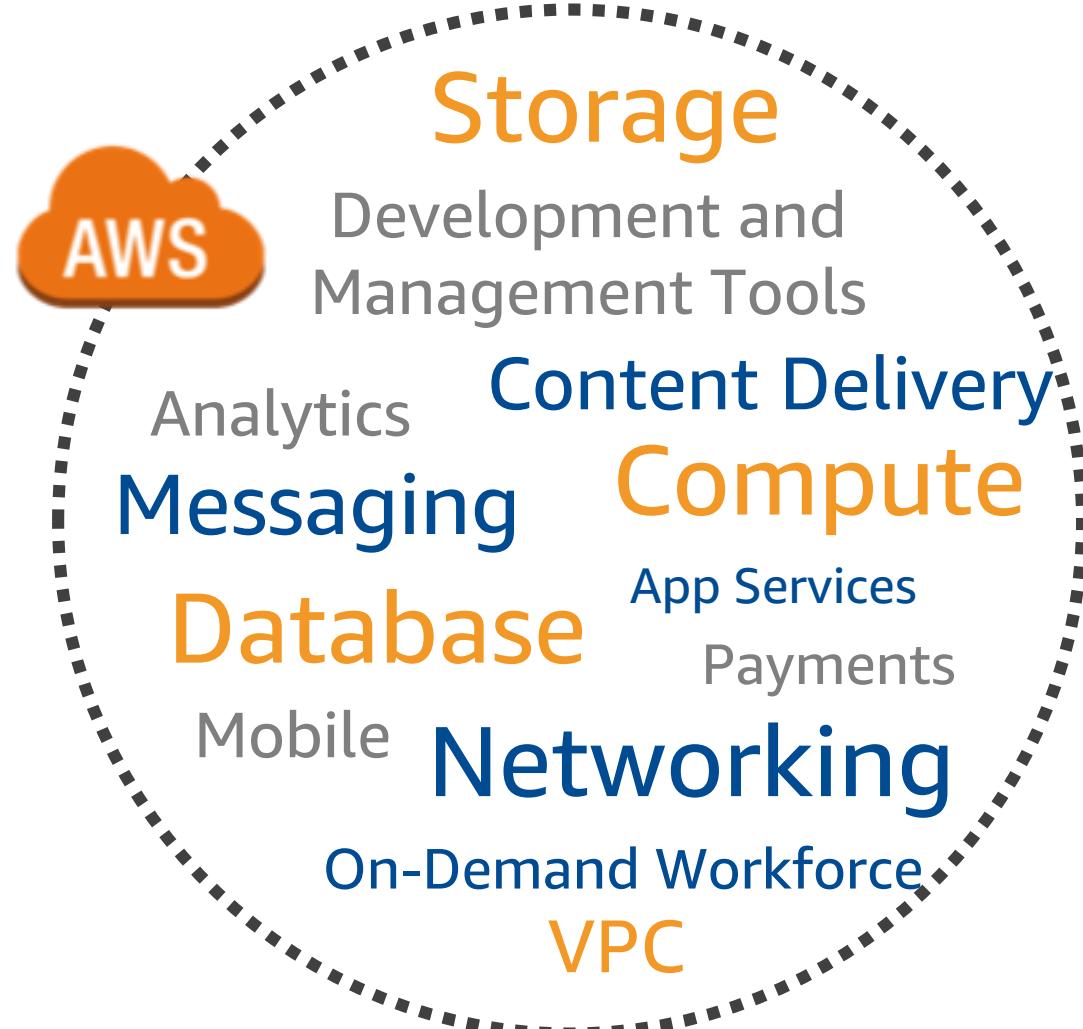
2013:  
Amazon Art  
was  
launched.



# Amazon Web Services



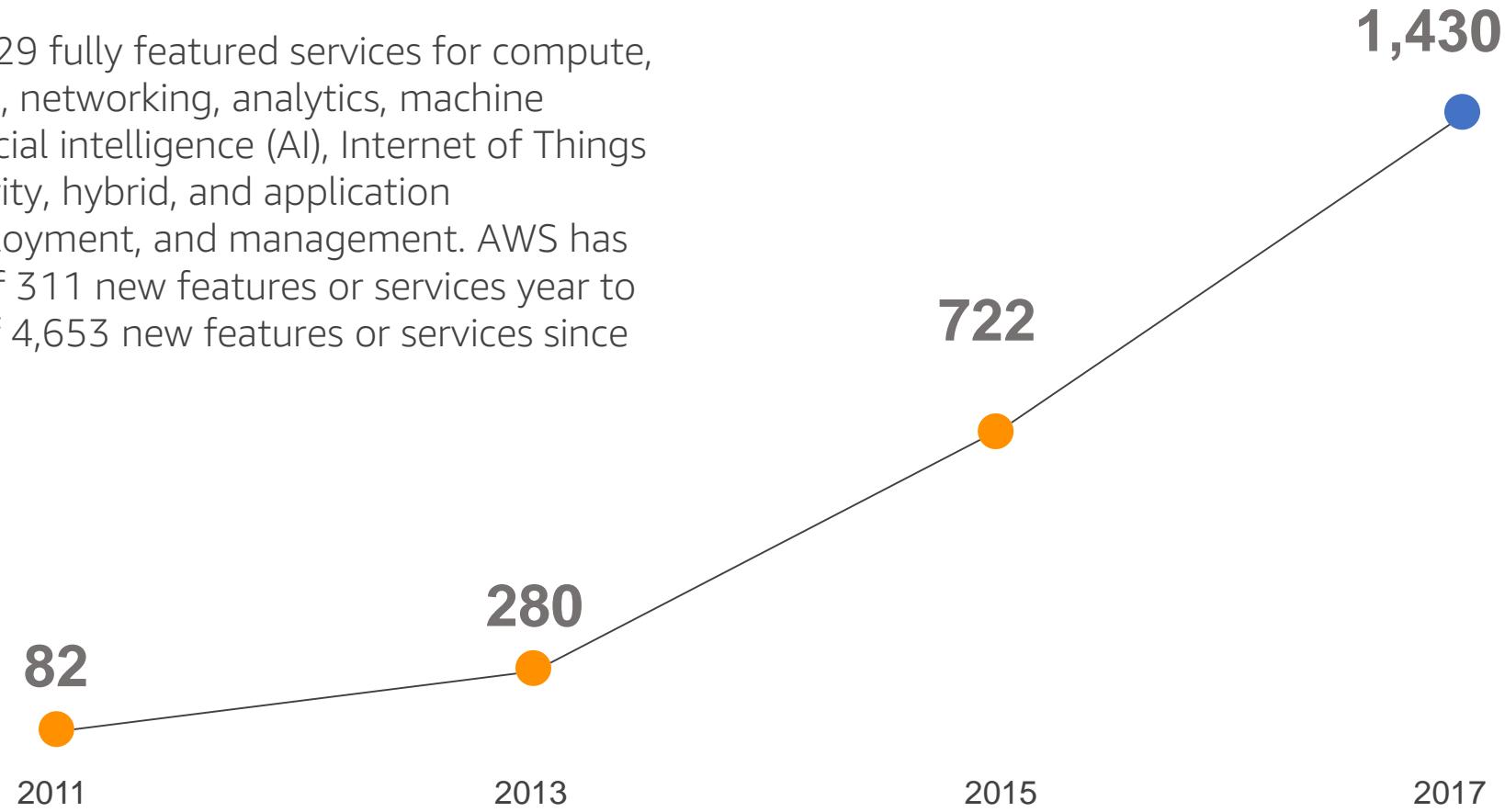
- Enable businesses and developers to use web services to build scalable, sophisticated applications.



# AWS Pace of Innovation



AWS offers over 129 fully featured services for compute, storage, databases, networking, analytics, machine learning, and artificial intelligence (AI), Internet of Things (IoT), mobile, security, hybrid, and application development, deployment, and management. AWS has launched a total of 311 new features or services year to date\* for a total of 4,653 new features or services since inception in 2006.



\* As of 31 March 2018

# Total New Services and Features



AWS Batch	Schema Conversion Tool	AWS Storage Gateway	Amazon Cognito	AWS Certificate Manager
AWS Snowmobile	AWS OpsWorks	Amazon ElastiCache	AWS Config	Amazon EFS AWS CodePipeline
AWS Organizations	AWS CodeDeploy	Amazon Lumberyard	Amazon AppStream 2.0	AWS Elastic Beanstalk
<b>Amazon Lex</b>	AWS CodeCommit	<b>Amazon Lightsail</b>		Amazon Route 53
AWS Managed Services	Amazon Inspector			Lambda
Amazon Redshift				AWS Glue
Amazon Kinesis Firehose				AWS X-Ray
Amazon Pinpoint				AWS CodeBuild
Amazon DynamoDB				Amazon RDS for Aurora
AWS Snowball	<b>Amazon Athena</b>			AWS Mobile Hub
Amazon WorkMail	AWS WAF	AWS OpsWorks for Chef Automate	<b>Amazon Machine Learning</b>	CloudWatch Logs
<b>AWS IoT</b>			Device Farm	Mobile Analytics
Amazon Polly	WorkSpaces	<b>AWS IoT Greengrass</b>	WorkDocs	AWS Import/Export
AWS Personal Health Dashboard		AWS Direct Connect	Amazon Inspector	AWS Service Catalog
	<b>Amazon EC2 Systems Manager</b>		<b>AWS Step Functions</b>	
			<b>AWS Discovery Services</b>	
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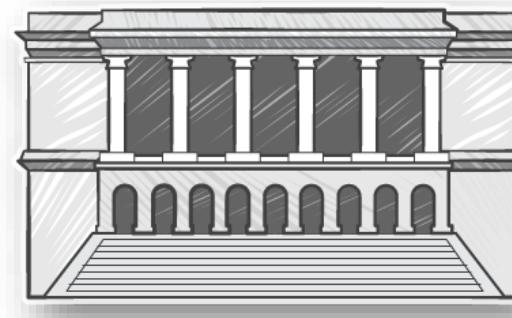
## Enterprise Customers

*Amazon Web Services delivers a mature set of services specifically designed for the unique security, compliance, privacy, and governance requirements of large organizations.*



## Public Sector

*Paving the way for innovation and supporting world-changing projects in government, education and nonprofit organizations.*

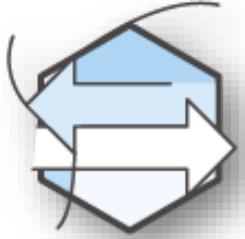


## Startups

*From the spark of an idea, to your first customer, to IPO and beyond, let Amazon Web Services help you build and grow your startup.*



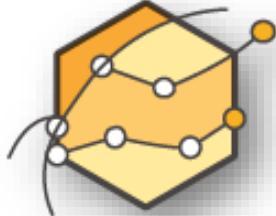
# Advantages and Benefits of AWS Cloud Computing



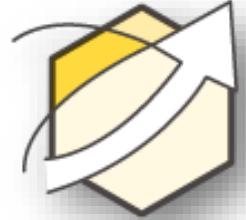
Trade capital expense  
for variable expense.



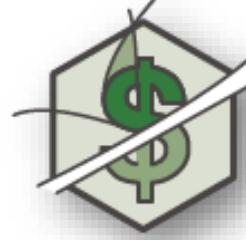
Benefit from massive  
economies of scale.



Stop guessing  
capacity.



Increase speed and  
agility.



Stop spending money on  
running and maintaining data  
centers.



Go global in minutes.

# AWS Core Infrastructure and Services



Firewalls



ACLs



Administrators

## Security



Security groups



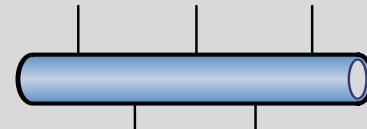
Network ACLs



AWS IAM



Router



Network pipeline



Switch

## Networking



Elastic Load Balancing



Amazon VPC



On-premises servers

## Servers



AMI



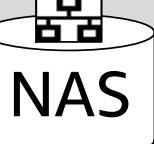
Amazon EC2 instances



DAS



SAN



NAS



RDBMS

## Storage and Database



Amazon EBS



Amazon EFS



Amazon S3



Amazon RDS

# AWS Cloud Computing



## Applications



Virtual Desktops



Collaboration and Sharing

## Platform Services

### Databases

Relational

NoSQL

Caching

### Analytics

Cluster Computing

Real-time

Data Warehouse

Data Workflows

### App Services

Queuing

Orchestration

App Streaming

Transcoding

Email

Search

### Deployment and Management

Containers

DevOps Tools

Resource Templates

Usage Tracking

Monitoring and Logs

### Mobile Services

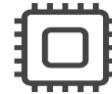
Identity

Sync

Mobile Analytics

Notifications

## Foundation Services



Compute  
(Virtual, Auto Scaling, and load balancing)



Networking



Storage  
(Object, block, and archive)

## Infrastructure



Regions



Availability Zones



Edge locations

# AWS Global Infrastructure



## Regions

- Geographic locations
- Consist of at least two Availability Zones

## Availability Zones

- Clusters of data centers
- Isolated from failures in other Availability Zones

# AWS Global Infrastructure Map

aws training and certification



# AWS Global Infrastructure Regions

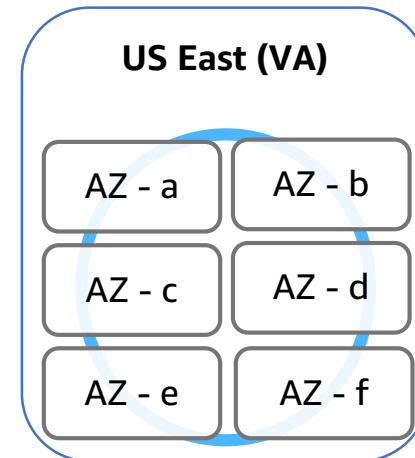


At least 2 Availability Zones per region

Examples:

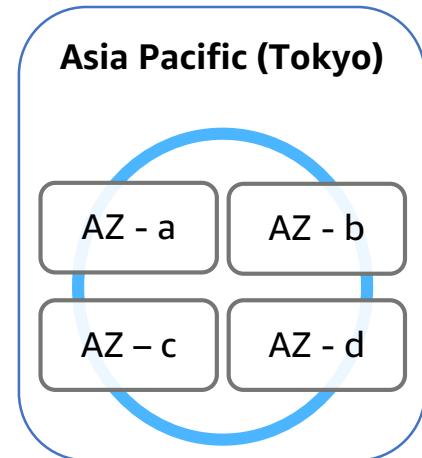
## US East (N. Virginia)

us-east-1a  
us-east-1b  
us-east-1c  
us-east-1d  
us-east-1e  
us-east-1f



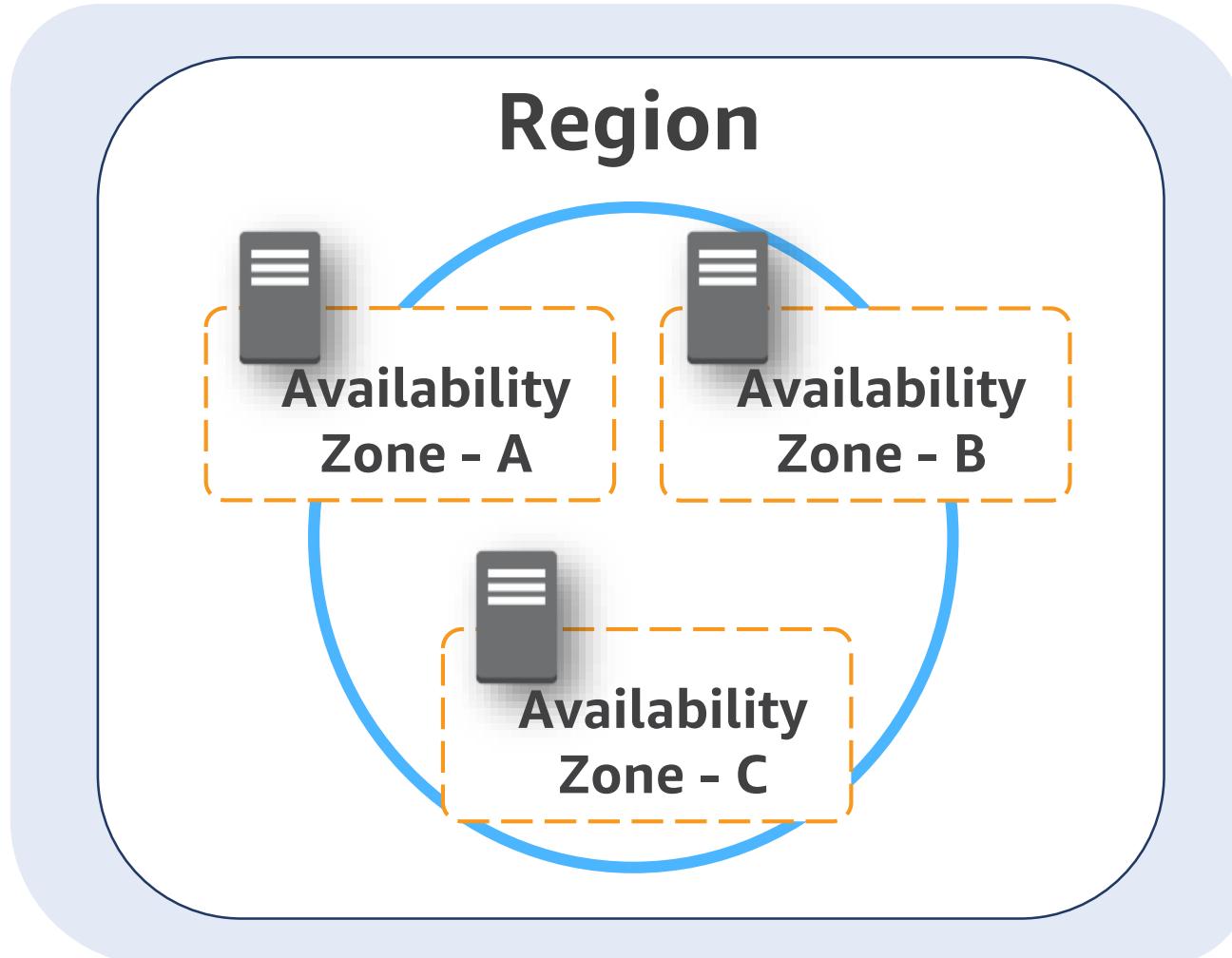
## Asia Pacific (Tokyo)

ap-northeast-1a  
ap-northeast-1b  
ap-northeast-1c  
ap-northeast-1d



**Note:** Conceptual drawing only. The number of Availability Zones (AZ) may vary.

# High Availability Using Multi-AZ Deployments



# AWS Global Infrastructure – Edge Locations



- 100+ edge locations
- Local points of presence that support AWS services like:

 **Amazon Route 53**

 **Amazon CloudFront**

 **AWS WAF**

 **AWS Shield**

# Knowledge Check



💡 Q: What is the AWS term for physically distinct groups of data centers within a region?

**Availability Zone**

💡 True or False: There are more regions than edge locations.

**False**

💡 True or False: AWS owns and maintains the infrastructure required for application services. You provision and use them as needed.

💡 Q: How do Availability Zones in the same region differ?

**True**

**Each Availability Zone is isolated, but the Availability Zones in a region are connected through low-latency links.**



## End of Introduction and History of AWS

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# AWS Foundational Services

# Module 2 Topics



- Amazon Elastic Compute Cloud (Amazon EC2)

- Amazon Virtual Private Cloud (Amazon VPC)

- Lab 1: Build your VPC and launch a web server

- Amazon Storage Services

- Amazon Simple Storage Service (Amazon S3)

- Amazon Elastic Block Store (Amazon EBS)

# Amazon Elastic Compute Cloud (Amazon EC2)



Amazon  
EC2

- Resizable compute capacity
- Complete control of your computing resources
- Reduced time required to obtain and boot new server instances

# Amazon EC2 Facts



- Scale capacity as your computing requirements change
- Pay only for capacity that you actually use
- Choose Linux or Windows
- Deploy across AWS Regions and Availability Zones for reliability
- Use tags to help manage your Amazon EC2 resources

# Launching an Amazon EC2 Instance via the Management Console



- Determine the **AWS Region** in which you want to launch the Amazon EC2 instance.
- Launch an Amazon EC2 instance from a pre-configured **Amazon Machine Image (AMI)**.
- Choose an instance **type** based on CPU, memory, storage, and network requirements.
- Configure **network**, IP address, security groups, **storage volume**, tags, and **key pair**.

# Amazon Machine Image (AMI) Details



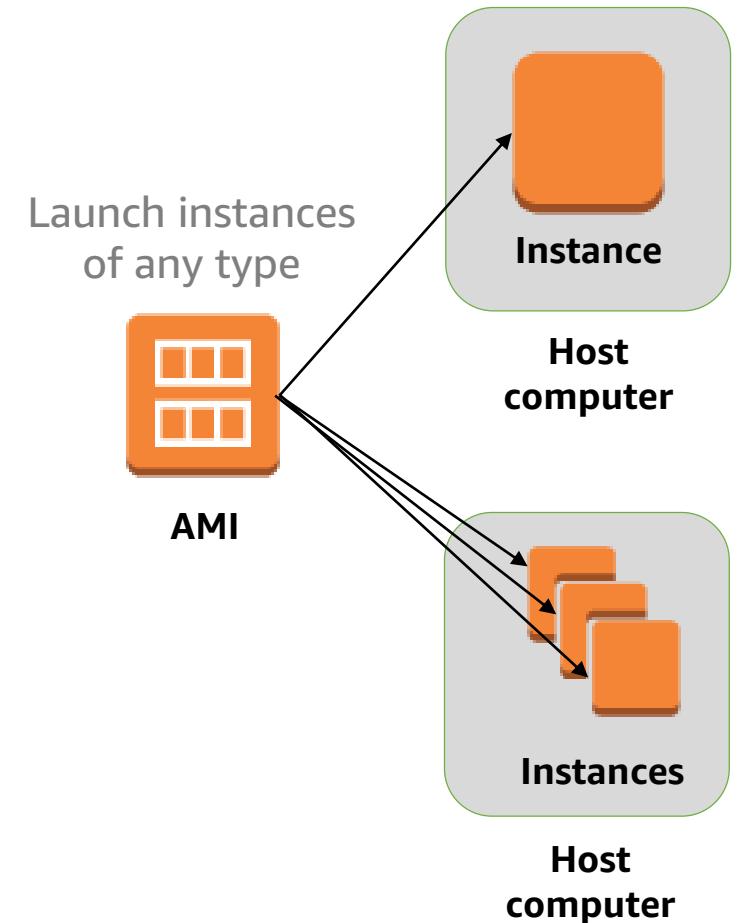
An AMI includes the following:

- A template for the **root volume** for the instance (for example, an operating system, an application server, and applications).
- **Launch permissions** that control which AWS accounts can use the AMI to launch instances.
- A block device mapping that specifies the **volumes to attach** to the instance when it is launched.

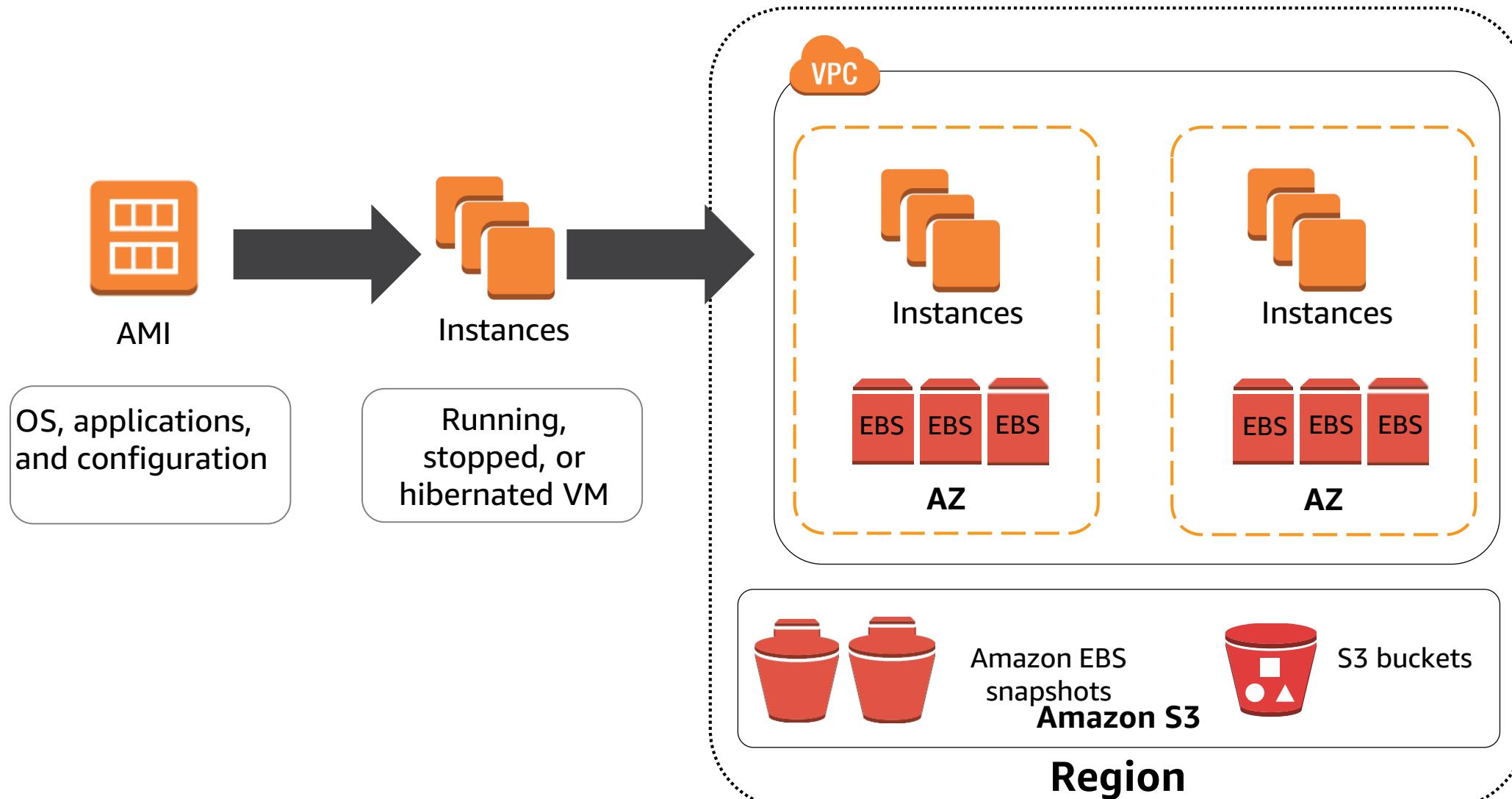
# Instances and AMIs

Select an AMI based on:

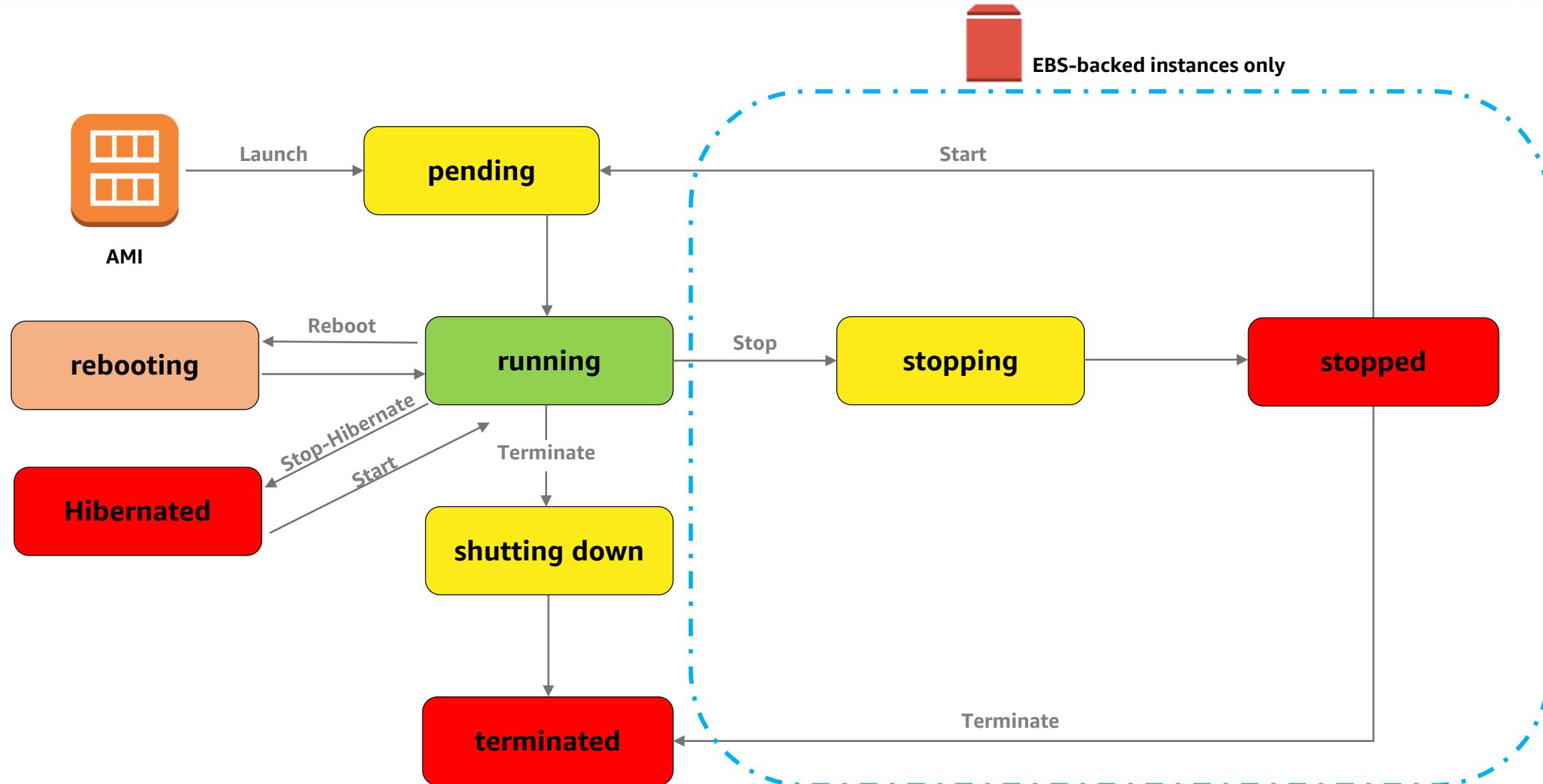
- Region
- Operating system
- Architecture (32/64bit x86 or 64-bit ARM)
- Launch permissions
- Storage for the root device



# Amazon EC2 Instances



# Instance Lifecycle



# Instance Types

Instance Family	Some Use Cases
<b>General purpose</b> (A1, T3, T2, M5, M5a, M4)	<ul style="list-style-type: none"><li>• Low-traffic websites and web applications</li><li>• Small databases and midsize databases</li></ul>
<b>Compute-optimized</b> (C5, C5n, C4)	<ul style="list-style-type: none"><li>• High-performance web servers</li><li>• Video-encoding</li></ul>
<b>Memory-optimized</b> (R5, R5a, R4, X1e, X1, High Memory, z1d)	<ul style="list-style-type: none"><li>• High-performance databases</li><li>• Distributed memory caches</li></ul>
<b>Storage-optimized</b> (H1, I3, D2)	<ul style="list-style-type: none"><li>• Data warehousing</li><li>• Log or data-processing applications</li></ul>
<b>Accelerated Computing</b> (P3, P2, G3, F1)	<ul style="list-style-type: none"><li>• 3D visualizations</li><li>• Machine learning</li></ul>

# Retrieving Instance Metadata

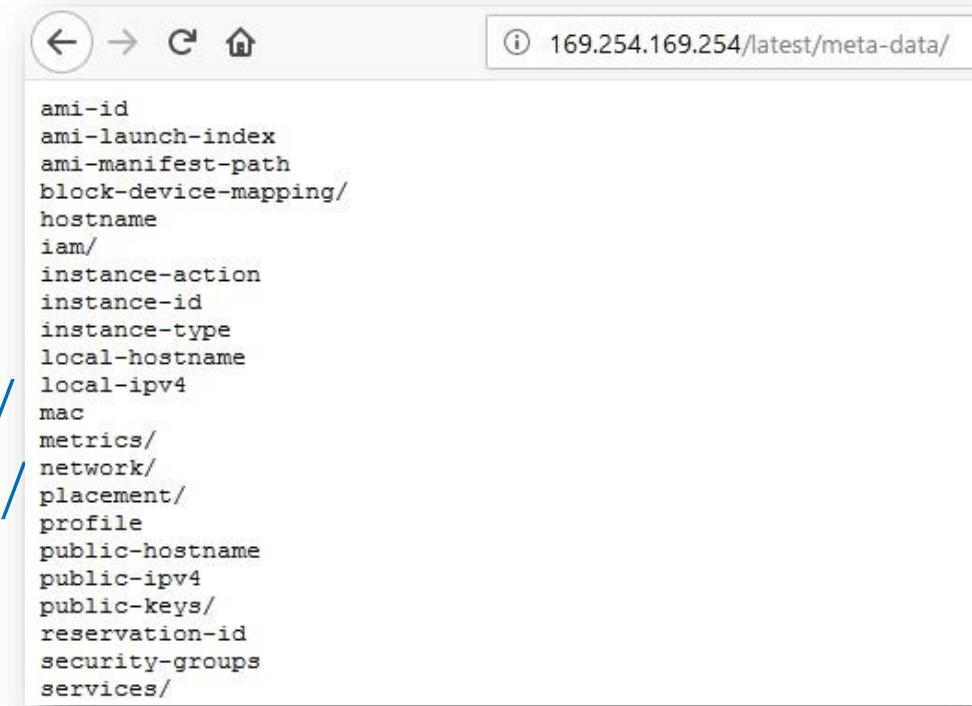
- To view all categories of instance metadata from within a running instance, use the following URI:

<http://169.254.169.254/latest/meta-data/>

- On a Linux instance, you can use:

```
$ curl http://169.254.169.254/latest/meta-data/  
$ GET http://169.254.169.254/latest/meta-data/
```

- All metadata is returned as text (content type text/plain).



# Instance User Data



- Can be passed to the instance **at launch**
- Can be used to perform common automated configuration tasks
- Runs scripts after the instance starts

# Adding User Data

- You can specify user data when launching an instance.
- User data can be:
  - **Linux** script – executed by cloud-init
  - **Windows** batch or PowerShell scripts – executed by EC2Launch service
- User data scripts **run once** per instance ID by default.

# Linux Example: User Data

```
#!/bin/sh
```

User data shell scripts must start with the #! characters and the path to the interpreter you want to read the script.

```
yum -y install httpd  
chkconfig httpd on  
/etc/init.d/httpd start
```

Install Apache web server  
Enable the web server  
Start the web server

# Windows Example: User Data

```
<powershell>
```

```
Import-Module ServerManager
```

Import the Server Manager module for PowerShell.

```
Install-WindowsFeature web-server, web-webserver
```

```
Install-WindowsFeature web-mgmt-tools
```

```
</powershell>
```

Install IIS  
Install Web Management Tools

# Retrieving User Data



- 💡 To retrieve user data, use the following URI:

`http://169.254.169.254/latest/user-data`

- 💡 On a Linux instance, you can use:

```
$ curl http://169.254.169.254/latest/user-data/
```

```
$ GET http://169.254.169.254/latest/user-data/
```

# Amazon EC2 Purchasing Options



## On-Demand Instances

Pay by the hour/second

## Reserved Instances

Purchase, at a significant discount, instances that are **always available**

1-year to 3-year terms

## Scheduled Instances

Purchase instances that are **always available** on the specified **recurring schedule**, for a one-year term.

## Spot Instances

Bid on **unused instances**, which can run as long as they are available and your bid is above the Spot price.

## Dedicated Instances

Pay, by the hour, for instances that run on **single-tenant hardware**.

## Dedicated Hosts

Pay for a physical host that is **fully dedicated** to running your instances.

# AWS Marketplace: IT Software Optimized for the Cloud



- Online store to discover, purchase, and deploy IT software on top of the AWS infrastructure.
- Catalog of thousands of Paid, BYOL, open-source, SaaS, and free-to-try options.
- Pre-configured to operate on AWS.
  - Software checked by AWS for security and operability.
  - Deploys to AWS environment in minutes.
  - Flexible, usage-based billing models.
  - Software charges billed to AWS account.
- Includes AWS Test Drive/Quick Starts.
- <https://aws.amazon.com/marketplace>

The screenshot shows the AWS Marketplace search results for 'All Categories' (4109 results). The interface includes a sidebar with categories like Infrastructure Software, Developer Tools, and Business Software, as well as filters for Vendors and Operating Systems. The main content area displays several software items with their logos, names, ratings, and brief descriptions. For example, it lists 'CentOS 7 (x86\_64) - with Updates HVM', 'WordPress Certified by Bitnami', 'CentOS 6 (x86\_64) - with Updates HVM', 'OpenVPN Access Server', and 'Debian GNU/Linux 8 (Jessie)'.

# Networking: Amazon VPC

# Amazon Virtual Private Cloud (VPC)



Amazon  
VPC

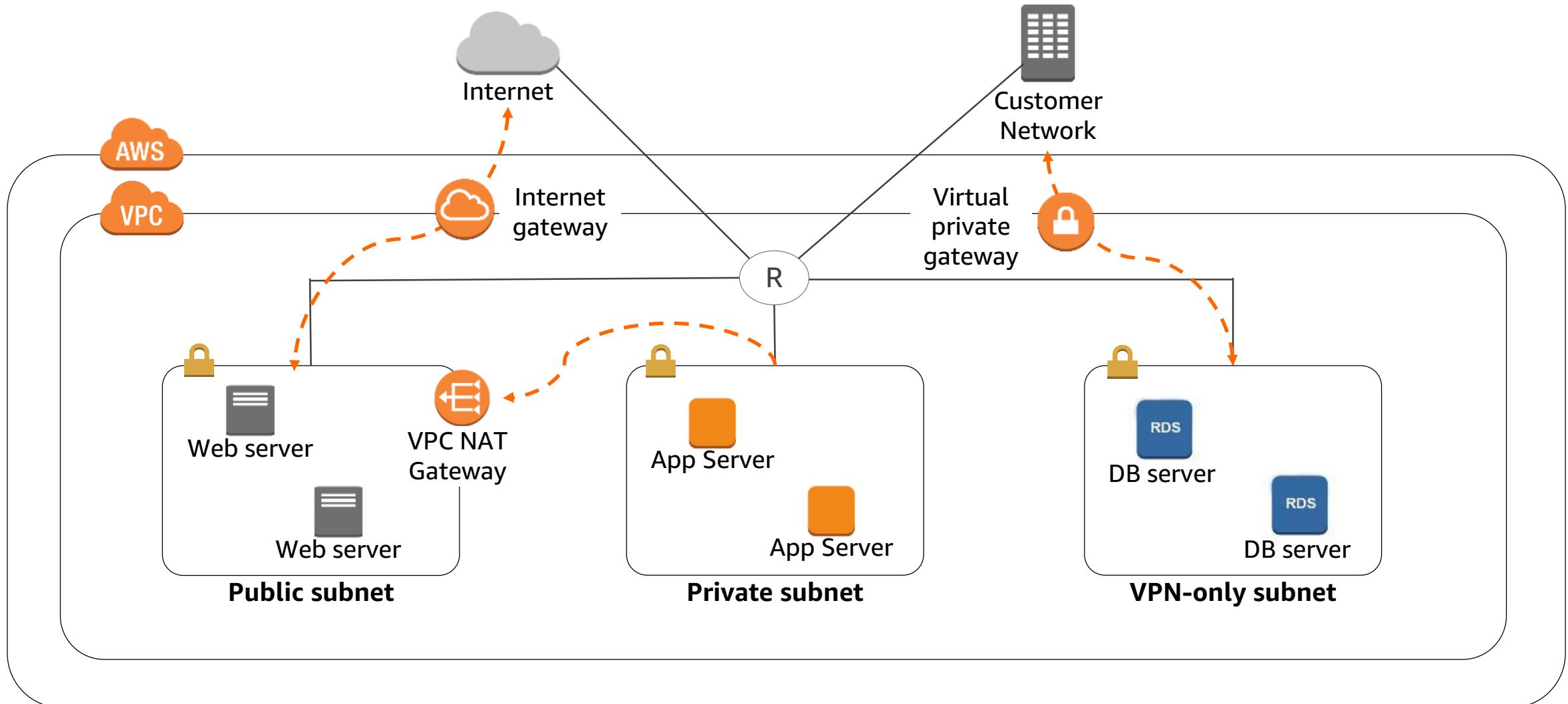
- Provision a private, isolated virtual network on the AWS cloud.
- Have complete control over your virtual networking environment.

# VPCs and Subnets



- A subnet defines a range of IP addresses in your VPC.
- You can launch AWS resources into a subnet that you select.
- A **private subnet** should be used for resources that won't be accessible over the internet.
- A **public subnet** should be used for resources that will be accessed over the internet.
- Each subnet must reside entirely within one Availability Zone and cannot span zones.

# Amazon VPC Example

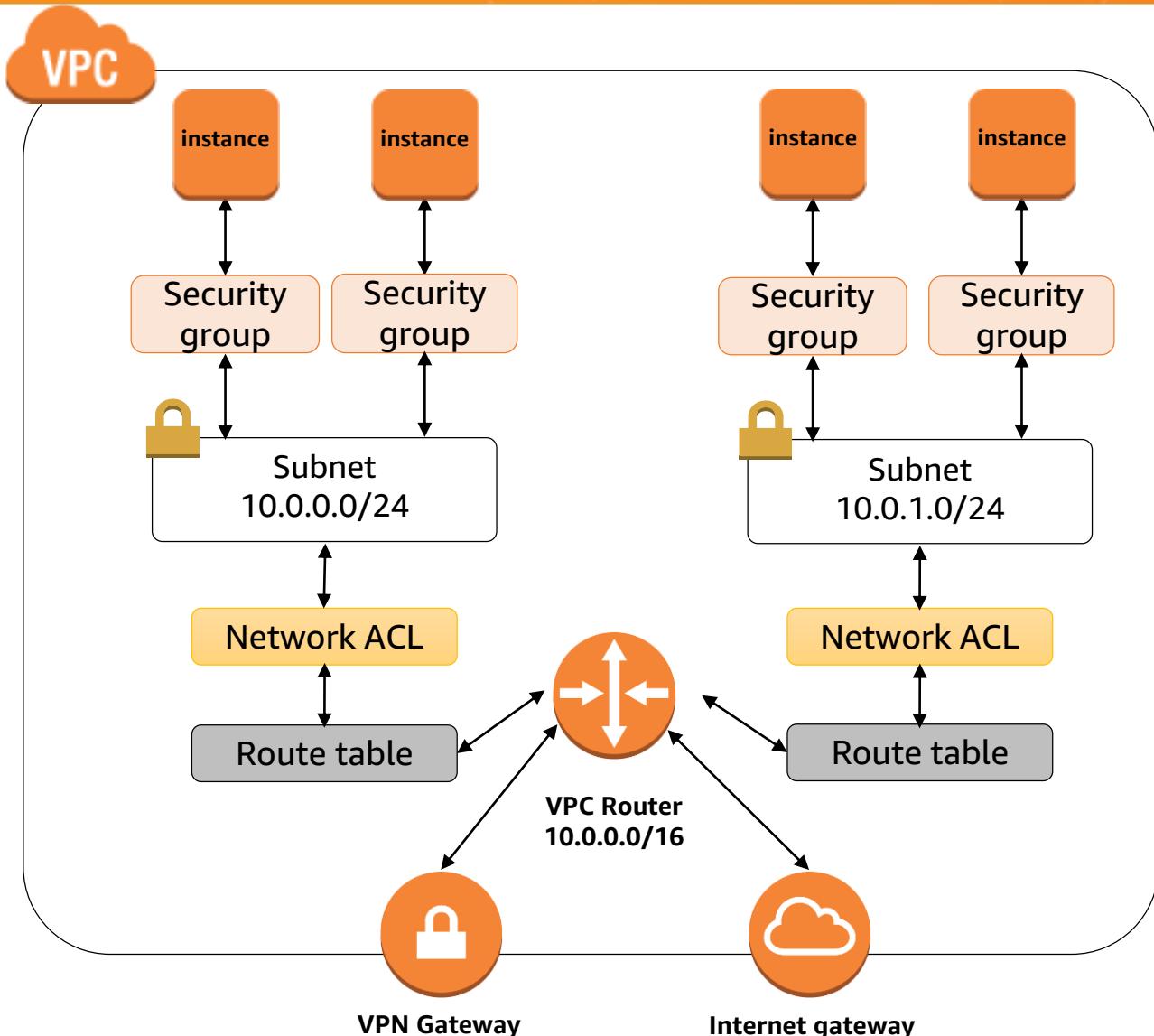


# Security in Your VPC

## Security groups

## Network access control lists (ACLs)

## Key pairs

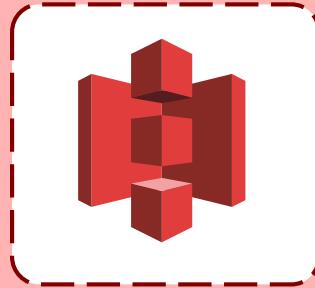


# VPN Connections



VPN Connectivity option	Description
AWS hardware VPN	You can create an IPsec hardware VPN connection between your VPC and your remote network.
AWS Direct Connect	AWS Direct Connect provides a <b>dedicated</b> private connection from a remote network to your VPC.
AWS Transit Gateway	Connect VPCs and on-premises networks to a single gateway.
AWS VPN CloudHub	You can create <b>multiple</b> AWS hardware VPN connections via your VPC to enable communications between various remote networks.
Software VPN	You can create a VPN connection to your remote network by using an Amazon EC2 instance in your VPC that's running a software <b>VPN appliance</b> .

# Amazon Simple Storage Service (S3)



Amazon S3

- Storage for the internet
- Natively online, HTTP access
- Storage that allows you to store and retrieve any amount of data, any time, from anywhere on the web
- Highly scalable, reliable, fast, and durable

# Amazon S3 Facts



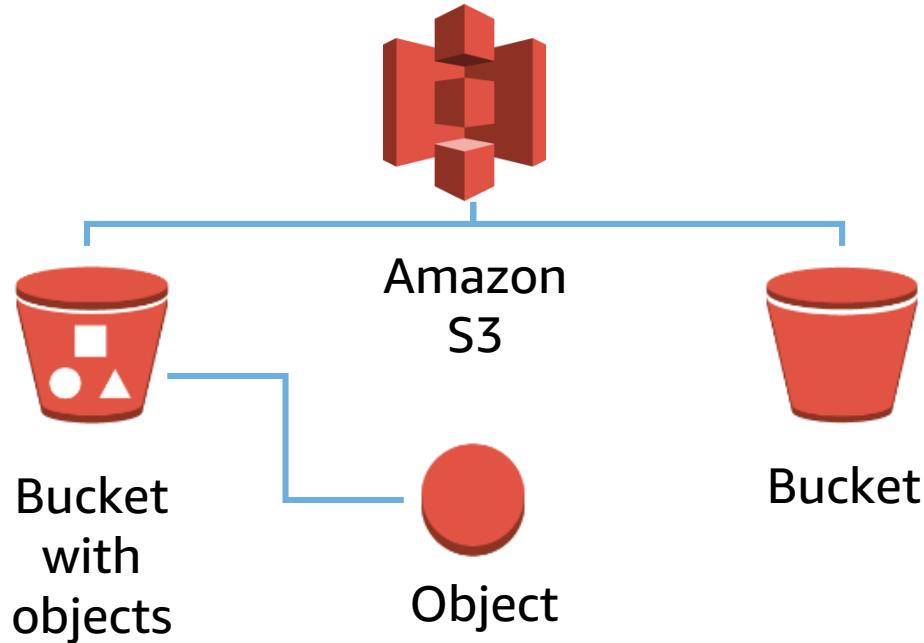
- Can store an **unlimited** number of objects in a bucket
- Objects can be up to **5 TB**; no bucket size limit
- Designed for **99.99999999%** durability and **99.99%** availability of objects over a given year
- Can use **HTTP/S** endpoints to store and retrieve any amount of data, at any time, from anywhere on the web
- Highly scalable, reliable, fast, and inexpensive
- Can use optional server-side **encryption** using AWS or customer-managed provided client-side encryption
- Auditing is provided by access **logs**
- Provides standards-based **REST** and **SOAP** interfaces

# Common Use Scenarios



- Storage and backup
- Application file hosting
- Media hosting
- Software delivery
- Store AMIs and snapshots

# Amazon S3 Concepts



- Amazon S3 stores data as objects within buckets.
- An object is composed of a file and optionally any metadata that describes that file.
- You can have up to 100 buckets in each account.
- You can control access to the bucket and its objects.
- Object Lock blocks object version deletion.

# Object Keys

An object key is the unique identifier for an object in a bucket.

<http://doc.s3.amazonaws.com/2006-03-01/AmazonS3.html>

Bucket

Object/Key

# Amazon S3 Security



- You can **control access** to buckets and objects with:
  - Access Control Lists (ACLs)
  - Bucket policies
  - Identity and Access Management (IAM) policies
- You can upload or download data to Amazon S3 via **SSL encrypted** endpoints.
- You can encrypt data using AWS SDKs.

# Amazon S3 Versioning

- Protects from accidental overwrites and deletes with no performance penalty.
- Generates a new version with every upload.
- Allows easily retrieval of deleted objects or roll back to previous versions.
- Three states of an Amazon S3 bucket
  - Unversioned (default)
  - Versioning-enabled
  - Versioning-suspended



**Versioning  
Enabled**

# Amazon S3 Object Lifecycle



- Lifecycle management defines how Amazon S3 manages objects during their lifetime.
- Some objects that you store in an Amazon S3 bucket might have a well-defined lifecycle:
  - Log files
  - Archive documents
  - Digital media archives
  - Financial and healthcare records
  - Raw genomics sequence data
  - Long-term database backups
  - Data that must be retained for regulatory compliance

# Amazon S3 Pricing

- Pay only for what you use
- No minimum fee
- Prices based on location of your Amazon S3 bucket
- Estimate monthly bill using the **AWS Simple Monthly Calculator**
- Pricing is available as:
  - Storage Pricing
  - Request Pricing
  - Data Transfer Pricing: data transferred out of Amazon S3



# Amazon S3 Glacier



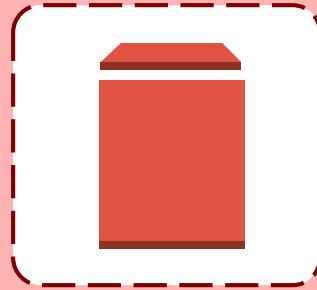
- Long-term low-cost **archiving** service
- Optimal for **infrequently accessed** data
- Designed for 99.99999999% durability
- 3–5 hours' standard retrieval time
- Less than \$0.01 per GB/month (depending on region)

# Amazon S3 Storage Classes



Storage Class	Durability	Availability	Other Considerations
Amazon S3 Standard	99.99999999%	99.99%	
Amazon S3 Standard - Infrequent Access (IA)	99.99999999%	99.9%	<ul style="list-style-type: none"><li>• Retrieval fee associated with objects</li><li>• Most suitable for infrequently accessed data</li></ul>
Amazon S3 One Zone-Infrequent Access	99.99999999%	99.5%	<ul style="list-style-type: none"><li>• Amazon S3 One Zone-Infrequent Access (S3 One Zone-IA)</li><li>• For data that is accessed less frequently, but requires rapid access when needed.</li><li>• Stores data in a single Availability Zone</li><li>• Costs 20% less than S3 Standard-IA.</li></ul>
Amazon S3 Glacier	99.99999999%	99.99% (once restored)	<ul style="list-style-type: none"><li>• Not available for real-time access</li><li>• Must restore objects before you can access them</li><li>• Restoring objects can take 1 minute - 12 hours</li></ul>

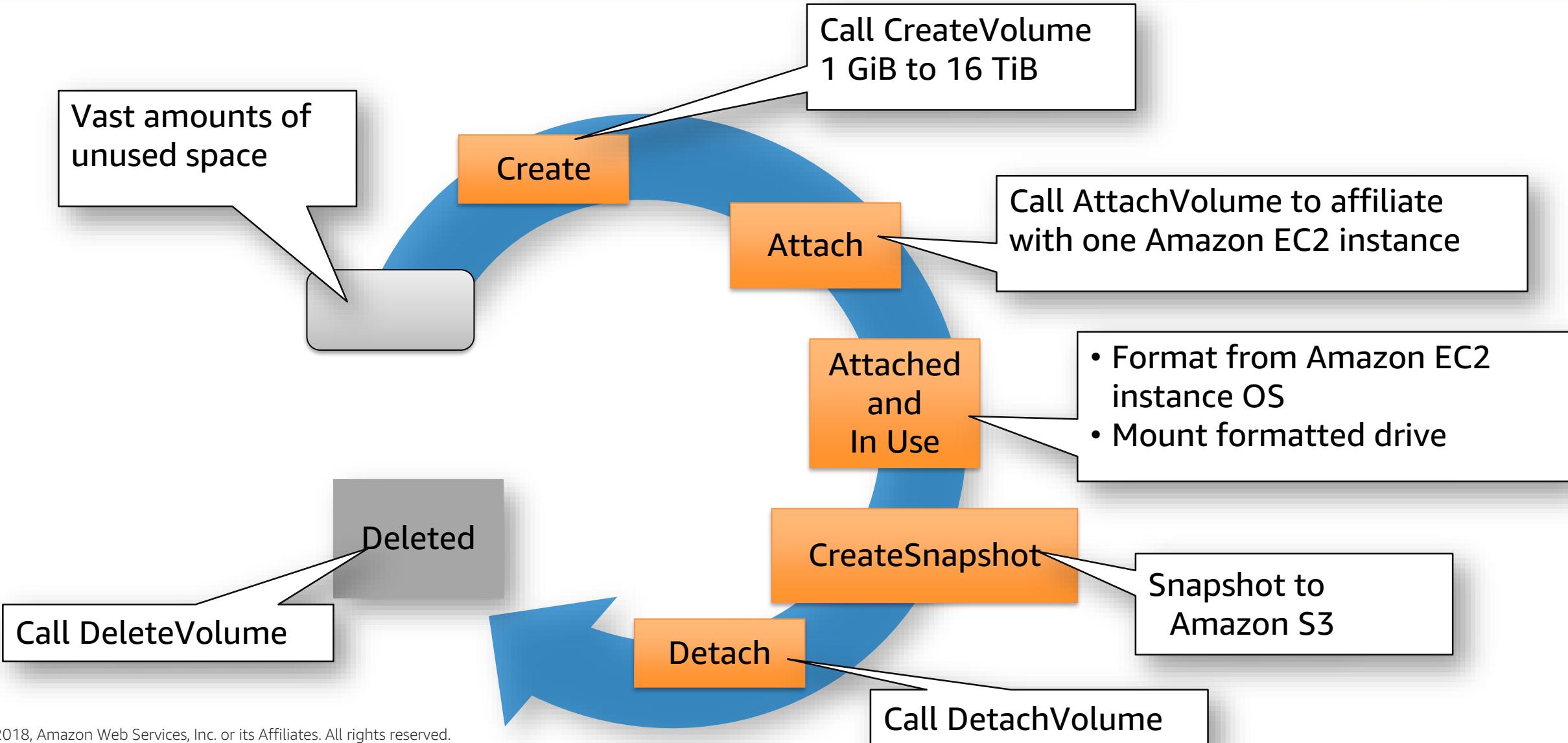
# Amazon Elastic Block Store



Amazon  
EBS

- Persistent block level storage volumes offer consistent and low-latency performance.
- Stored data is automatically replicated within its Availability Zone.
- Snapshots are stored durably in Amazon S3.

# Amazon EBS Lifecycle



# Amazon EBS Volume Types



## SSD-backed volumes:

- Optimized for transactional workloads that involve frequent read/write operations with small I/O size.
- Dominant in IOPS performance.

## HDD-backed volumes

- Optimized for large streaming workloads.
- Dominant in throughput (measured in MiB/s).

# Amazon EBS Volume Types



	SSD		HDD	
Volume Type	General Purpose SSD (gp2)	Provisioned IOPS SSD (io1)	Throughput Optimized HDD (st1)	Cold HDD (sc1)
Description	Balances price and performance for a wide variety of transactional loads.	Highest-performance SSD volume designed for mission-critical applications.	Low-cost HDD designed for frequently accessed, throughput-intensive workloads.	Lowest cost HDD designed for less frequently accessed workloads.
Volume Sizes	1 GiB – 16 TiB	4 GiB – 16 TiB	500 GiB – 16 TiB	500 GiB – 16 TiB
Dominant Performance Attribute	IOPS	IOPS	MiB/s	MiB/s

# Amazon EBS Facts



- EBS is recommended when data must be quickly accessible and requires long-term **persistence**.
- You can launch your EBS volumes as **encrypted** volumes. Data stored at rest on the volume, disk I/O, and snapshots created from the volume are all encrypted.
- You can create point-in-time **snapshots** of EBS volumes, which are persisted to Amazon S3.

# Amazon EBS Use Cases



- **OS:** Use for boot/root volume, secondary volumes
- **Databases:** Scales with your performance needs
- **Enterprise applications:** Provides reliable block storage to run mission-critical applications
- **Business continuity:** Minimize data loss and recovery time by regularly backing up using EBS Snapshots
- **Applications:** Install and persist any application

# Amazon EBS Pricing



Pay for what you provision:

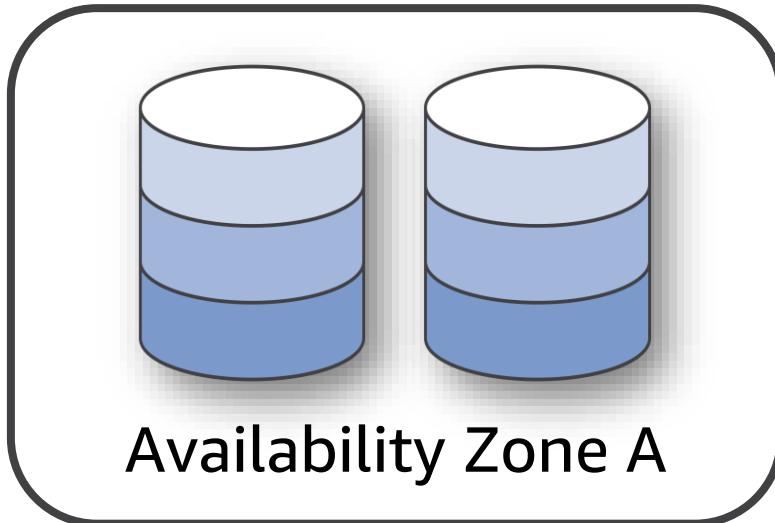
- Pricing based on region
- Review Pricing Calculator online
- Pricing is available as:
  - Storage
  - IOPS

\* Check Amazon EBS Pricing page for current pricing for all regions.

# Amazon EBS Scope

**Amazon EBS volumes are in a single Availability Zone**

EBS Volume 1



EBS Volume 2



Volume data is replicated across multiple servers in an Availability Zone.

# Amazon EBS and Amazon S3



	<b>Amazon EBS</b> 	<b>Amazon S3</b> 
<b>Paradigm</b>	Block storage with file system	Object store
<b>Performance</b>	Very fast	Fast
<b>Redundancy</b>	Across multiple servers in an Availability Zone	Across multiple facilities in a Region
<b>Security</b>	EBS encryption – Data volumes and snapshots	Encryption
<b>Access from the internet?</b>	No (1)	Yes (2)
<b>Typical use case</b>	It is a disk drive	Online storage

- (1) Accessible from the internet if mounted to server and set up as FTP, etc.
- (2) Only with proper credentials, unless ACLs are world-readable.

# Amazon EC2 Instance Storage



- Is local, complimentary direct attached block storage.
- Includes availability, number of disks, and size based on EC2 instance type.
- Is optimized for up to 365,000 Read IOPS and 315,000 First Write IOPS.
- Is SSD or magnetic.
- Has no persistence.
- Automatically deletes data when an EC2 instance stops, fails or is terminated.

# Amazon EBS vs. Amazon EC2 Instance Store



## Amazon EBS

- Data stored on an Amazon EBS volume can persist independently of the life of the instance.
- Storage is **persistent**.

## Amazon EC2 instance store

- Data stored on a local instance store persists only as long as the instance is alive.
- Storage is **ephemeral**.

# Reboot vs. Stop vs. Terminate



Characteristic	Reboot	Stop/Start (EBS-backed instances only)	Terminate	Hibernate
Host computer	The instance stays on the same host computer.	The instance runs on a new host computer.		The instance runs on a new host computer.
Public IP address	No change	New address assigned		New address assigned
Elastic IP addresses	Remains associated with the instance.	Remains associated with the instance.	Disassociated from the instance.	Remains associated with the instance.
Instance store volumes	Preserved	Erased	Erased	Not Supported
EBS volume	Preserved	Preserved	Boot volume is deleted by default.	Preserved
Billing	Instance billing hour doesn't change.	You stop incurring charges as soon as state is changed to stopping.	You stop incurring charges as soon as state is changed to shutting-down.	You stop incurring charges as soon as Hibernated

# Knowledge Check

💡 Q: What AWS service would help support your web application by hosting static assets and storing user uploaded images and video off-instance?

**Amazon S3**

💡 Q: How would an Amazon EC2 instance find its private and public IP addresses?

**Retrieve the instance metadata: <http://169.254.169.254/latest/meta-data/>**

💡 Q: What acts as an additional layer of security at the subnet level in a VPC?

**Network ACLs**

💡 True or False: Amazon S3 limits the total amount you can store.

**False (There is a 5-TB limit per object)**



# End of AWS Foundational Services

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# AWS Databases

# SQL and NoSQL Databases



	SQL	NoSQL
Data Storage	Rows and Columns	Key-Value
Schemas	Fixed	Dynamic
Querying	Using SQL	Focused on a collection of documents
Scalability	Vertical	Horizontal

## SQL

ISBN	Title	Author	Format
9182932465265	Cloud Computing Concepts	Wilson, Joe	Paperback
3142536475869	The Database Guru	Gomez, Maria	Ebook

## NoSQL

```
{  
  ISBN: 9182932465265,  
  Title: "Cloud Computing Concepts",  
  Author: "Wilson, Joe",  
  Format: "Paperback"  
}
```

# Data Storage Considerations



- No one size fits all.
- Analyze your data requirements by considering:
  - Data formats
  - Data size
  - Query frequency
  - Data access speed
  - Data retention period



# AWS Relational Database Service (RDS)

# Amazon Relational Database Service



Amazon  
RDS

- Cost-efficient and resizable capacity
- Manages time-consuming database administration tasks
- Access to the full capabilities of Amazon Aurora, MySQL, MariaDB, Microsoft SQL Server, Oracle, and PostgreSQL databases
- Deployable on VMware

# Amazon RDS

- Simple and fast to deploy
- Manages common database administrative tasks
- Compatible with your applications
- Fast, predictable performance
- Simple and fast to scale
- Secure
- Cost-effective



# DB Instances



- DB instances are the basic building blocks of Amazon RDS.
- They are an isolated database environment in the cloud.
- They can contain multiple user-created databases.

# How Amazon RDS Backups Work

## Automatic Backups:

- Restore your database to a point in time.
- Are enabled by default.
- Let you choose a retention period up to 35 days.



## Manual Snapshots:

- Let you build a new database instance from a snapshot.
- Are initiated by the user.
- Persist until the user deletes them.
- Are stored in Amazon S3.

# Cross-Region Snapshots

- Are a copy of a database snapshot stored in a different AWS Region.
- Provide a backup for disaster recovery.
- Can be used as a base for migration to a different region.

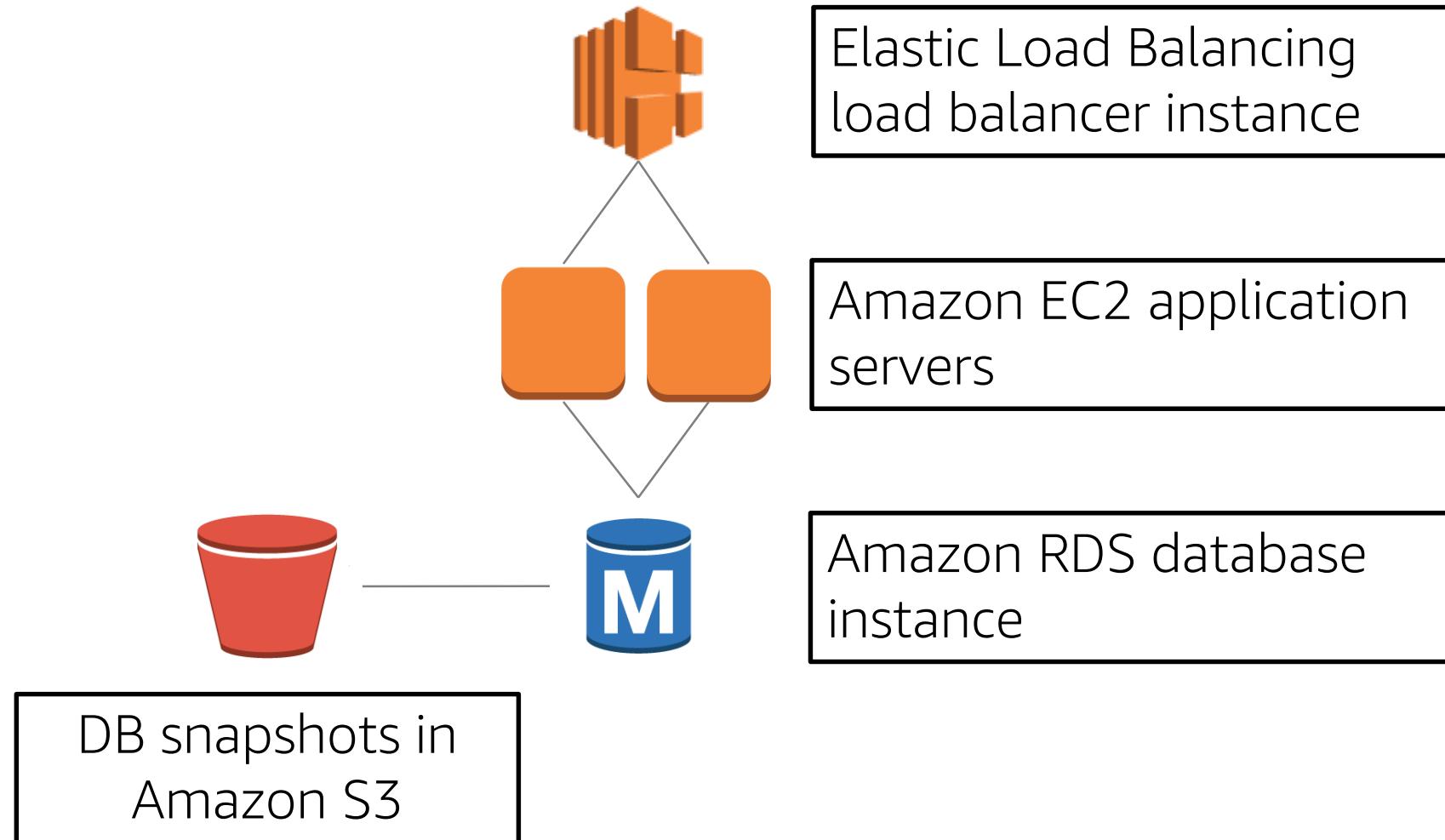


# Amazon RDS Security



- Run your DB instance in an **Amazon VPC**.
- Use **IAM** policies to grant access to RDS resources.
- Use **security groups**.
- Use Secure Socket Layer (**SSL**) connections with DB instances (Amazon Aurora, Oracle, MySQL, MariaDB, PostgreSQL, Microsoft SQL Server).
- Use RDS **encryption** to secure instances and snapshots at rest.
- Use network encryption and Transparent Data Encryption (**TDE**) with Oracle DB and Microsoft SQL Server instances.
- Use security features of your DB engine to control access to DB instance.

# Simple Application Architecture

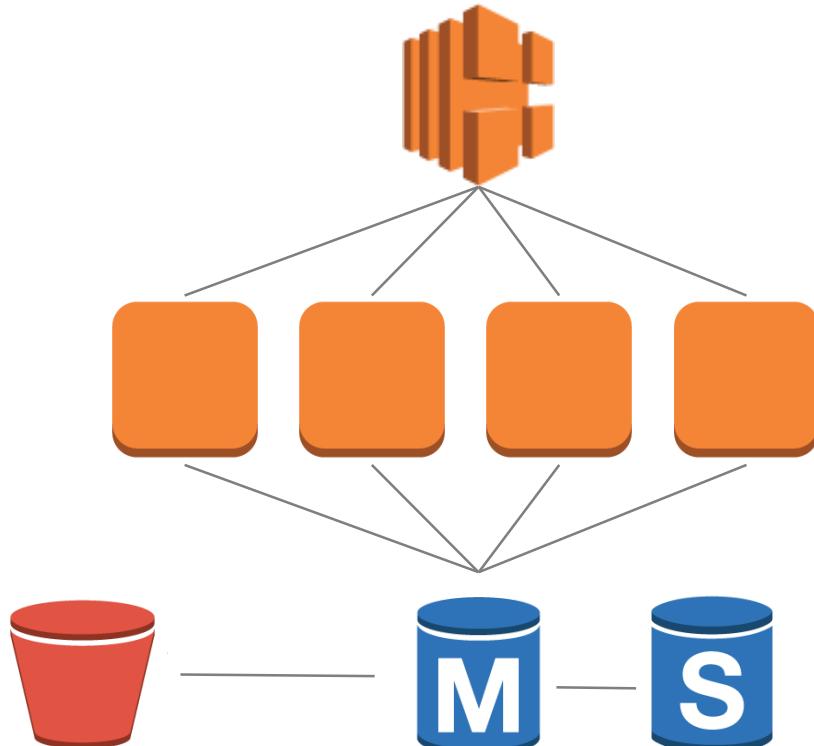


# Multi-AZ RDS Deployment



- With Multi-AZ operation, your database is synchronously replicated to another Availability Zone in the same AWS Region.
- Fail over to the standby automatically occurs in case of a master database failure.
- Planned maintenance is applied first to standby databases.

# Resilient, Durable Application Architecture



DB snapshots in  
Amazon S3

Elastic Load Balancing  
load balancer instance

Application, in Amazon  
EC2 instances

Amazon RDS database instances:  
Master and Multi-AZ standby

# Amazon RDS Best Practices



- Monitor your memory, CPU, and storage usage.
- Use Multi-AZ deployments to automatically provision and maintain a synchronous standby in a different Availability Zone.
- Enable automatic **backups**.
- Set the backup window to occur during the daily low in Write IOPS.
- To increase the I/O capacity of a DB instance:
  - Migrate to a DB instance class with high I/O capacity.
  - Convert from standard storage to Provisioned IOPS storage and use a DB instance class optimized for Provisioned IOPS.
  - Provision additional throughput capacity (if using Provisioned IOPS storage).
- If your client application is caching the DNS data of your DB instances, set a TTL of less than 30 seconds.
- Test failover for your DB instance.



# AWS DynamoDB

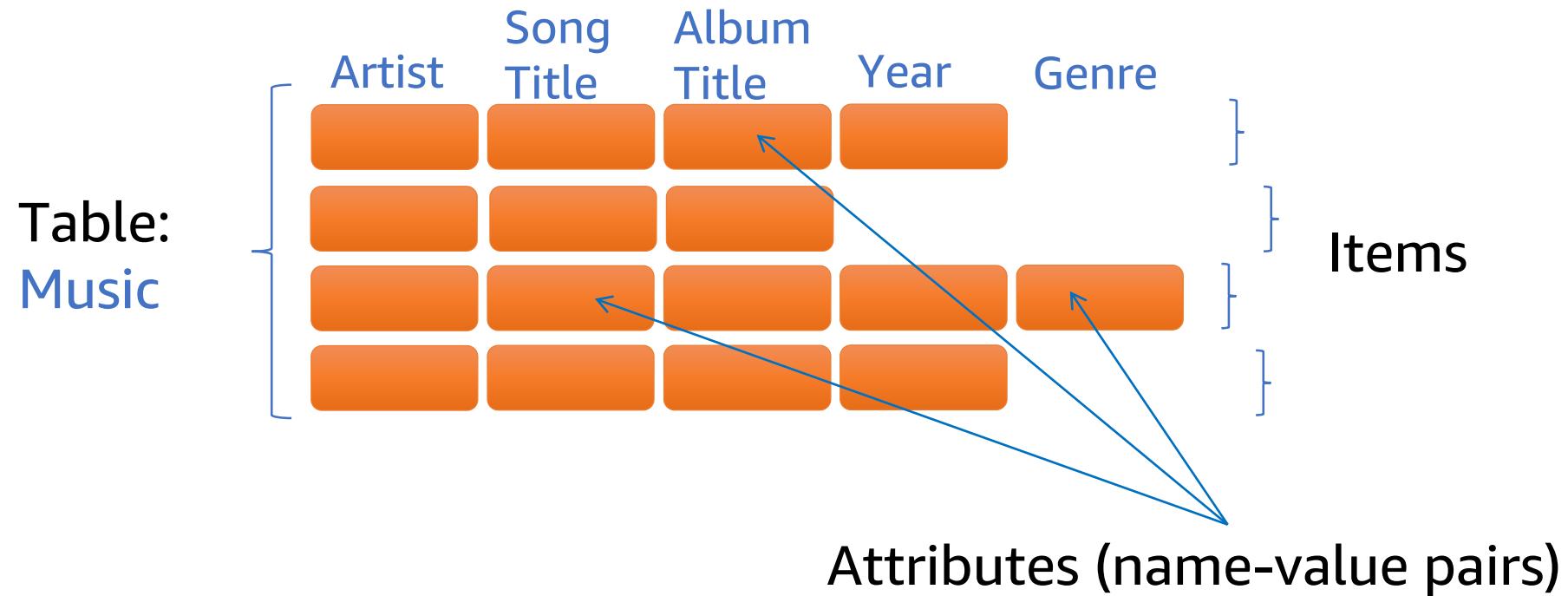
# Amazon DynamoDB



Amazon  
DynamoDB

- Allows you to store any amount of data with no limits.
- Provides fast, predictable performance using SSDs.
- Allows you to easily provision and change the request capacity needed for each table.
- Is a fully managed, NoSQL database service.
- Accommodate changing workloads with on-demand mode

# DynamoDB Data Model



# Primary Keys



(DynamoDB maintains a sorted index for both keys)

# Provisioned Throughput



- You specify how much provisioned throughput capacity you need for reads and writes.
- Amazon DynamoDB allocates the necessary machine resources to meet your needs.

# Supported Operations

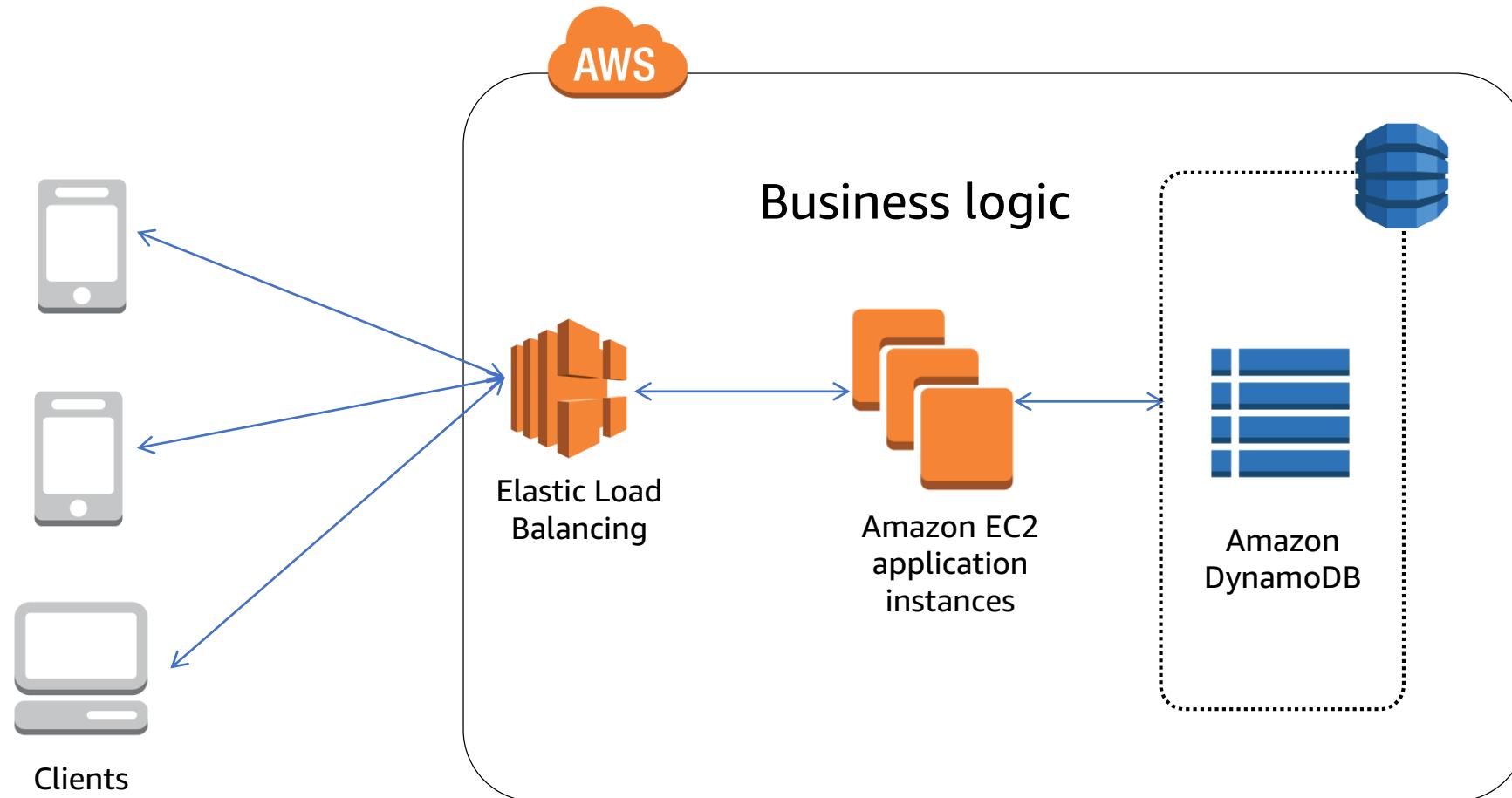
## Query:

- Query a table using the partition key and an optional sort key filter.
- If the table has a secondary index, query using its key.
- It is the most efficient way to retrieve items from a table or secondary index.

## Scan:

- You can scan a table or secondary index.
  - Scan reads every item – slower than querying.
- 
- You can use conditional expressions in both Query and Scan operations.

# Simple Application Architecture



# Amazon RDS and Amazon DynamoDB



Factors	Relational (Amazon RDS)	NoSQL (Amazon DynamoDB)
Application Type	<ul style="list-style-type: none"><li>Existing database apps</li><li>Business process–centric apps</li></ul>	<ul style="list-style-type: none"><li>New web-scale applications</li><li>Large number of small writes and reads</li></ul>
Application Characteristics	<ul style="list-style-type: none"><li><b>Relational</b> data models, transactions</li><li><b>Complex</b> queries, joins, and updates</li></ul>	<ul style="list-style-type: none"><li><b>Simple</b> data models, transactions</li><li><b>Range queries</b>, simple updates</li></ul>
Scaling	Application or DBA–architected (clustering, partitions, sharding)	Seamless, <b>on-demand</b> scaling based on application requirements
QoS	<ul style="list-style-type: none"><li>Performance—depends on data model, indexing, query, and storage optimization</li><li>Reliability and availability</li><li>Durability</li></ul>	<ul style="list-style-type: none"><li>Performance—<b>Automatically optimized</b> by the system</li><li>Reliability and availability</li><li>Durability</li></ul>

# Database Considerations

If You Need	Consider Using
A relational database service with minimal administration	<b>Amazon RDS</b> <ul style="list-style-type: none"><li>• Choice of Amazon Aurora, MySQL, MariaDB, Microsoft SQL Server, Oracle, or PostgreSQL database engines</li><li>• Scale compute and storage</li><li>• Multi-AZ availability</li></ul>
A fast, highly scalable NoSQL database service	<b>Amazon DynamoDB</b> <ul style="list-style-type: none"><li>• Extremely fast performance</li><li>• Seamless scalability and reliability</li><li>• Low cost</li></ul>
A database you can manage on your own	Your choice of <b>AMIs</b> on Amazon EC2 and Amazon EBS that provide scale compute and storage, complete control over instances, and more.

# Knowledge Check

Q: What are the basic building blocks of Amazon Relational Database Service (Amazon RDS)?

**DB instances**

Q: You are creating a resilient, durable application using Amazon RDS. In addition to Amazon RDS's automatic backups, what feature should you use to ensure that your backups are durable retained?

**Manual snapshots**

True or False: Amazon DynamoDB allows you to store any amount of data with no limits.

**True**

True or False: Scan is the most efficient way to retrieve items from a DynamoDB table.

**False**



# End of AWS Databases

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# AWS Security, Identity, and Access Management

# AWS Shared Responsibility Model



Customers

## Customer Applications & Content

Platform, Applications, Identity, and Access Management

Operating system, network, and firewall configuration

Client-side data  
encryption

Server-side data  
encryption

Network Traffic  
Protection

Customers are  
responsible for  
security **IN** the cloud

## AWS Foundation Services

Compute

Storage

Database

Networking

AWS Global  
Infrastructure

Availability Zones

Regions

Edge  
locations

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

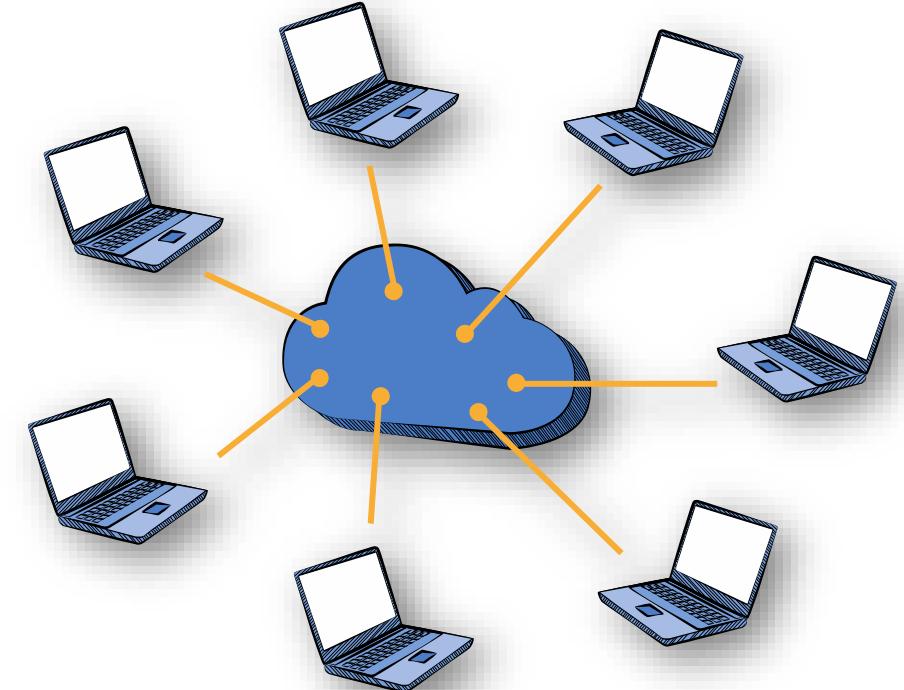
# Physical Security



- 24/7 trained security staff
- AWS data centers in nondescript and undisclosed facilities
- Two-factor authentication for authorized staff
- Authorization for data center access

# Hardware, Software, and Network

- Automated change-control process
- Bastion servers that record all access attempts
- Firewall and other boundary devices
- AWS monitoring tools



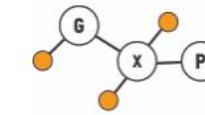
# Assurance Programs

**aws** training and certification

## Global



## USA



## Asia Pacific



## Europe



# SSL Endpoints



## SSL Endpoints

### Secure Transmission

Use secure endpoints to establish secure communication sessions (HTTPS).

## Security Groups

### Instance Firewalls

Use security groups to configure firewall rules for instances.

## VPC

### Network Control

Use public and private subnets, NAT, and VPN support in your virtual private cloud to create low-level networking constraints for resource access.

# Security Groups



## SSL Endpoints

### Secure Transmission

Use secure endpoints to establish secure communication sessions (HTTPS).

## Security Groups

### Instance Firewalls

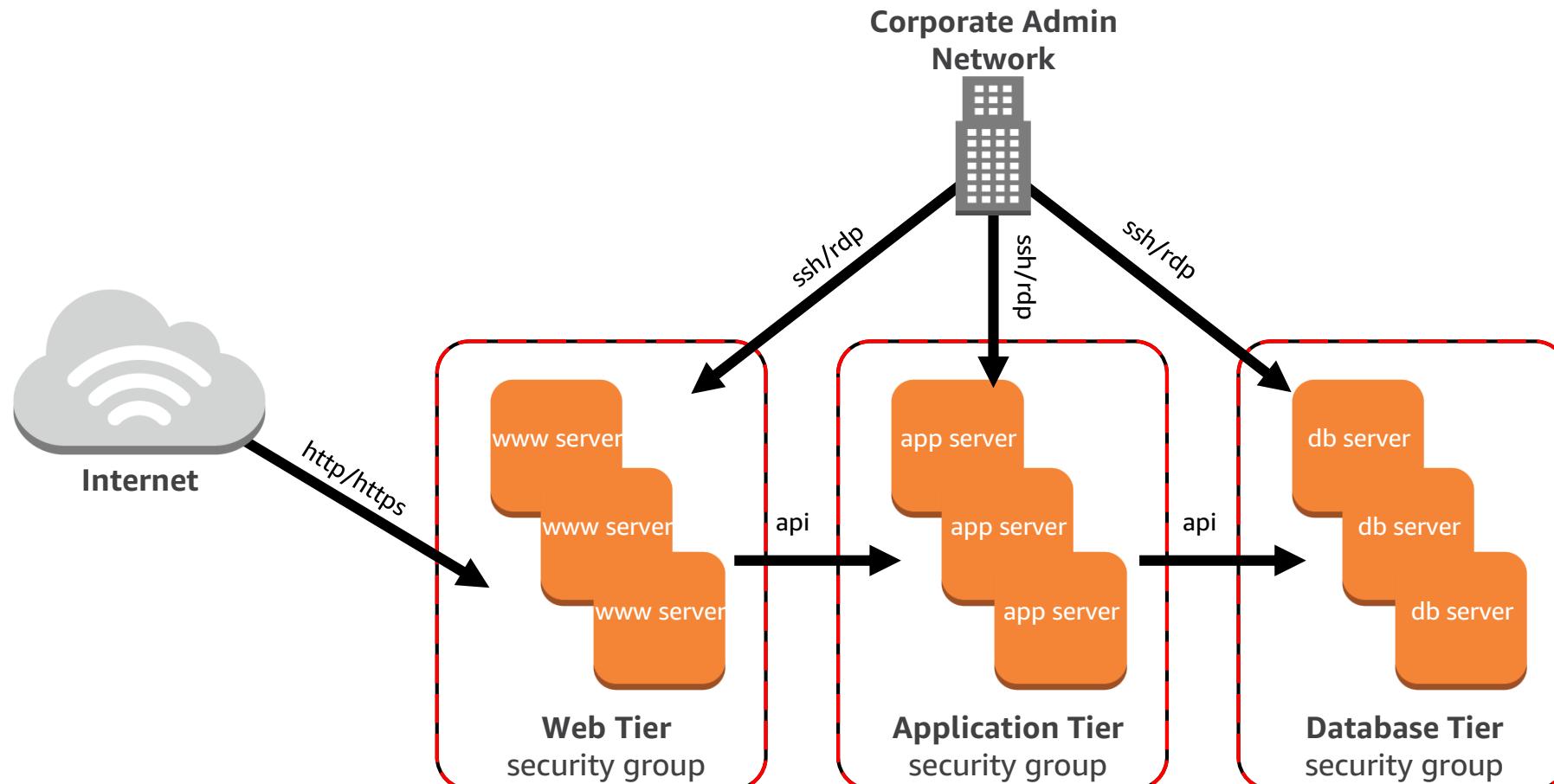
Use security groups to configure firewall rules for instances.

## VPC

### Network Control

Use public and private subnets, NAT, and VPN support in your virtual private cloud to create low-level networking constraints for resource access.

# AWS Multi-Tier Security Groups



# Amazon Virtual Private Cloud



## SSL Endpoints

### Secure Transmission

Use secure endpoints to establish secure communication sessions (HTTPS).

## Security Groups

### Instance Firewalls

Use security groups to configure firewall rules for instances.

## VPC

### Network Control

Use public and private subnets, NAT, and VPN support in your virtual private cloud to create low-level networking constraints for resource access.

# AWS Identity and Access Management



1

**Manage AWS IAM users  
and their access**

2

**Manage AWS IAM roles  
and their permissions**

3

**Manage federated users  
and their permissions**

# AWS IAM Authentication



Authentication

AWS Management Console

User name and Password

Account ID or alias

IAM user name

Password

**Sign In**

[Sign-in using root account credentials](#)



AWS services

Find a service by name or feature (for example, EC2, S3 or VM, storage).

Recently visited services

All services

Compute	Management Tools	Mobile Services
EC2	CloudWatch	Mobile Hub
Lightsail	AWS Auto Scaling	AWS AppSync
Elastic Container Service	CloudFormation	Device Farm
Lambda	CloudTrail	Mobile Analytics
Batch	Config	
Elastic Beanstalk	OpsWorks	
	Service Catalog	
	Systems Manager	
	Trusted Advisor	
	Managed Services	

Storage	AR & VR
S3	Amazon Sumerian
EFS	
Glacier	
Storage Gateway	

Media Services	Application Integration
Elastic Transcoder	Step Functions
Kinesis Video Streams	Amazon MQ
MediaConvert	Simple Notification Service
MediaLive	Simple Queue Service
	SWF

Database
RDS

Helpful tips

Manage your costs  
Get real-time billing alerts based on your cost and usage budgets. [Start now](#)

Create an organization  
Use AWS Organizations for policy-based management of multiple AWS accounts. [Start now](#)

Explore AWS

Amazon Relational Database Service (RDS)  
RDS manages and scales your database for you. RDS supports Aurora, MySQL, PostgreSQL, MariaDB, Oracle, and SQL Server. [Learn more.](#)

Real-Time Analytics with Amazon Kinesis  
Stream and analyze real-time data, so you can get timely insights and react quickly. [Learn more.](#)

# AWS IAM Authentication



- Authentication
- AWS CLI or SDK API
- Access Key and Secret Key



IAM User

Access Key ID: AKIAIOSFODNN7EXAMPLE  
Secret Access Key: wJalrXUtnFEMI/K7MDENG/bPxRfCYEXAMPLEKEY

AWS CLI

```
:~ $ aws configure
AWS Access Key ID [*****022A]:
AWS Secret Access Key [*****4m8i]:
Default region name [ap-southeast-1]:
Default output format [json]:
```

AWS SDK & API



Java

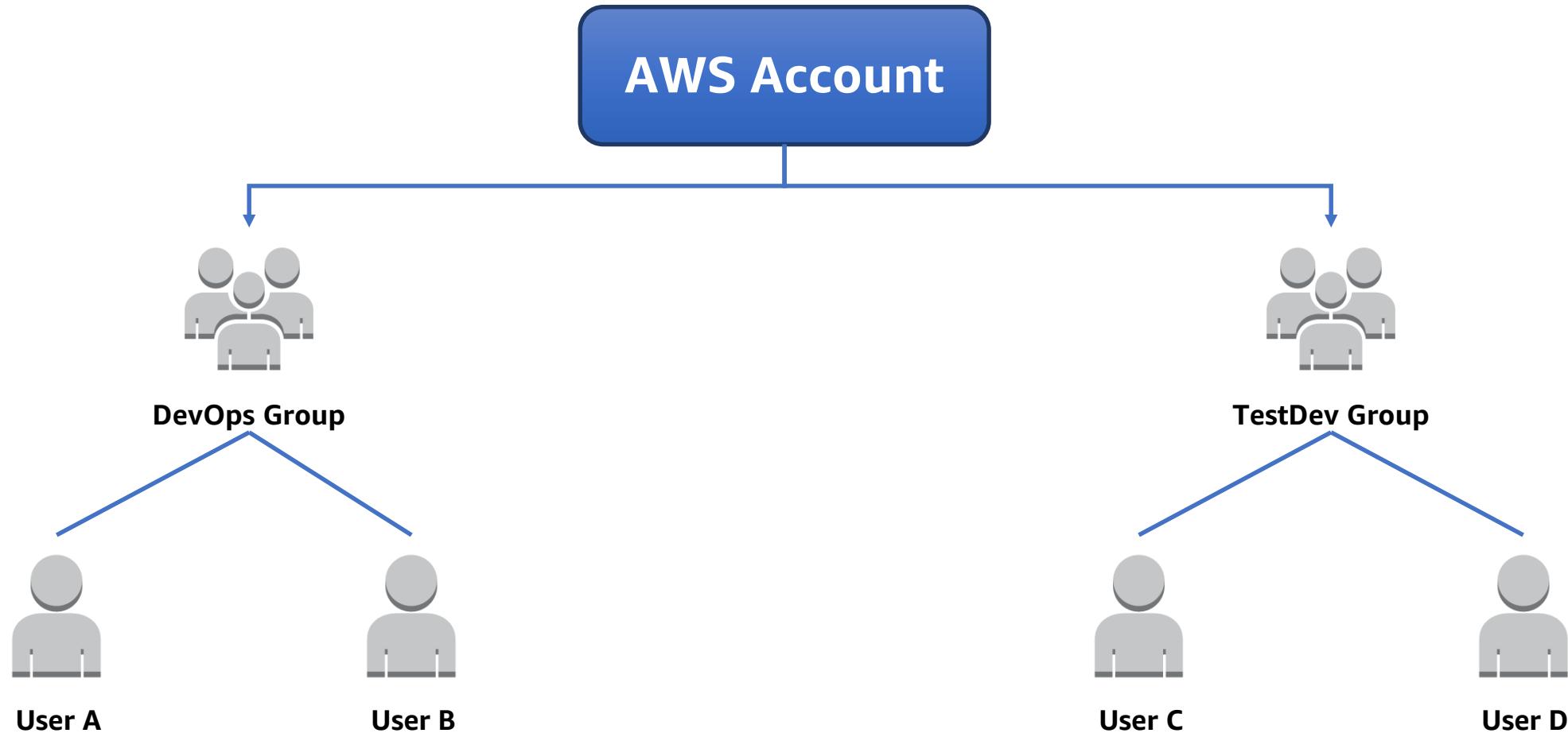


Python



.NET

# AWS IAM User Management - Groups



# AWS IAM Authorization



## Authorization

### Policies:

- Are JSON documents to describe permissions.
- Are assigned to users, groups, or roles.



IAM User



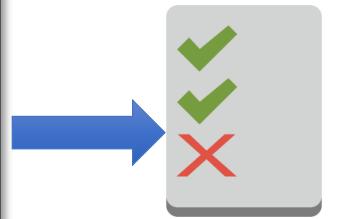
IAM Group



IAM Roles

# AWS IAM Policy Elements

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Sid": "Stmt1453690971587",  
      "Action": [  
        "ec2:Describe*",  
        "ec2:StartInstances",  
        "ec2:StopInstances"  
      ],  
      "Effect": "Allow",  
      "Resource": "*",  
      "Condition": {  
        "IpAddress": {  
          "aws:SourceIp": "54.64.34.65/32"  
        }  
      }  
    },  
    {  
      "Sid": "Stmt1453690998327",  
      "Action": [  
        "s3:GetObject*"  
      ],  
      "Effect": "Allow",  
      "Resource": "arn:aws:s3:::example_bucket/*"  
    }  
  ]  
}
```

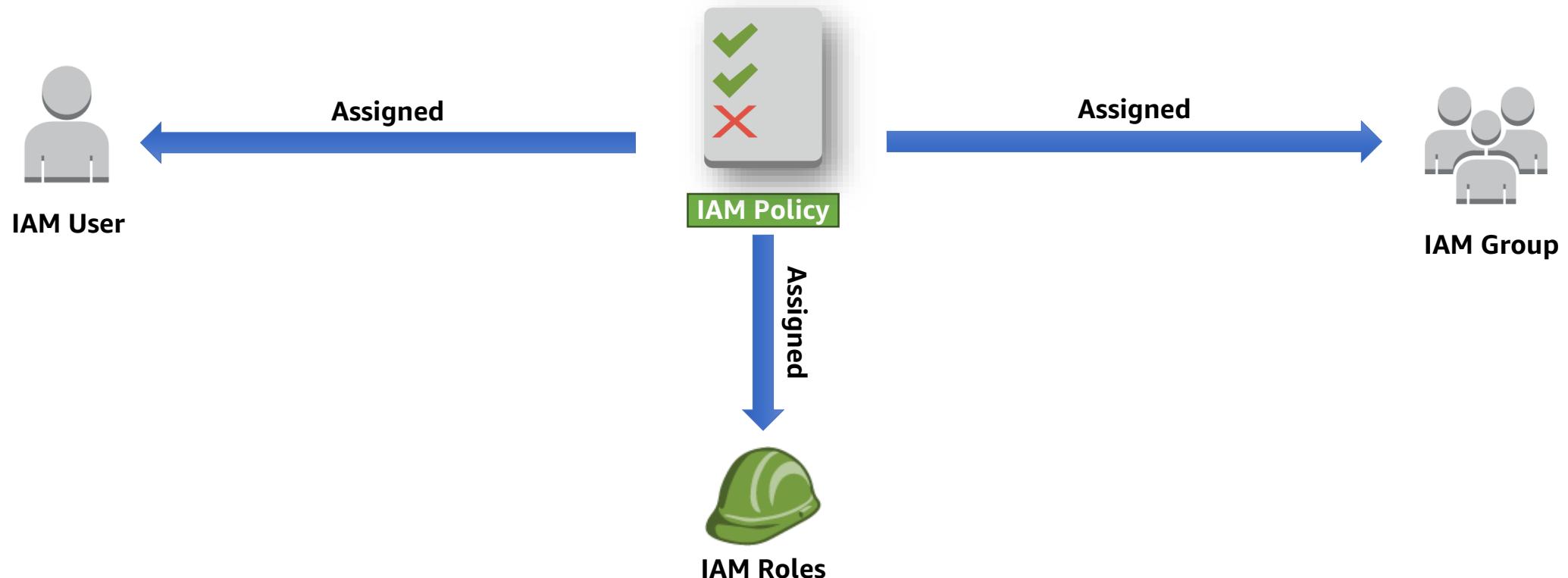


IAM Policy

# AWS IAM Policy Assignment



# AWS IAM Policy Assignment



# AWS IAM Roles

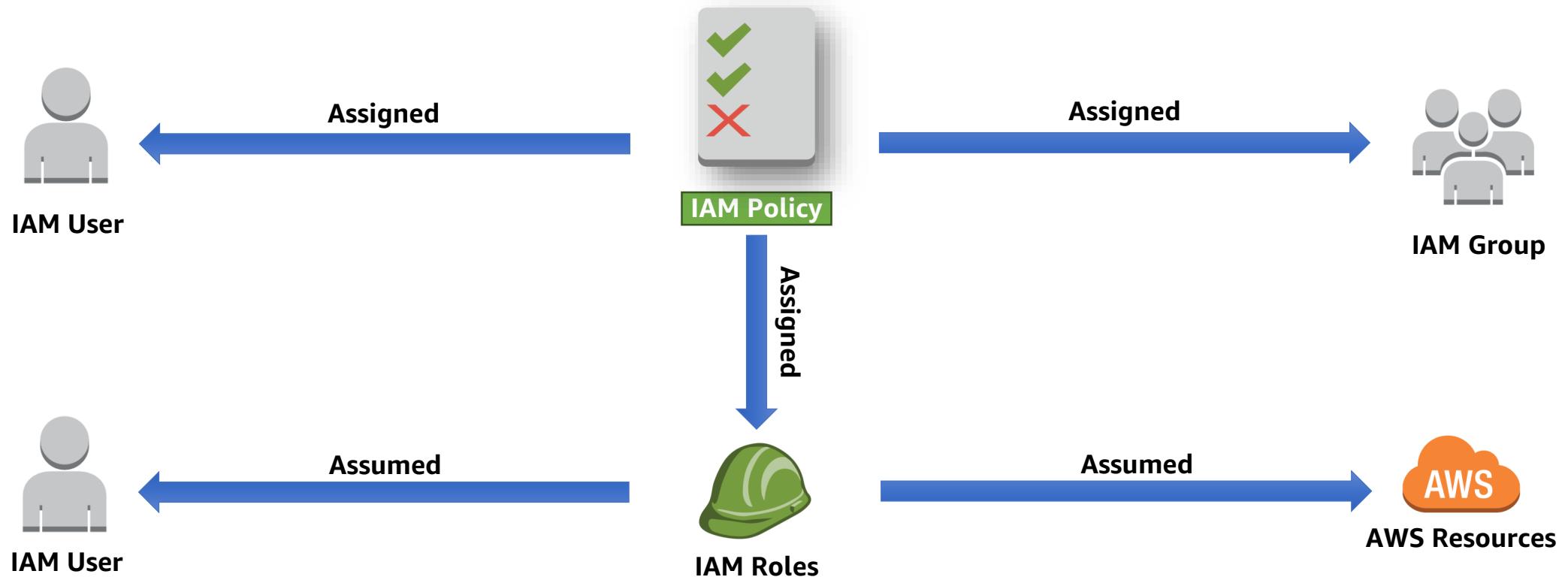


- An IAM role uses a policy.
- An IAM role has no associated credentials.
- IAM users, applications, and services may assume IAM roles.



**IAM Roles**

# AWS IAM Policy Assignment



# Example: Application Access to AWS Resources



- Python application hosted on an Amazon EC2 instance needs to interact with Amazon S3.
- AWS credentials are required:
  - Option 1: ~~Store AWS Credentials on the Amazon EC2 instance.~~
  - Option 2: Securely distribute AWS credentials to AWS services and applications.

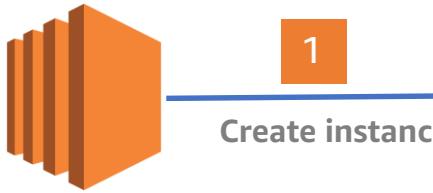


**IAM Roles**

# AWS IAM Roles - Instance Profiles



## Amazon EC2



1

Create instance

Screenshot of the AWS EC2 'Step 3: Configure Instance Details' page. The 'IAM role' dropdown menu is highlighted with a red box. The dropdown shows several options: 'None', 'aws-elasticbeanstalk-ec2-role', 'EMR\_EC2\_DefaultRole', and 'PythonInEC2AccessS3'. The 'PythonInEC2AccessS3' option is selected and highlighted with a blue box.

Number of instances: 1

Purchasing option: Request Spot instances

Network: vpc-53 (172.31.0.0/16) (default)

Subnet: No preference (default subnet in any Availability z)

Auto-assign Public IP: Use subnet setting (Enable)

Domain join directory: None

IAM role: PythonInEC2AccessS3

Shutdown behavior: None

Enable termination protection: Enabled

Monitoring: Enable CloudWatch detailed monitoring

Tenancy: Shared - Run a shared hardware instance

2 Select IAM Role

## Amazon S3



4

Application interacts with Amazon S3

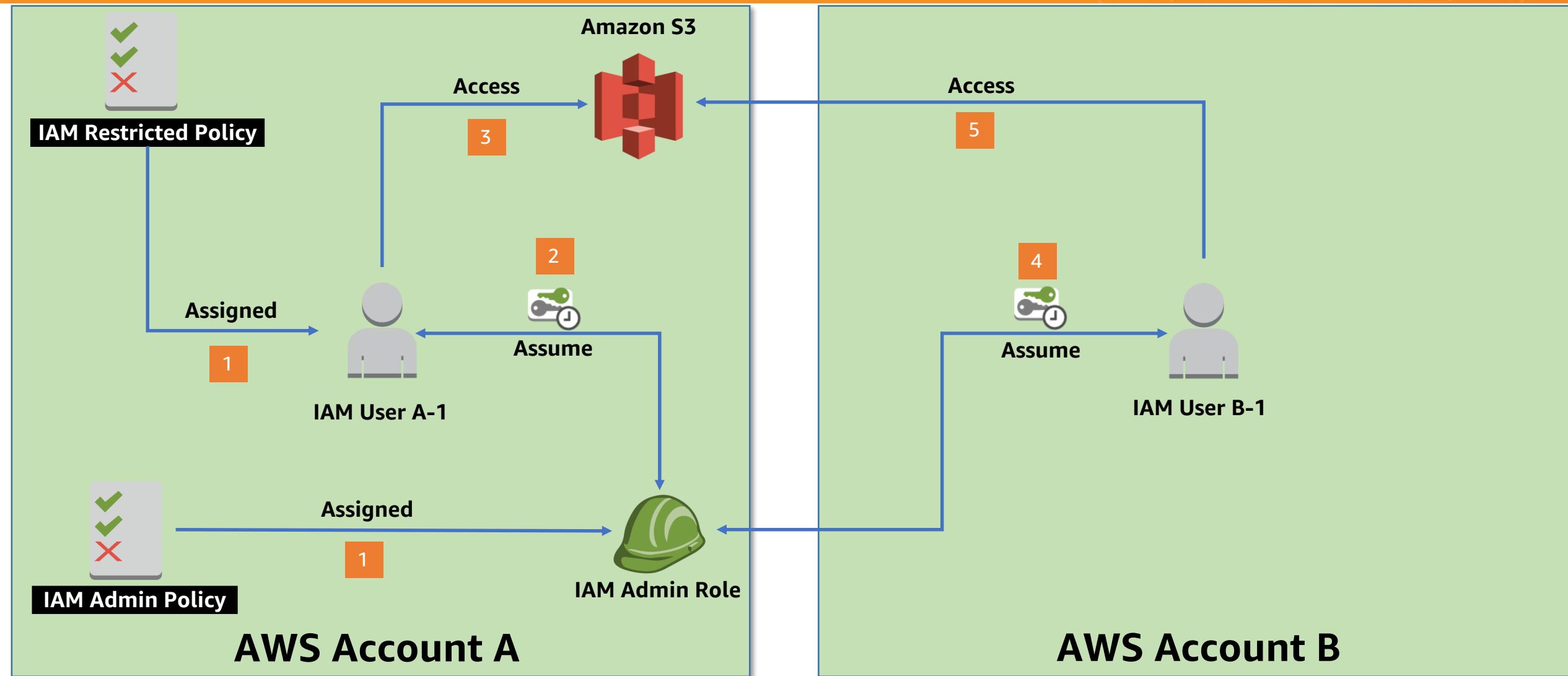
python op and



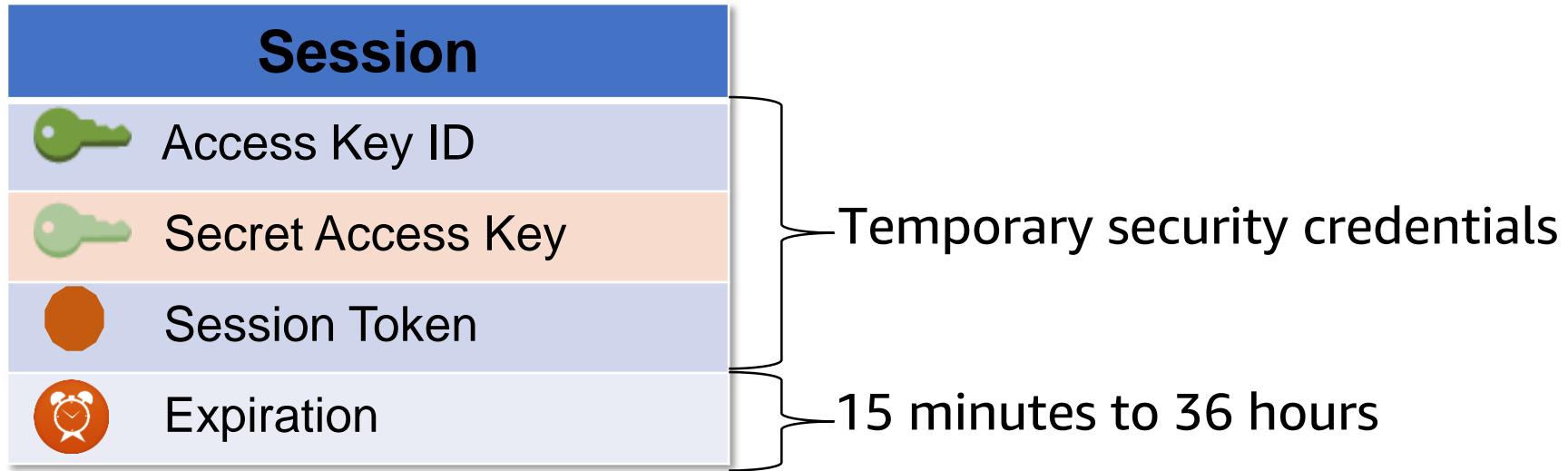
3

EC2 MetaData Service  
<http://169.254.169.254/latest/meta-data/iam/security-credentials/rolename>

# AWS IAM Roles – Assume Role



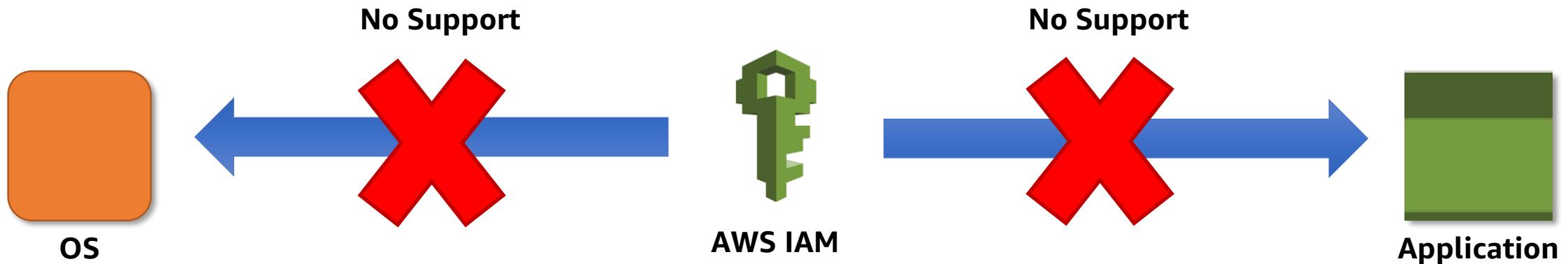
# Temporary Security Credentials (AWS STS)



## Use Cases

- Cross-account access
- Federation
- Mobile users
- Key rotation for Amazon EC2-based apps

# Application Authentication



# AWS IAM Authentication and Authorization



## Authentication

- AWS Management Console

- User Name and Password

- AWS CLI or SDK API

- Access Key and Secret Key

## Authorization

- Policies



IAM User



IAM Group



IAM Roles

# AWS IAM Best Practices



- Delete AWS account (root) access keys.
- Create individual IAM users.
- Use groups to assign permissions to IAM users.
- Grant least privilege.
- Configure a strong password policy.
- Enable MFA for privileged users.



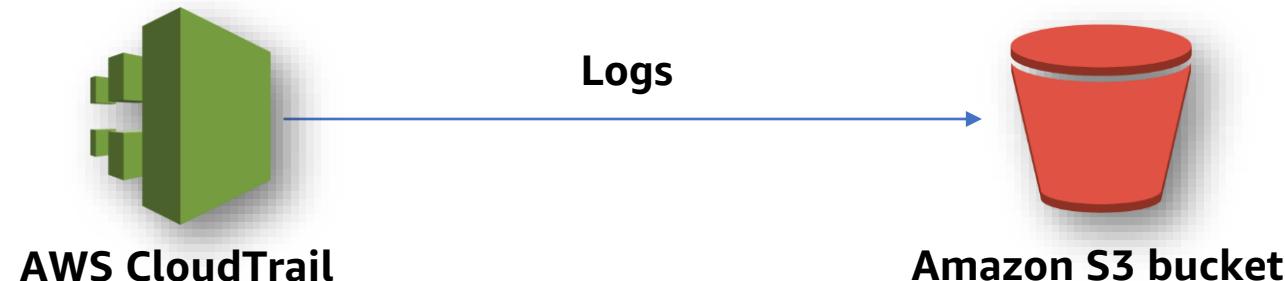
# AWS IAM Best Practices (continued)



- Use roles for applications that run on Amazon EC2 instances.
- Delegate by using roles instead of by sharing credentials.
- Rotate credentials regularly.
- Remove unnecessary users and credentials.
- Use policy conditions for extra security.
- Monitor activity in your AWS account.

# AWS CloudTrail

- Records AWS API calls for accounts.
- Delivers log files with information to an Amazon S3 bucket.
- Makes calls using the AWS Management Console, AWS SDKs, AWS CLI, and higher-level AWS services.



# Knowledge Check

Q: Your web application needs to read/write an Amazon DynamoDB table and an Amazon S3 bucket. This operation requires AWS credentials and authorization to use AWS services. What IAM entity should be used?

- >User
- Group
- Role
- Policy

A: **Role**



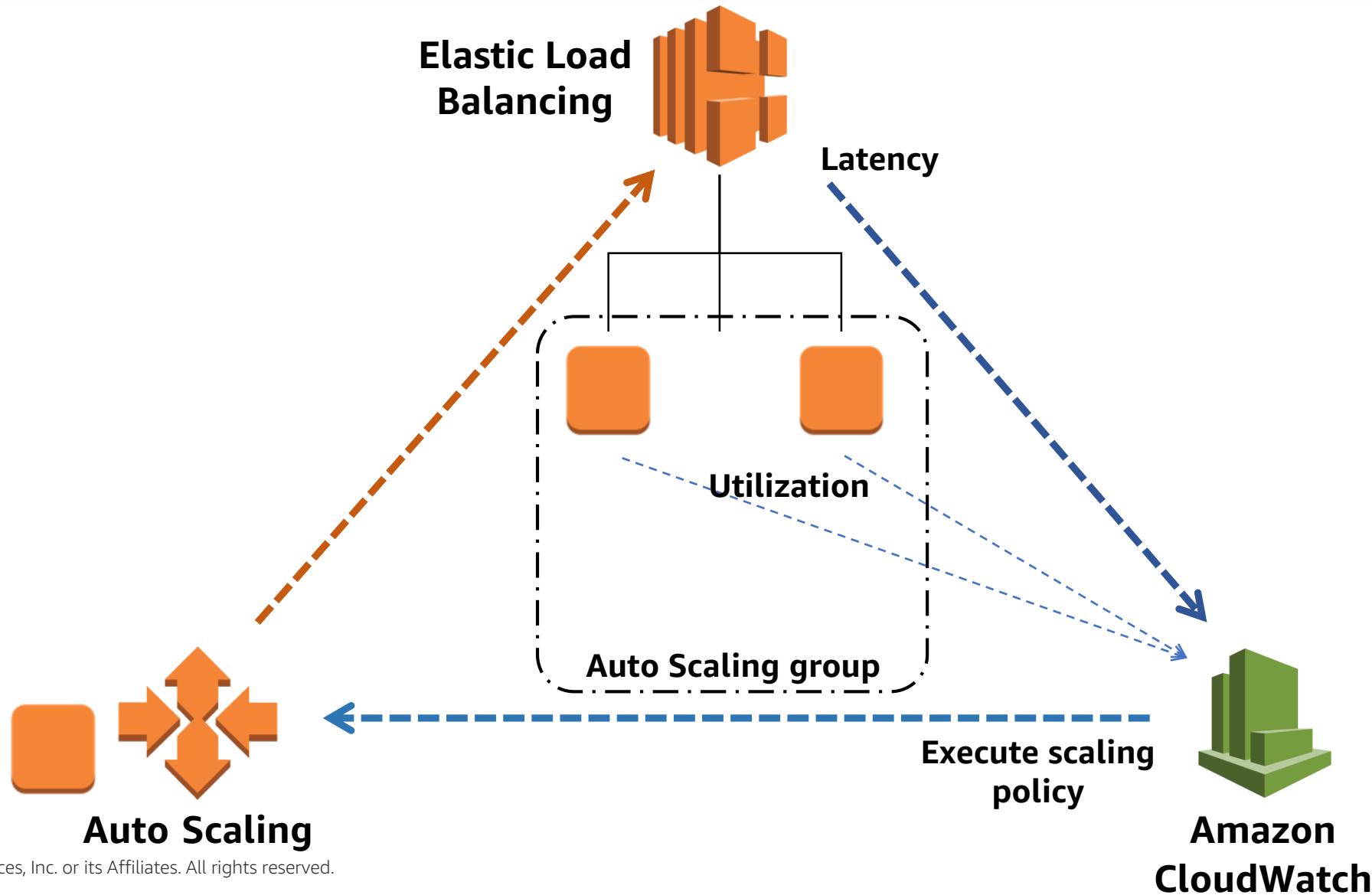
# End of AWS Security, Identity, and Access Management

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# AWS Elasticity and Management

# Triad of Services



# Elastic Load Balancing

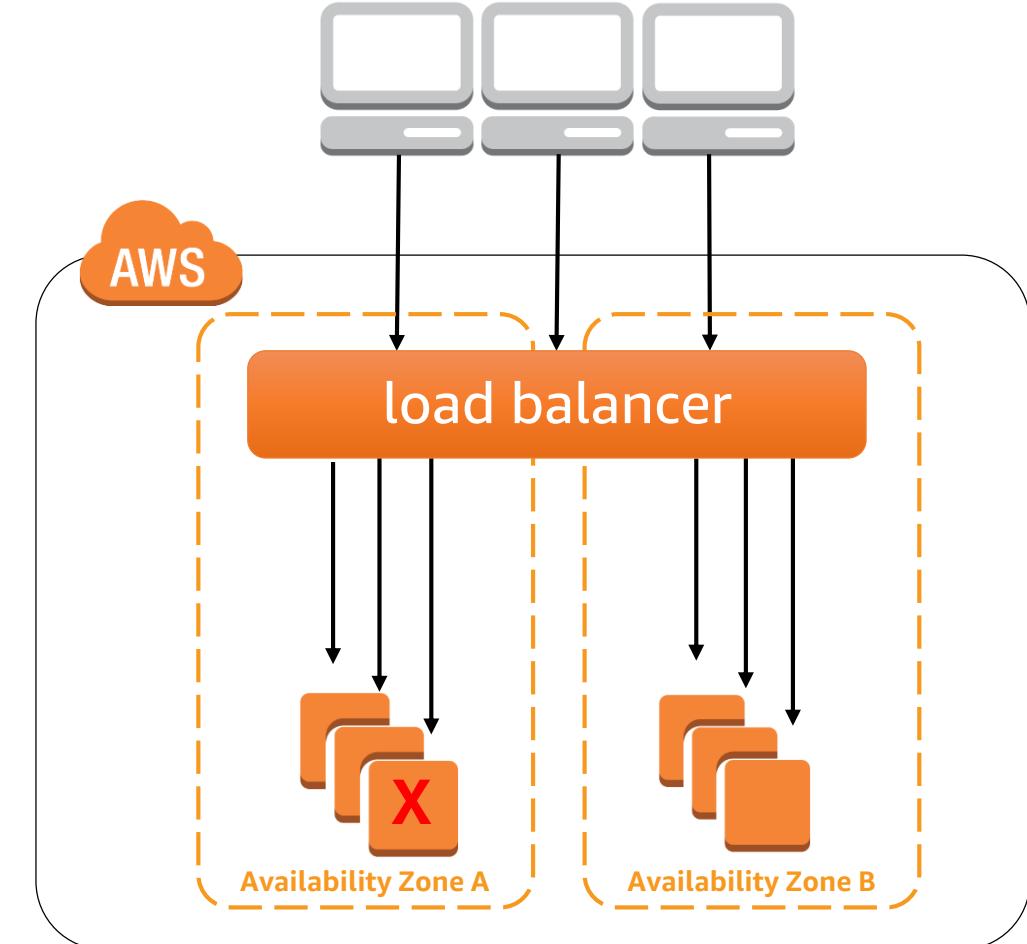


Elastic Load  
Balancing

- Distributes traffic across multiple EC2 instances, in multiple Availability Zones
- Supports health checks to detect unhealthy Amazon EC2 instances
- Supports the routing and load balancing of HTTP, HTTPS, SSL, and TCP traffic to Amazon EC2 instances

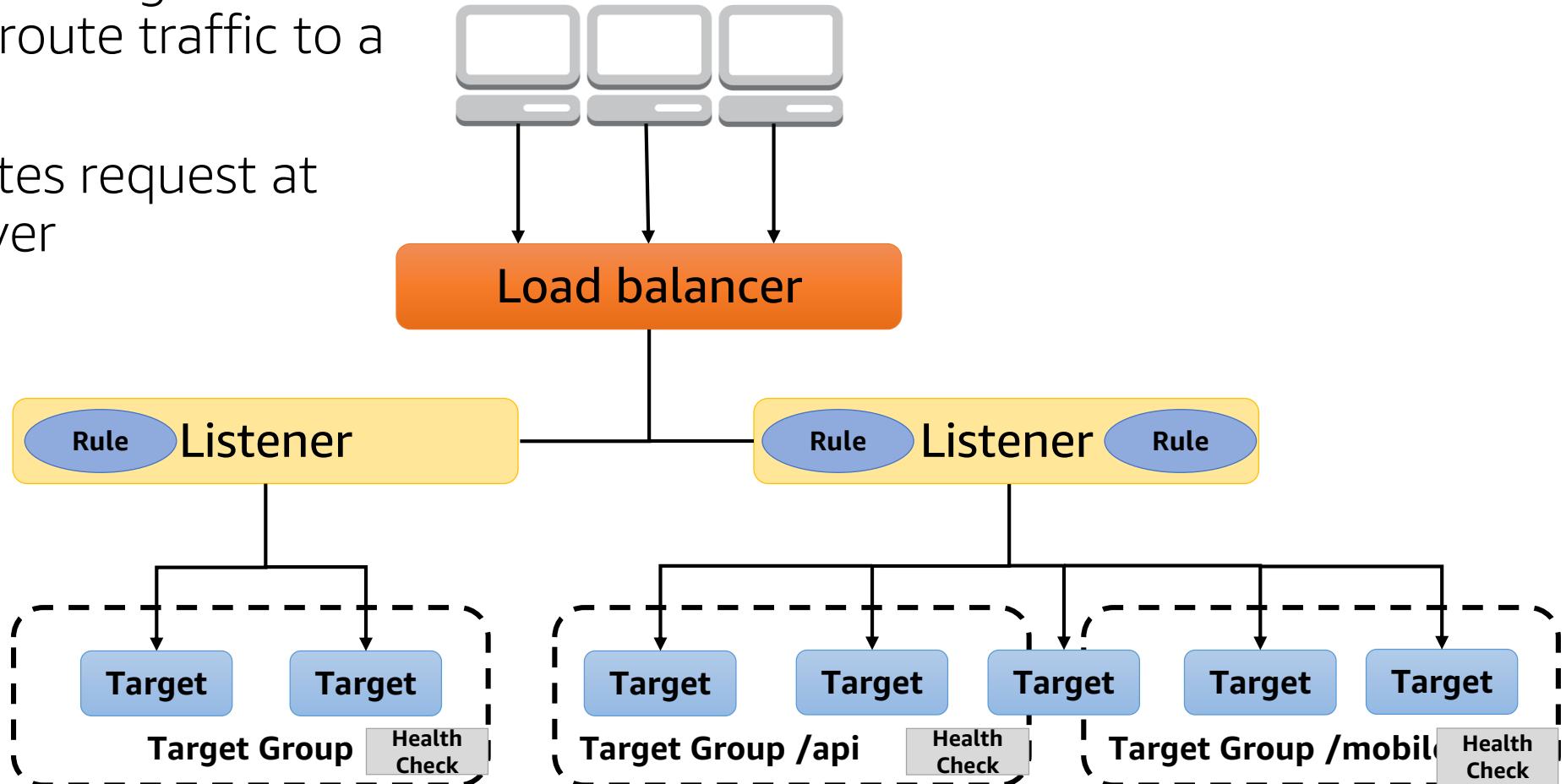
# Classic Load Balancer: How It Works

- Register instances with your load balancer.
- Load balancer routes request at either:
  - Transport layer (TCP)
  - Application layer (HTTP/HTTPS)
- Intended for applications build within the EC2-Classic network
  - Recommendation for new applications is to use Application Load Balancer or Network Load Balancer



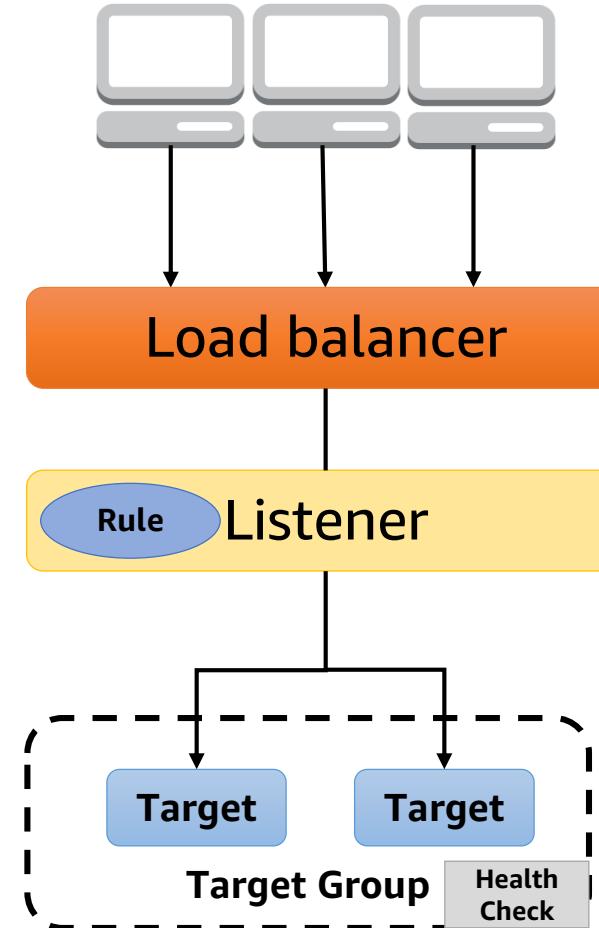
# Application Load Balancer: How It Works

- Register instances as targets in a target group, and route traffic to a target group.
- Load balancer routes request at the Application layer (HTTP/HTTPS).



# Network Load Balancer: How it Works

- Register instances as targets in a target group, and route traffic to a target group.
- Load balancer routes request at the Transport layer (TCP).



# Load Balancer Comparison



Feature	Classic Load Balancer	Application Load Balancer	Network Load Balancer
Protocols	TCP, SSL, HTTP, HTTPS	HTTP, HTTPS	TCP
Platforms	EC2-Classic, VPC	VPC	VPC
Cross-zone load balancing	Yes	Yes	Yes
Logging	Yes	Yes	Yes
Path-based routing	No	Yes	No
Sticky sessions	No	Yes	No
Static IP	No	No	Yes

# Amazon CloudWatch



Amazon  
CloudWatch

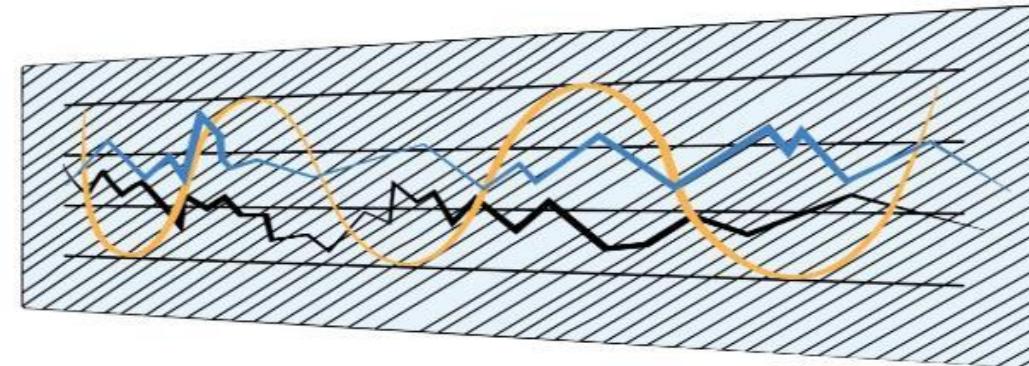
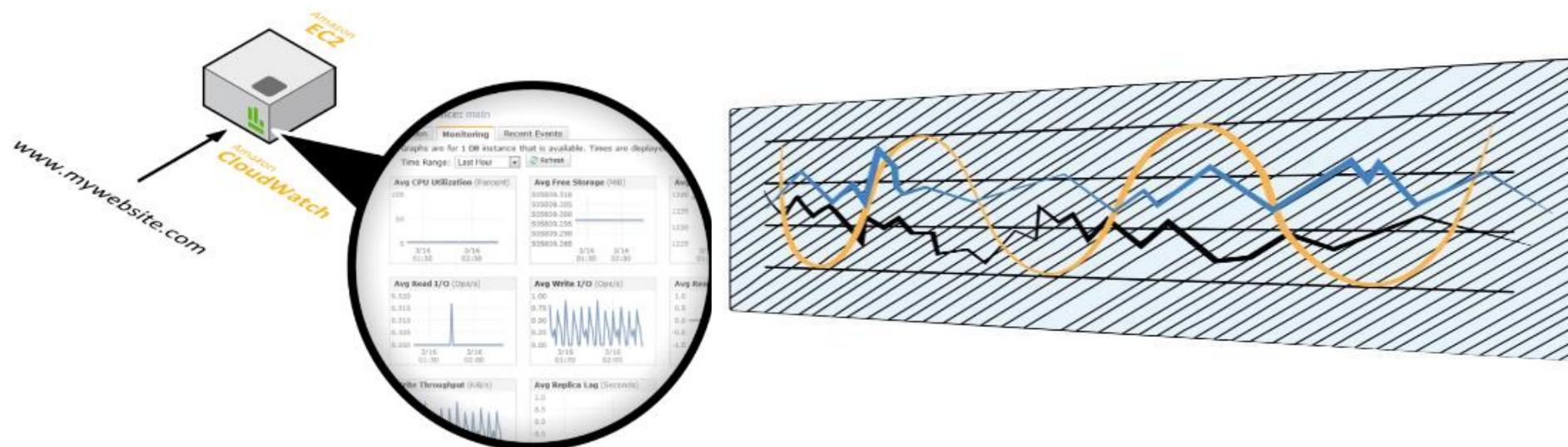
- A monitoring service for AWS Cloud resources and the applications you run on AWS
- Visibility into resource utilization, operational performance, and overall demand patterns
- Custom application-specific metrics of your own
- Accessible via AWS Management Console, APIs, AWS SDK, or AWS CLI

# Amazon CloudWatch Facts

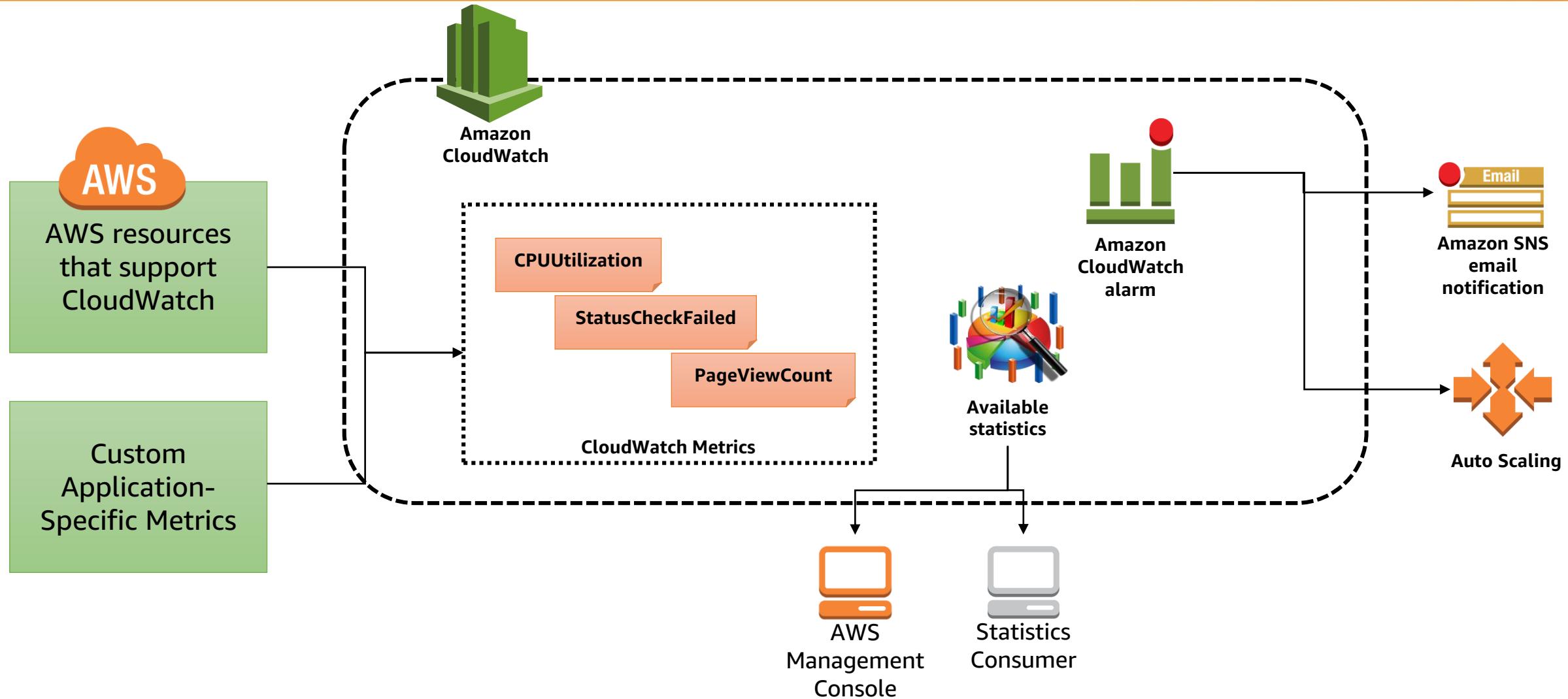
Monitor other AWS resources

- View graphics and statistics

Set alarms



# Amazon CloudWatch Architecture



# CloudWatch Metrics Examples



## CloudWatch Metrics by Category

Your CloudWatch metric summary has loaded. Total metrics: 97

EBS Metrics: 24

Per-Volume Metrics: 24

EC2 Metrics: 38

Per-Instance Metrics: 38

S3 Metrics: 18

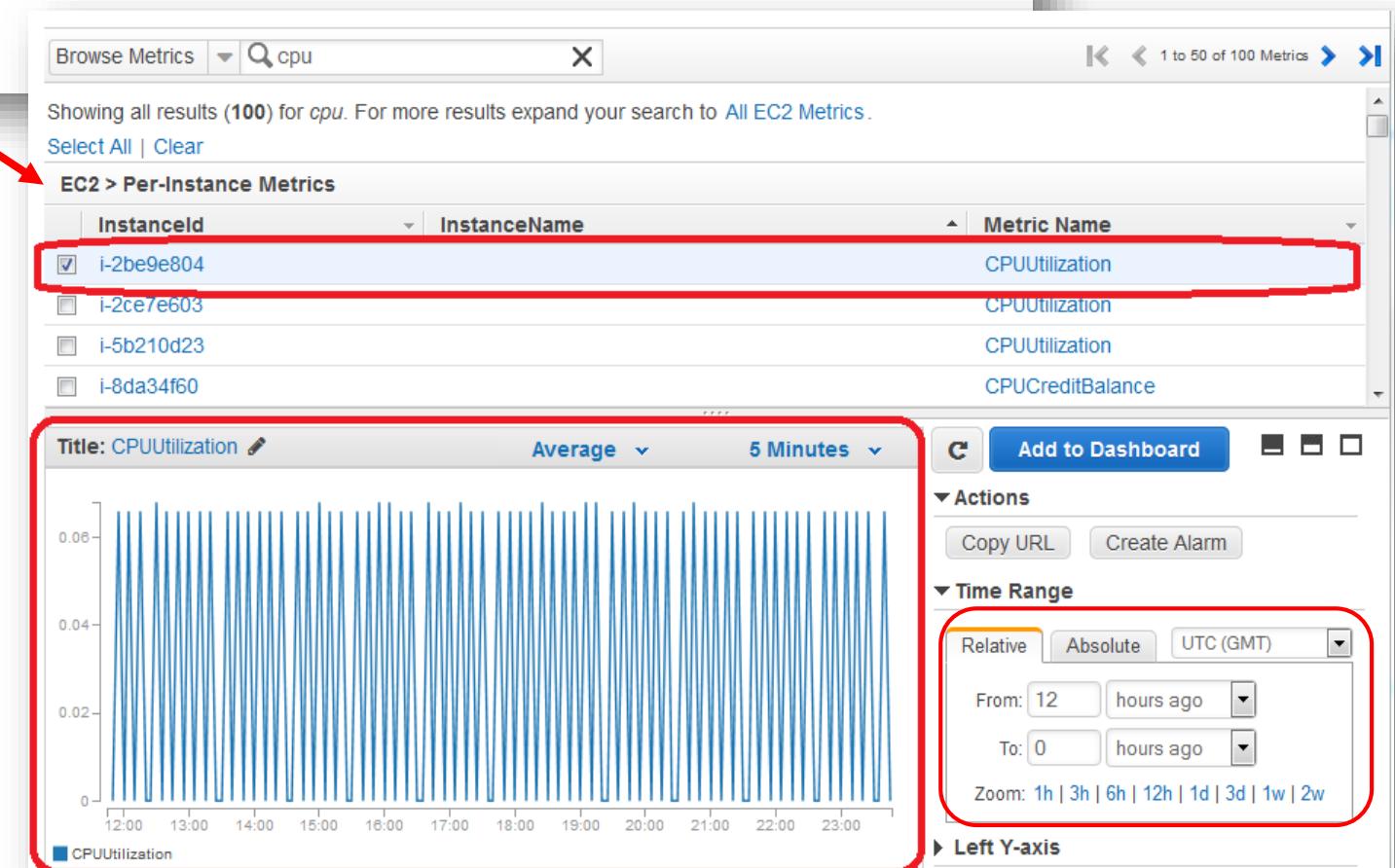
Storage Metrics: 18

SNS Metrics: 3

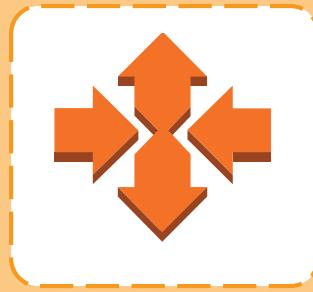
Topic Metrics: 3

SQS Metrics: 14

Queue Metrics: 14



# Auto Scaling

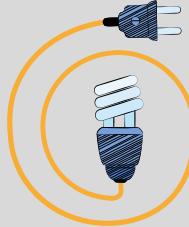


Auto  
Scaling

- Scale your Amazon EC2 capacity automatically
- Well-suited for applications that experience variability in usage
- Available at no additional charge

# Auto Scaling Benefits

**Better fault tolerance**



**Better availability**



**Better cost management**



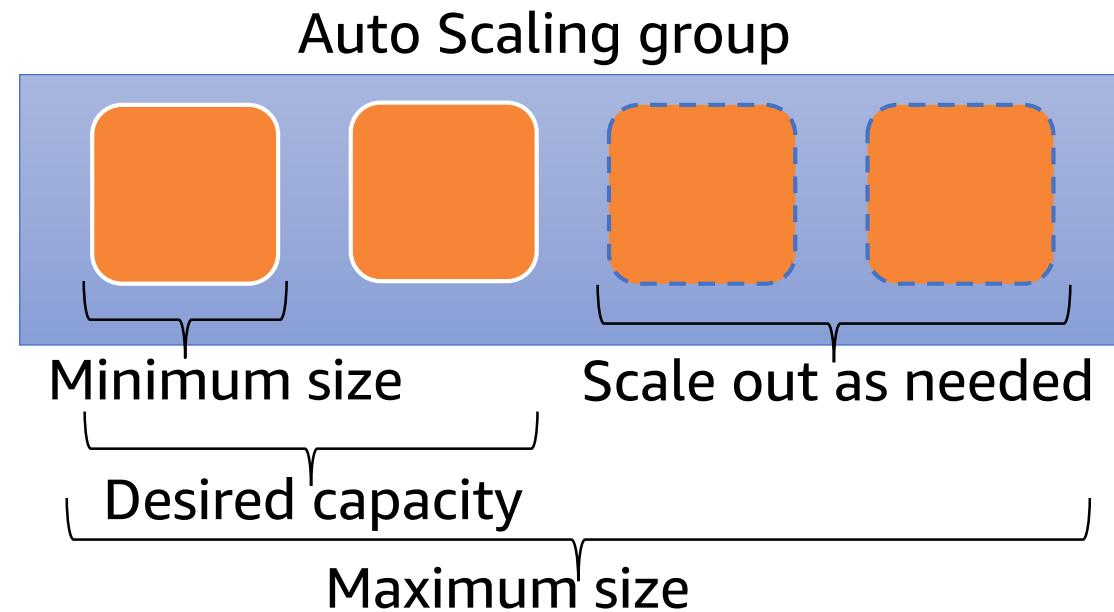
# Launch Configurations

- A launch configuration is a template that an Auto Scaling group uses to launch EC2 instances.
- When you create a launch configuration, you can specify:
  - AMI ID
  - Instance type
  - Key pair
  - Security groups
  - Block device mapping
  - User data



# Auto Scaling Groups

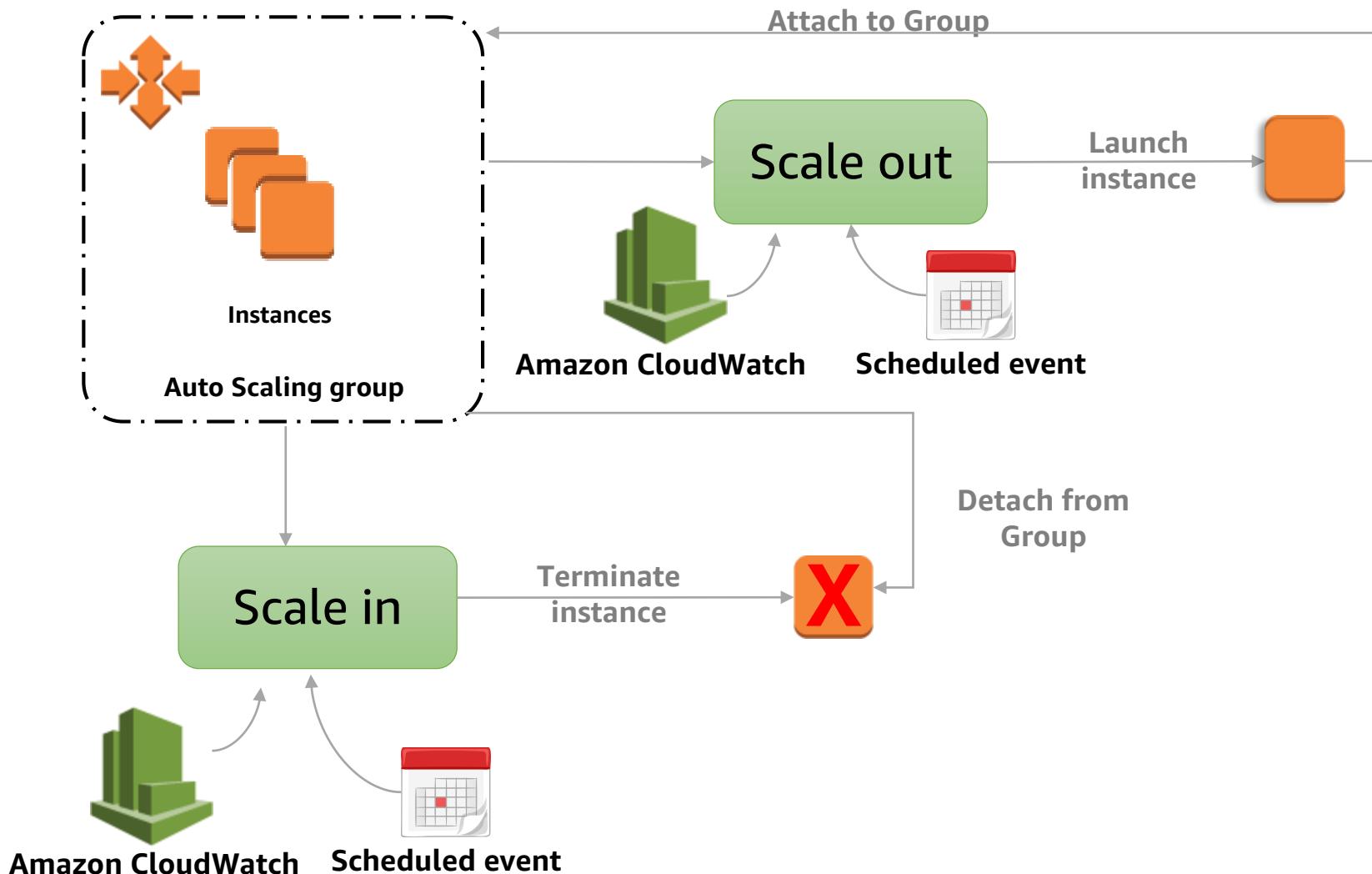
- Contain a collection of EC2 instances that share similar characteristics.
- Instances in an Auto Scaling group are treated as a logical grouping for the purpose of instance scaling and management.



# Dynamic Scaling

- You can create a scaling policy that uses CloudWatch alarms to determine:
  - When your Auto Scaling group should scale out.
  - When your Auto Scaling group should scale in.
  
- You can use alarms to monitor:
  - Any of the metrics that AWS services send to Amazon CloudWatch.
  - Your own custom metrics.

# Auto Scaling Basic Lifecycle



# AWS Trusted Advisor?



A service providing guidance to help you reduce cost,  
increase performance, and improve security

## Cost Optimization



0 ✓ 9 ▲ 0 !

**\$7,516.87**

Potential monthly savings

## Performance



3 ✓ 7 ▲ 0 !

## Security



2 ✓ 4 ▲ 11 !

## Fault Tolerance



0 ✓ 15 ▲ 5 !

## Service Limits



37 ✓ 0 ▲ 1 !

# Trusted Advisor: Core vs. Full



## Core Checks and Recommendations (included)

- Seven core checks around security and performance
- Service Limits

## Full Trusted Advisor Benefits (With Business or Enterprise support)

- Full set of checks
- Notifications
- Programmatic Access via API

# Knowledge Check

■ **True or False:** Auto Scaling helps you ensure that you have the correct number of EC2 instances available to handle the load for your application.

**True**

■ **Q:** What feature would you use with an Auto Scaling policy to determine when your Auto Scaling group should scale out/in?

**Amazon CloudWatch alarms**

■ **Q:** You have an application composed of individual services and need to route a request to a service based on the content of the request. What type of load balancer should you use?

**Application Load Balancer**

■ **Q:** Which AWS service serves as a best practice and recommendation engine?

**AWS Trusted Advisor**



# End of AWS Elasticity and Management

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# Course Wrap-Up

# Learning Path

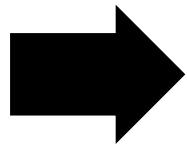
## AWS Introduction

- The AWS Cloud
  - History
  - Global Infrastructure
  - AWS Management Console



## AWS Foundational Services

- Compute:
  - Amazon EC2
- Networking:
  - Amazon VPC
- Storage:
  - Amazon EBS
  - Amazon S3
- Security
  - IAM
- Databases:
  - Amazon DynamoDB
  - Amazon RDS



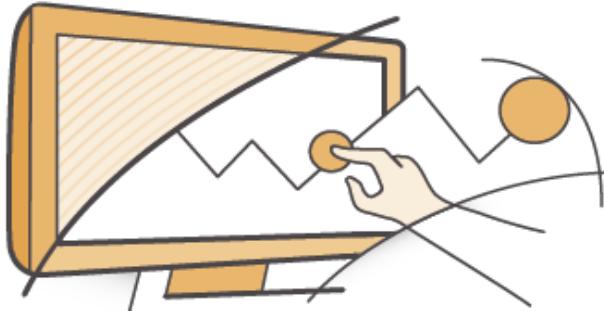
## AWS Management Tools

- Triad of Services:
  - Auto Scaling
  - ELB
  - Amazon CloudWatch
- AWS Trusted Advisor

# Expand Your Cloud Skills with AWS

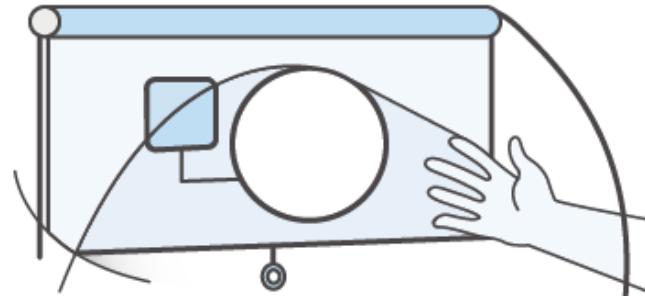


## Online videos and labs



Start working with an AWS service in minutes with free online instructional videos and labs

## Instructor-led courses



Learn how to design, deploy, and operate highly available, cost-effective, and secure applications on AWS

## Certification



Validate your proven technical expertise with the AWS platform and gain recognition for your skills

<https://aws.amazon.com/training/self-paced-labs/>

<https://aws.amazon.com/certification/>

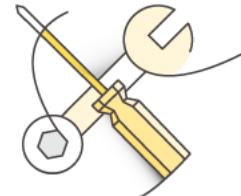
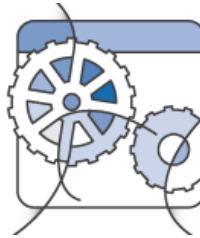
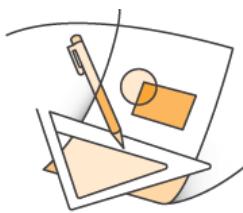
# Self-Paced Labs



- Learn an individual AWS Service topic
- Follow a Learning Quest by AWS Service Area or Use Case
- Practice working with AWS as you prepare for an exam
- **For more information, see:**
  - <https://aws.amazon.com/training/self-paced-labs/>



# AWS ILT Training Courses



Introductory  
courses

**AWS Technical Essentials**  
1 day

Intermediate  
courses

**Architecting on AWS**  
3 days

**Developing on AWS**  
3 days

**Systems Operations on AWS**  
3 days

Advanced  
courses

**Advanced Architecting on AWS**  
3 days

**DevOps Engineering on AWS**  
3 days

**Security Operations on AWS**  
3 days

Specialty  
courses

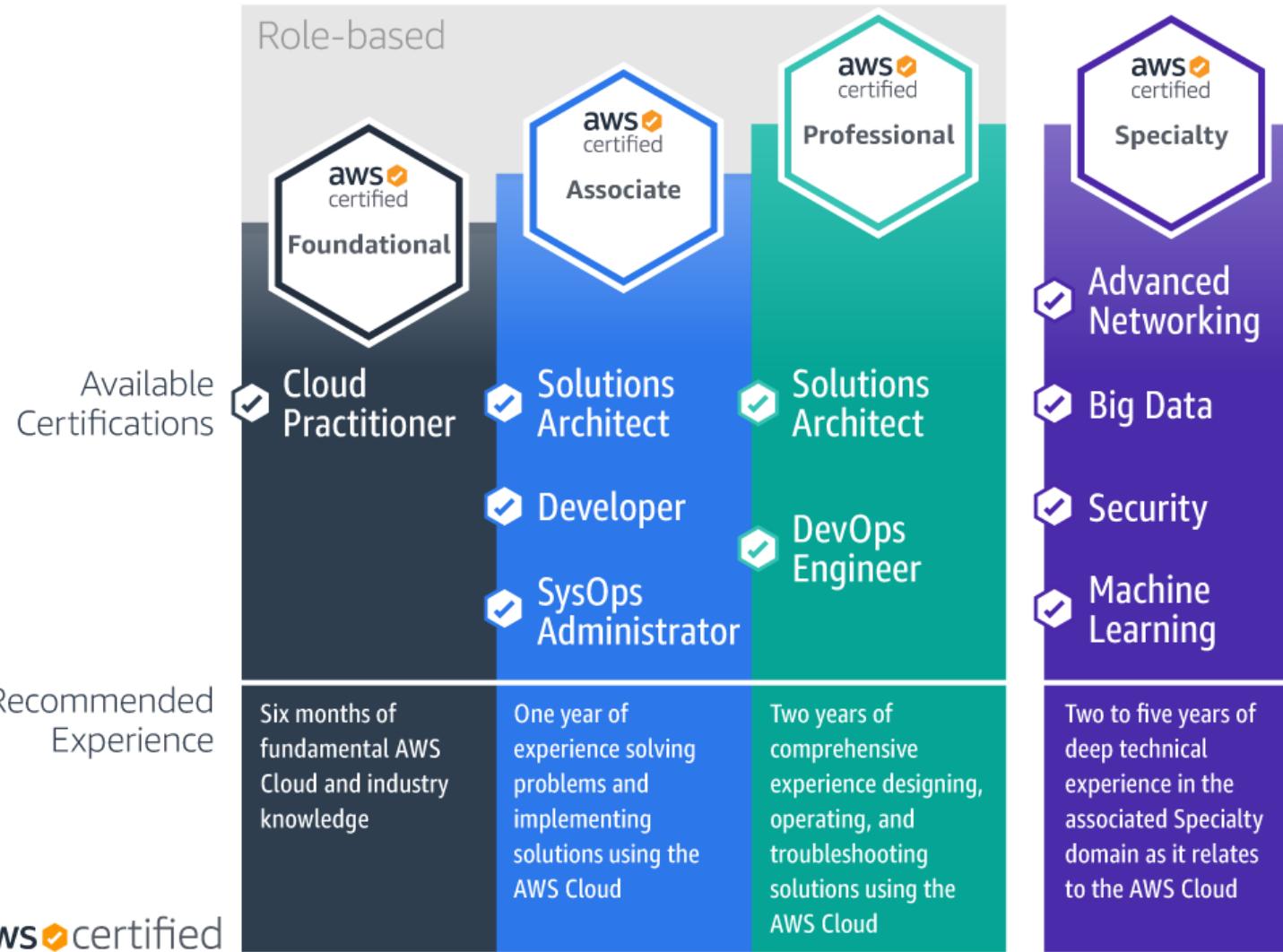
**Migrating to AWS**  
2 days

**Big Data on AWS**  
3 days

**Data Warehousing on AWS**  
3 days

<https://aws.amazon.com/training/>

# AWS Certification



# Benefits of AWS Certification



## Individual

- Demonstrate expertise
- Stand out
- Industry visibility
- Customer visibility
- Peer recognition
- Credibility with customers

## Employer

- Baseline bar on AWS skills
- Identify expert talent
- Leverage best practices
  - Reduce operational risk
  - Increase business advantage
  - Maximize AWS efficiencies
- Common vocabulary
- Accelerate time to cloud

# Preparing for AWS Certification



For resources to help you prepare for the certification exam, see: <https://aws.amazon.com/certification/certification-prep/>

**Exam Guides &  
Sample Questions**

**AWS-Authored Study Guide**

**Self-Paced Labs on *qwikLABS***

**AWS Technical Training**

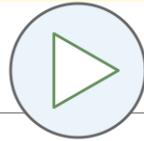
**AWS Whitepapers &  
FAQs**

**AWS Documentation &  
Reference Architectures**

**Practice Exams**

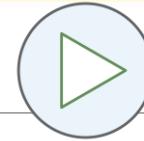
# AWS Support

# Support Options (1 of 2)



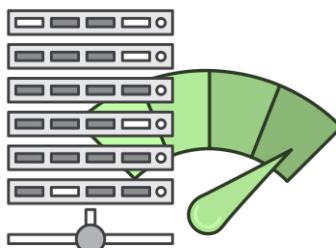
## The Technical Account Manager provides...

- ✓ A dedicated **voice within AWS** to serve as your **advocate**.
- ✓ **Proactive guidance and insight** into ways to optimize AWS through business and performance reviews.
- ✓ Orchestration and access to the full **breadth and depth of technical expertise** across the full range of AWS.
- ✓ Access to resources and **best practice recommendations**.



## Infrastructure Event Management provides...

- ✓ A common understanding of event objectives and use cases through **pre-event planning and preparation**.
- ✓ Resource **recommendations and deployment guidance** based on anticipated capacity needs.
- ✓ **Dedicated attention** of the your AWS Support team during your event.
- ✓ The ability to immediately **scale down resources** to normal operating levels post-event.



# Support Options (2 of 2)



## The Concierge Service provides...

- ✓ A primary contact to help **manage AWS resources**.
- ✓ **Personalized handling** of billing inquiries, tax questions, service limits, and bulk reserve instance purchases.
- ✓ Direct access to an agent to help **optimize costs**, and identify **underutilized resources**.



## AWS Trusted Advisor provides...

- ✓ Insight into how and where you can get the **most impact for your AWS spend**.
- ✓ Opportunities to *reduce* your monthly **spend** and retain or *increase* **productivity**.
- ✓ Guidance on getting the **optimal performance and availability** based on your requirements.
- ✓ Confidence that your environment is **secure**.

Cost Optimization



0 ✓ 0 ▲ 0 !

Performance



1 ✓ 0 ▲ 0 !

Security



0 ✓ 2 ▲ 0 !

Fault Tolerance



0 ✓ 0 ▲ 0 !

# Support Comparison



	Basic	Developer	Business	Enterprise
Customer Service and Communities	24x7 access to customer service, documentation, whitepapers, and support forums	24x7 access to customer service, documentation, whitepapers, and support forums	24x7 access to customer service, documentation, whitepapers, and support forums	24x7 access to customer service, documentation, whitepapers, and support forums
Best Practices	Access to 7 core Trusted Advisor checks	Access to 7 core Trusted Advisor checks	Access to full set of Trusted Advisor checks	Access to full set of Trusted Advisor checks
Technical Support		Business hours access to Cloud Support Associates via email	24x7 access to Cloud Support Engineers via email, chat & phone	24x7 access to Sr. Cloud Support Engineers via email, chat & phone
Case Severity/Response Times			Production system impaired: < 4 hours Production system down: < 1 hour	Production system impaired: < 4 hours Production system down: < 1 hour Business-critical system down: < 15 minutes



# Course Appendices



# Module 1 Appendix

## AWS Introduction and History

# Cloud Computing Concepts

# What is cloud computing?

- Cloud computing is on-demand delivery of IT resources and applications via the Internet with pay-as-you-go pricing.



# Essential Characteristics of Cloud Computing

On-Demand Self Services

Broad Network Access

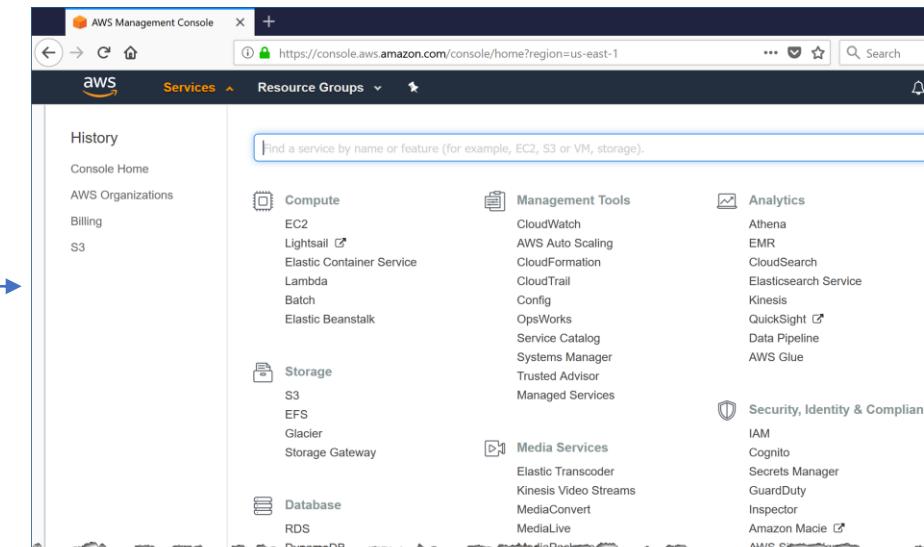
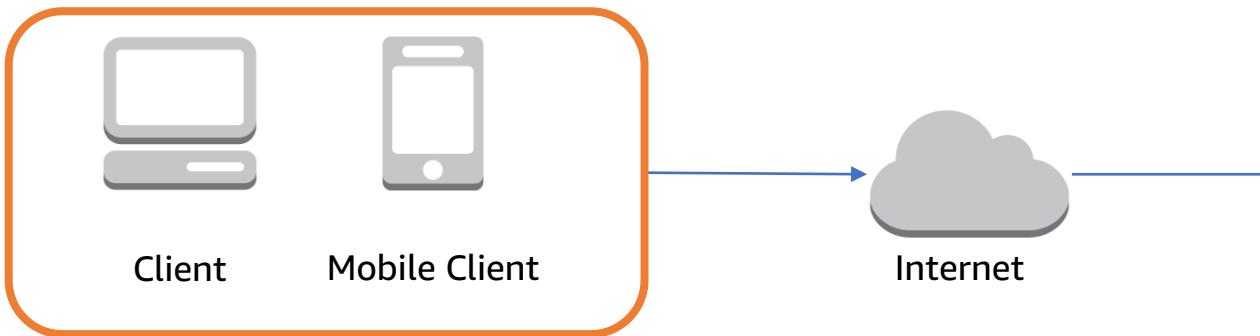
Resource Pooling

Rapid Elasticity

Measured Service

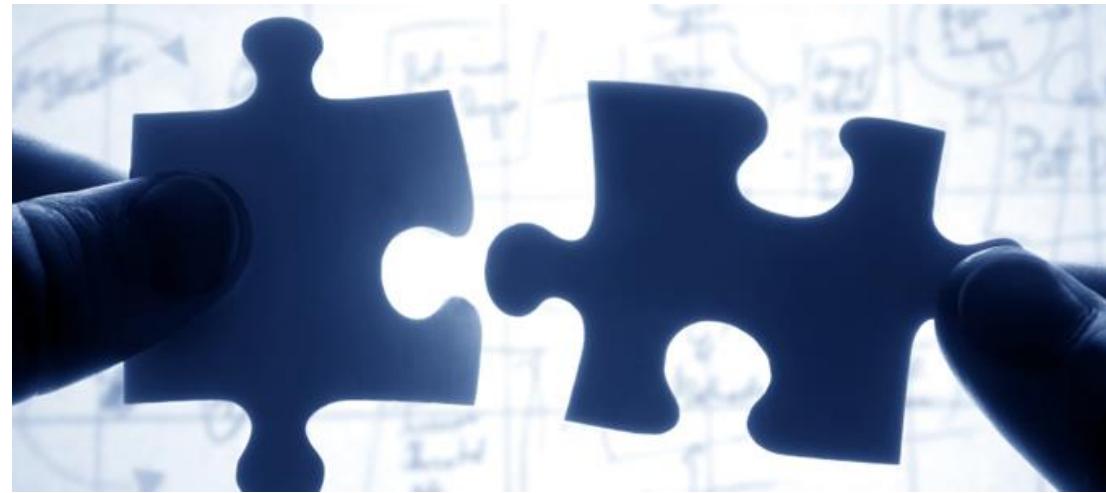
# On-Demand Self Services & Broad Network Access

- User provisions computing resources as needed.
- User interacts with cloud service provider through an online control panel.
- Clear solutions are available through a variety of network-connected devices and over varying platforms.



# Resource Pooling

Securely separate resources to service multiple customers.



# Rapid Elasticity

- Resources are quickly scalable and flexible based on business needs.



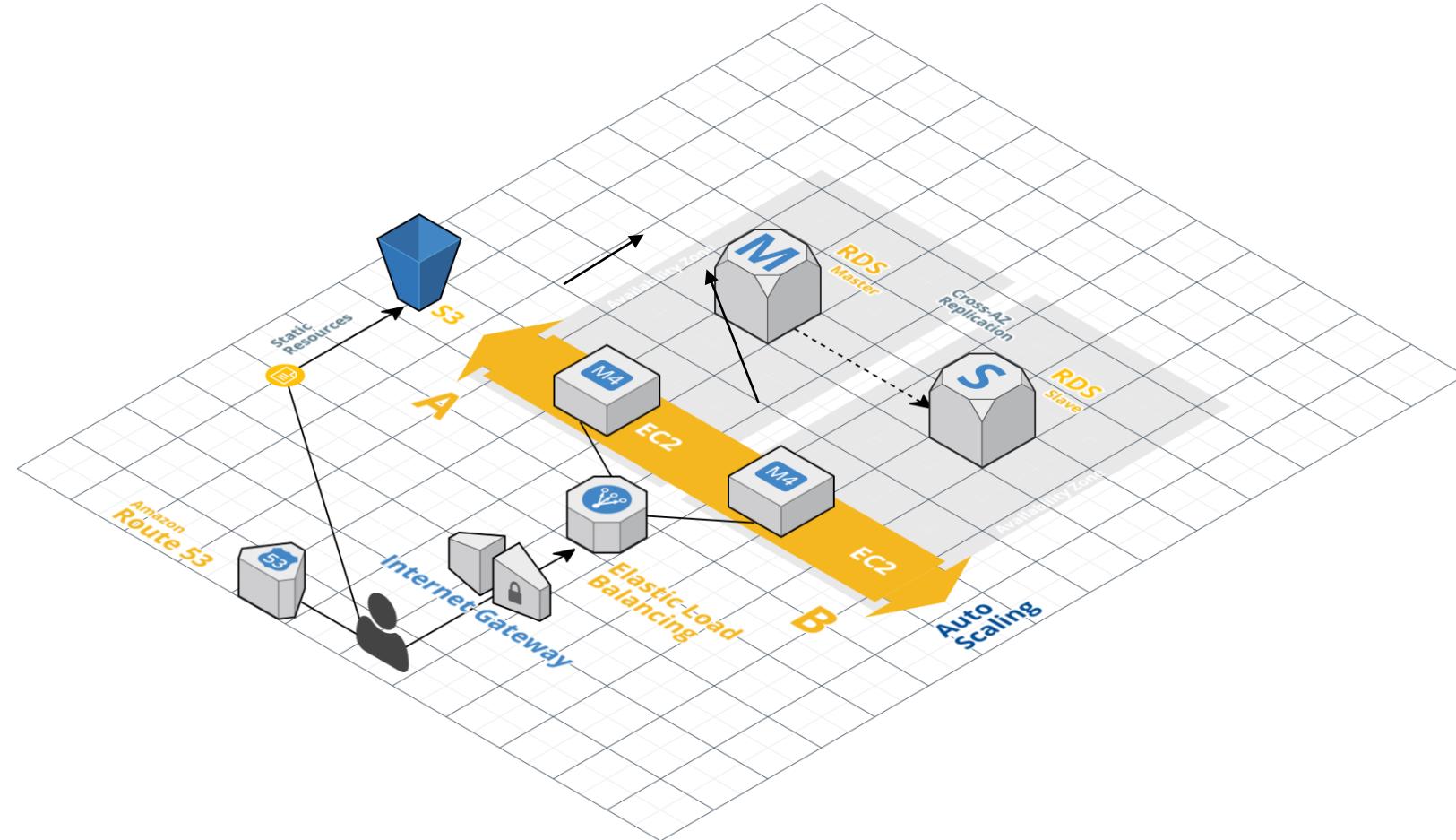
# Measured Service

💡 Pay for services as you go.



Electrical services analogy

# What Does My AWS Cloud Look Like?



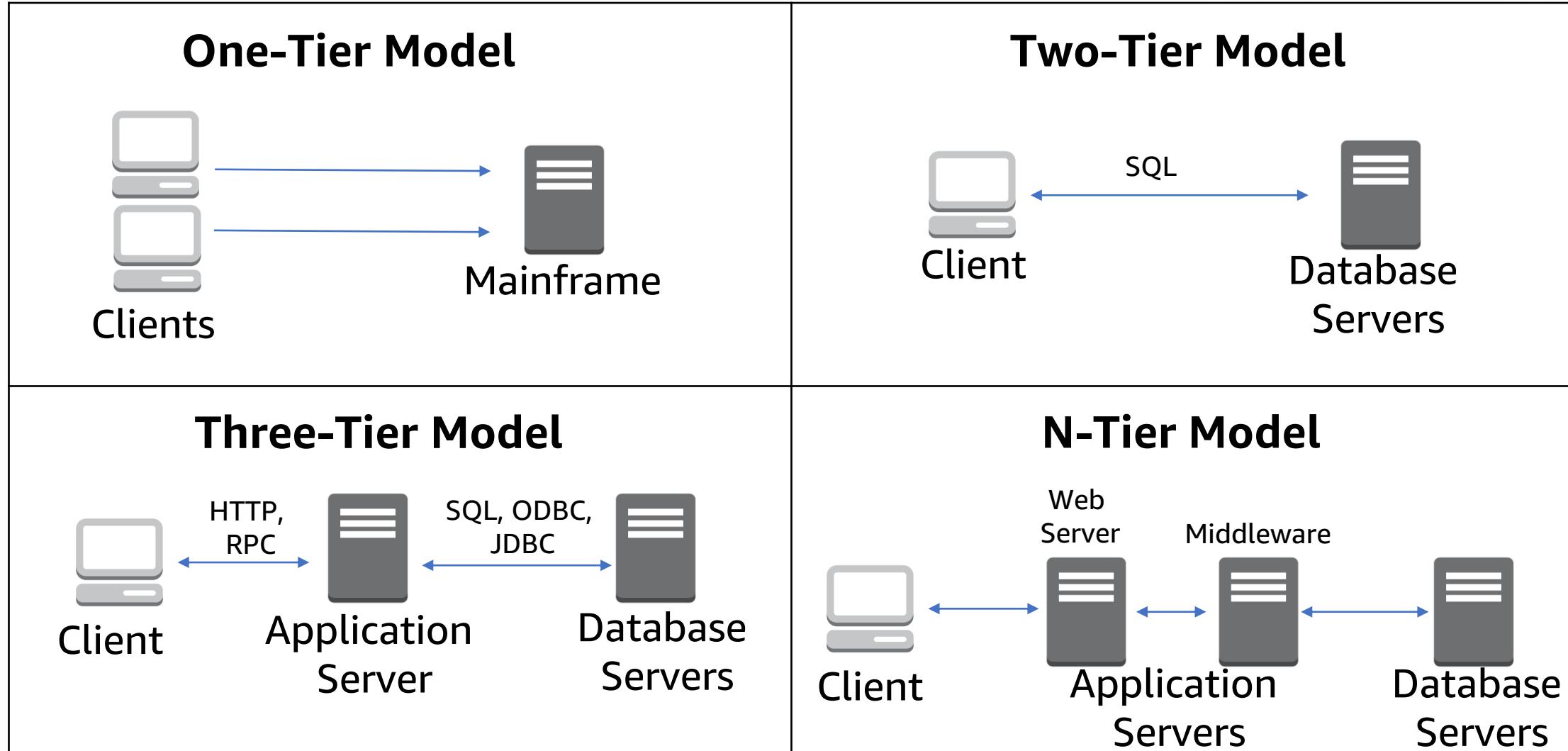


# Module 2 Appendix

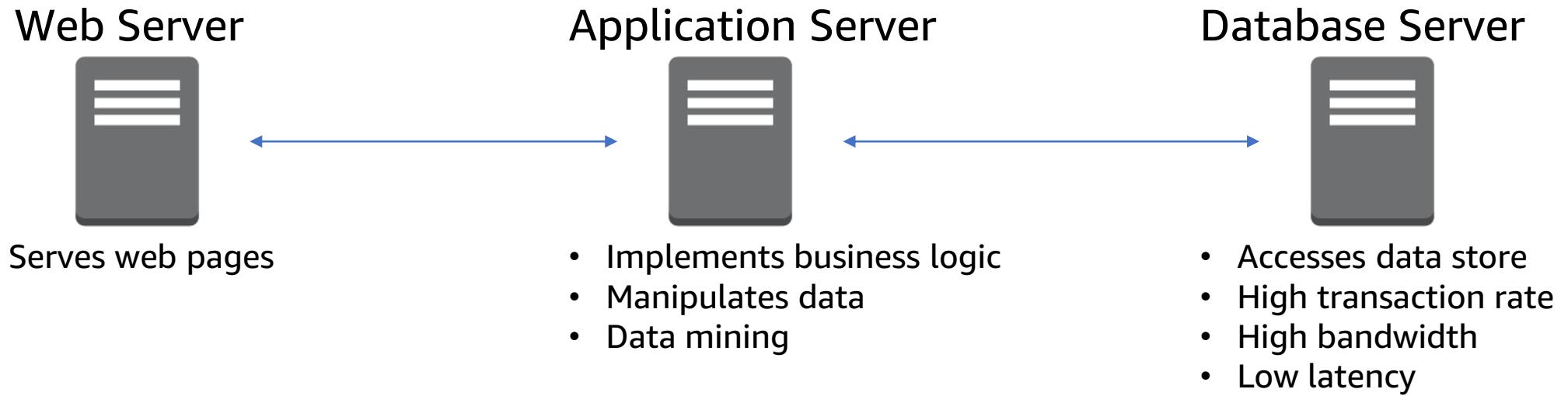
## AWS Foundational Services

# Data Center Design Models

# Application Design Model



# Web Services Model



# Amazon EC2

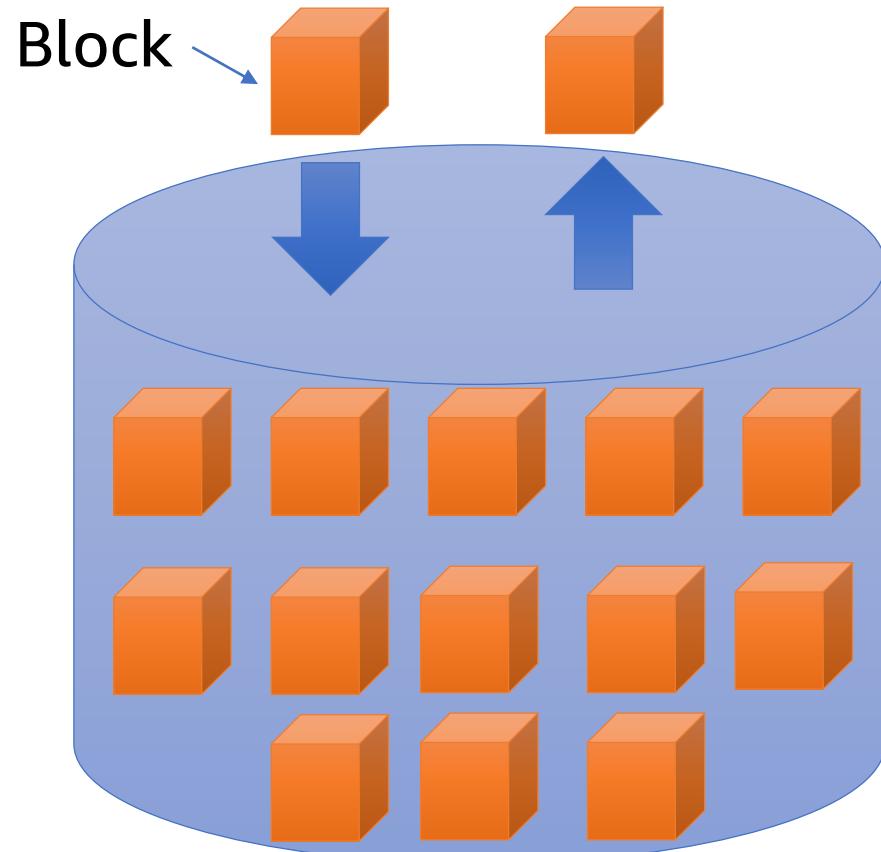
# AMI Types – Storage for the Root Device



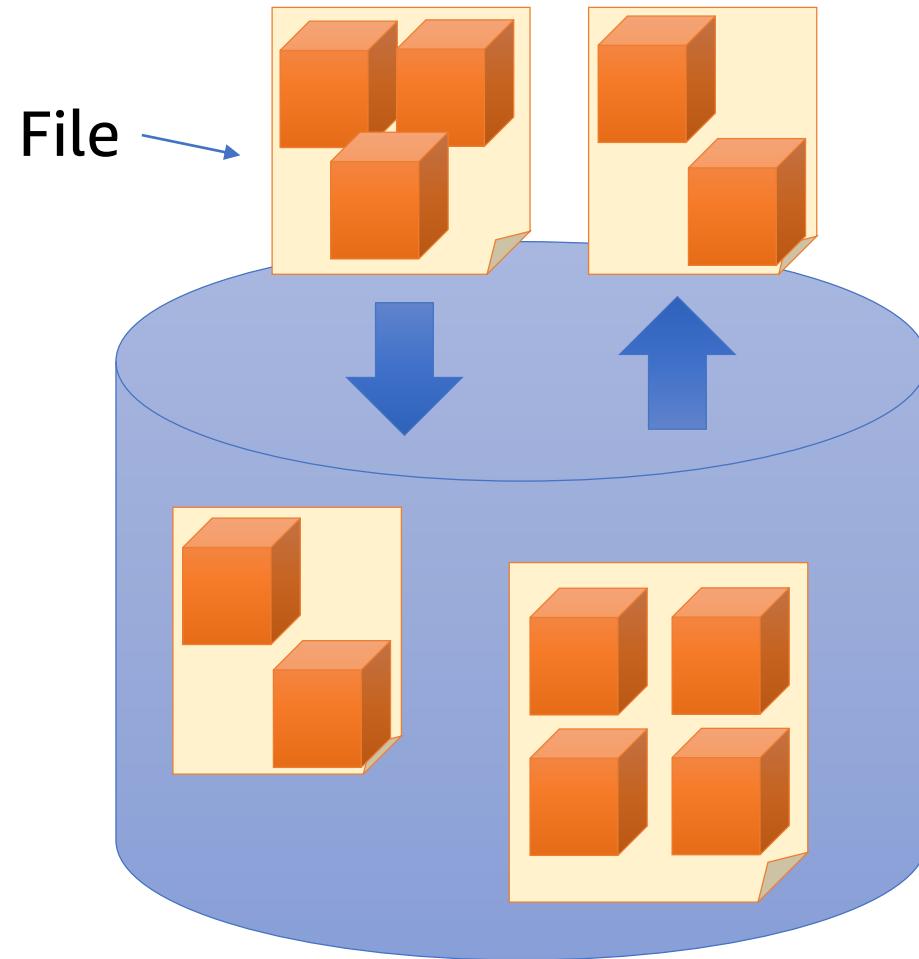
Characteristic	Amazon EBS-Backed	Amazon Instance Store-Backed
<b>Boot time</b>	Usually < 1 minute	Usually < 5 minutes
<b>Size limit</b>	16 TiB	10 GiB
<b>Data persistence</b>	The root volume is deleted when the instance terminates. Data on any other Amazon EBS volumes persists after the instance is terminated.	Data on any instance store volumes persists only during the life of the instance.
<b>Charges</b>	Instance usage, Amazon EBS volume usage, and storing your AMI as an Amazon EBS snapshot.	Instance usage and storing your AMI in Amazon S3.
<b>Stopped state</b>	Can be stopped.	Cannot be stopped.

# Storage Concepts and Solutions

# Block and File Level Storage

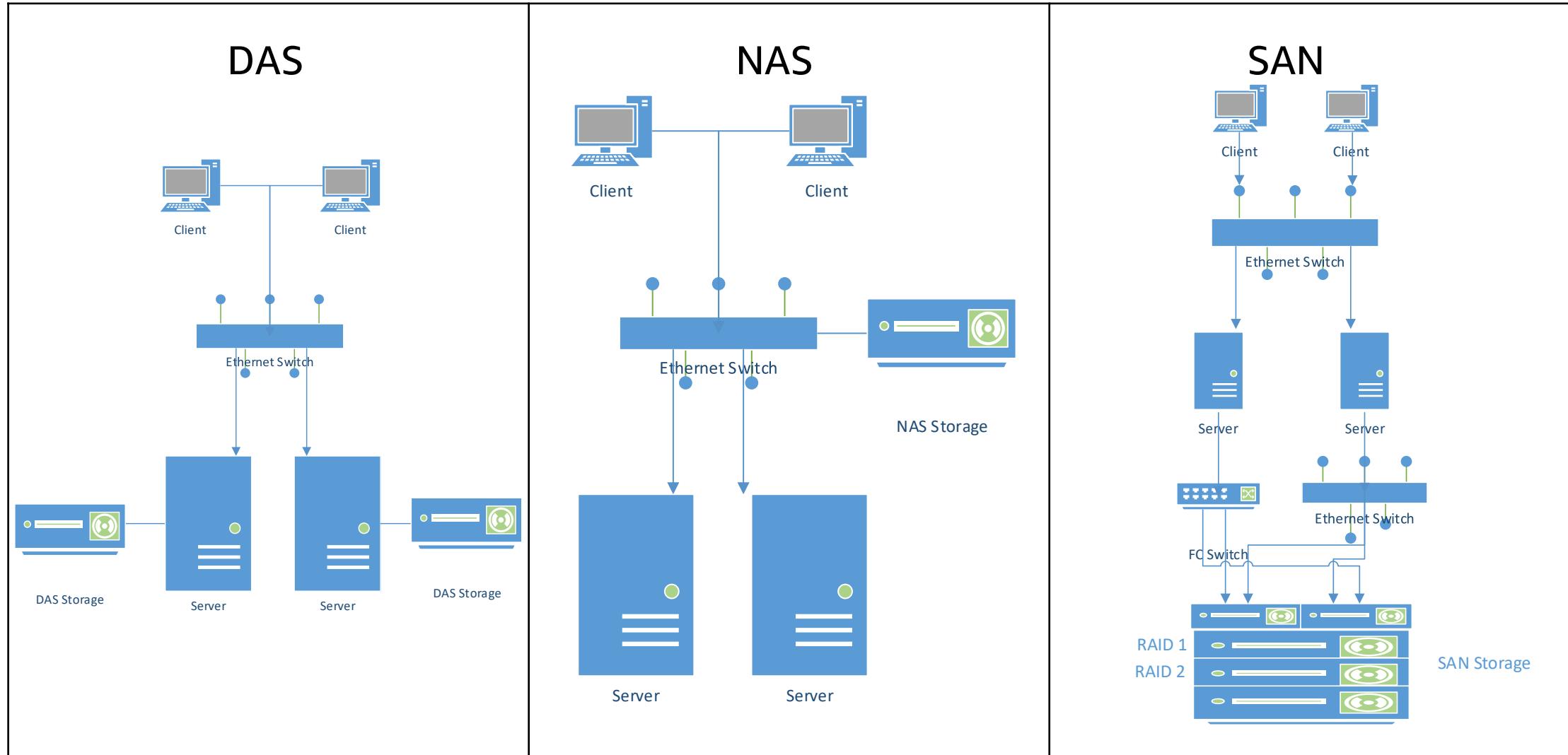


Block Level Storage



File Level Storage

# Storage Technologies



# Amazon S3

# Amazon S3 Buckets



- Organize the Amazon S3 namespace at the highest level.
- Identify the account responsible for storage and data transfer charges.
- Play a role in access control.
- Serve as the unit of aggregation for usage reporting.
- Have globally unique bucket names, regardless of the AWS region in which they were created.

# Amazon S3 Region Considerations



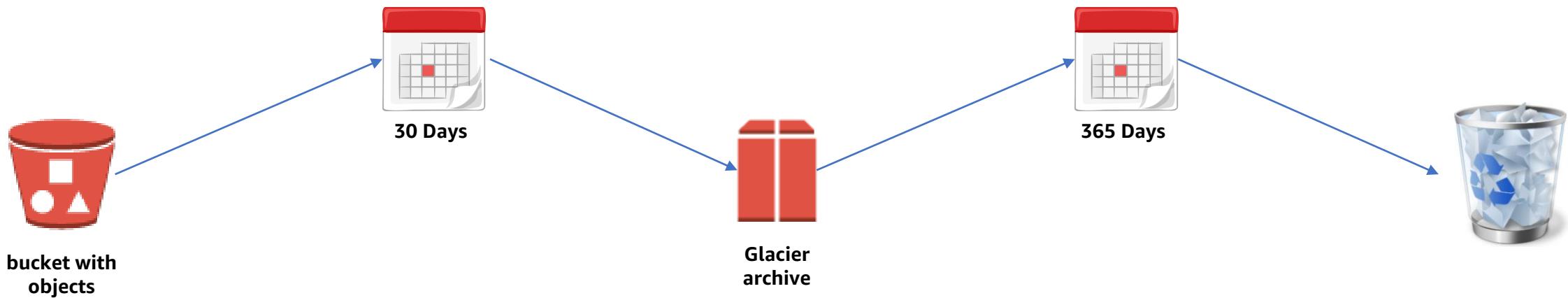
- Amazon S3 creates a bucket in the region you select.
- You can choose a region to:
  - Optimize latency
  - Minimize costs
  - Address regulatory requirements
- Objects stored in a region never leave the region unless you explicitly transfer them to another region.

# Amazon S3 Objects

- Objects are the fundamental entities stored in Amazon S3.
- When using the console, you can think of them as files.
- Objects consist of data and metadata. The data portion is opaque to Amazon S3. The metadata is a set of name-value pairs that describe the object.
  - Default metadata such as the date last modified
  - Standard HTTP metadata such as Content-Type
  - Custom metadata at the time the object is stored
  - A key that uniquely identifies as object within its bucket

# Amazon S3 + Amazon Glacier

- S3 Lifecycle policies allow you to delete or move objects based on age and set rules per S3 bucket.



# Amazon EBS

# EBS Performance

## ■ EBS Magnetic

- 40-200 IOPS

## ■ EBS General Purpose SSD

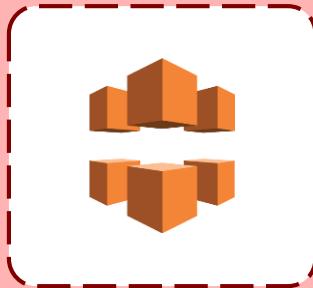
- SSD backed
- 3 IOPS / GB
- Burstable to 3,000 IOPS and up to 10,000 IOPS

## ■ EBS Provisioned IOPS SSD

- SSD backed
- Up to 32,000 IOPS consistently
- Up to 500 MB/s throughput

# Amazon CloudFront

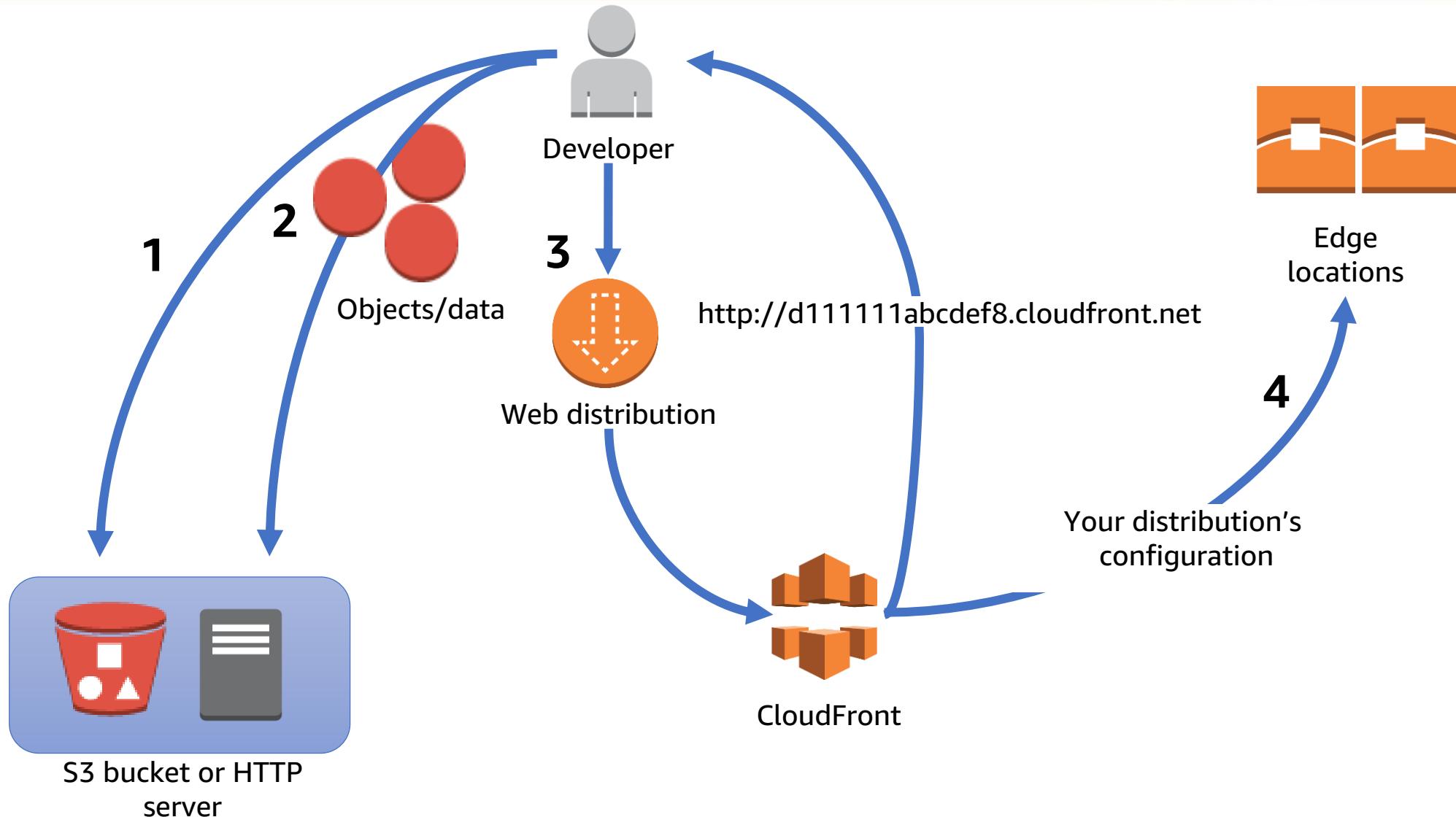
# Amazon CloudFront



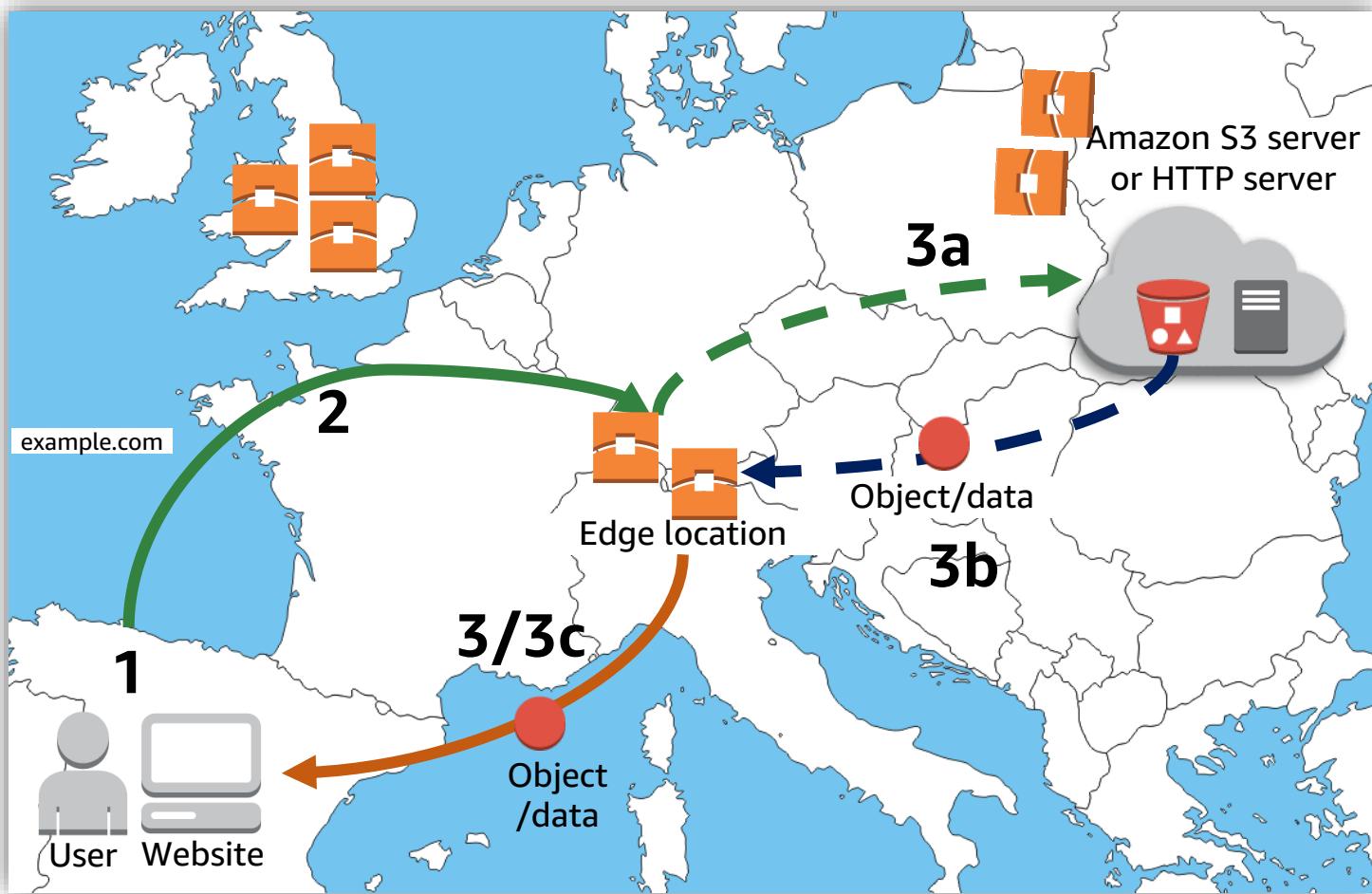
Amazon  
CloudFront

- Easy and cost effective way to distribute content to end users
- Low latency, high data transfer speeds
- Deliver your entire website, including static, dynamic, and streaming content using a global network of edge locations

# How You Configure CloudFront to Deliver Your Content



# How CloudFront Delivers Content to Your Users



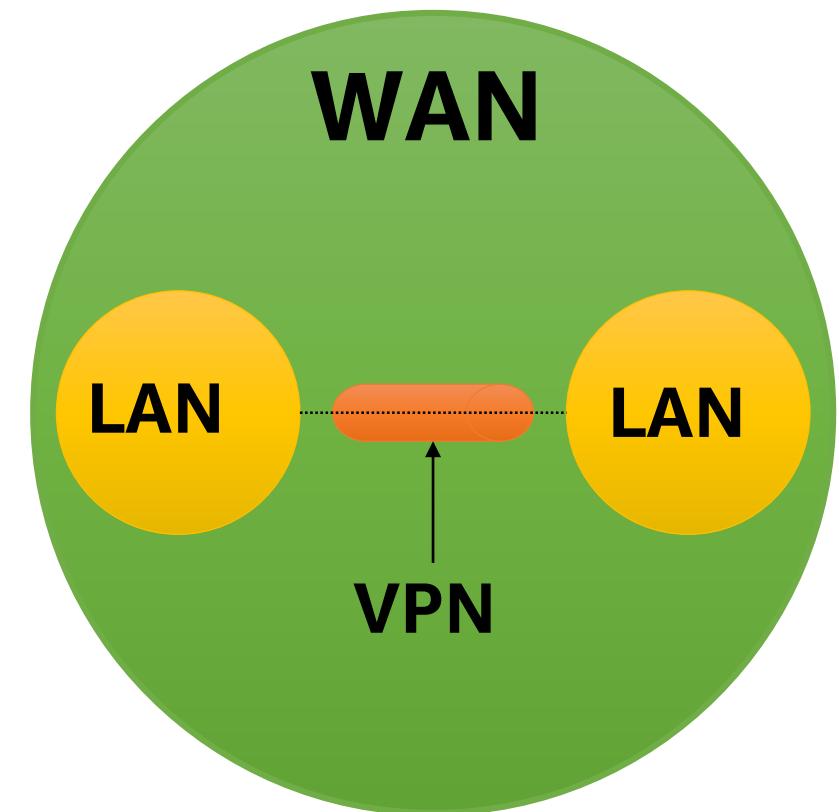
# Networking Concepts

# What is a Network?

■ A network is two or more computers linked to share resources, exchange files, or allow electronic communications.

■ Network Types:

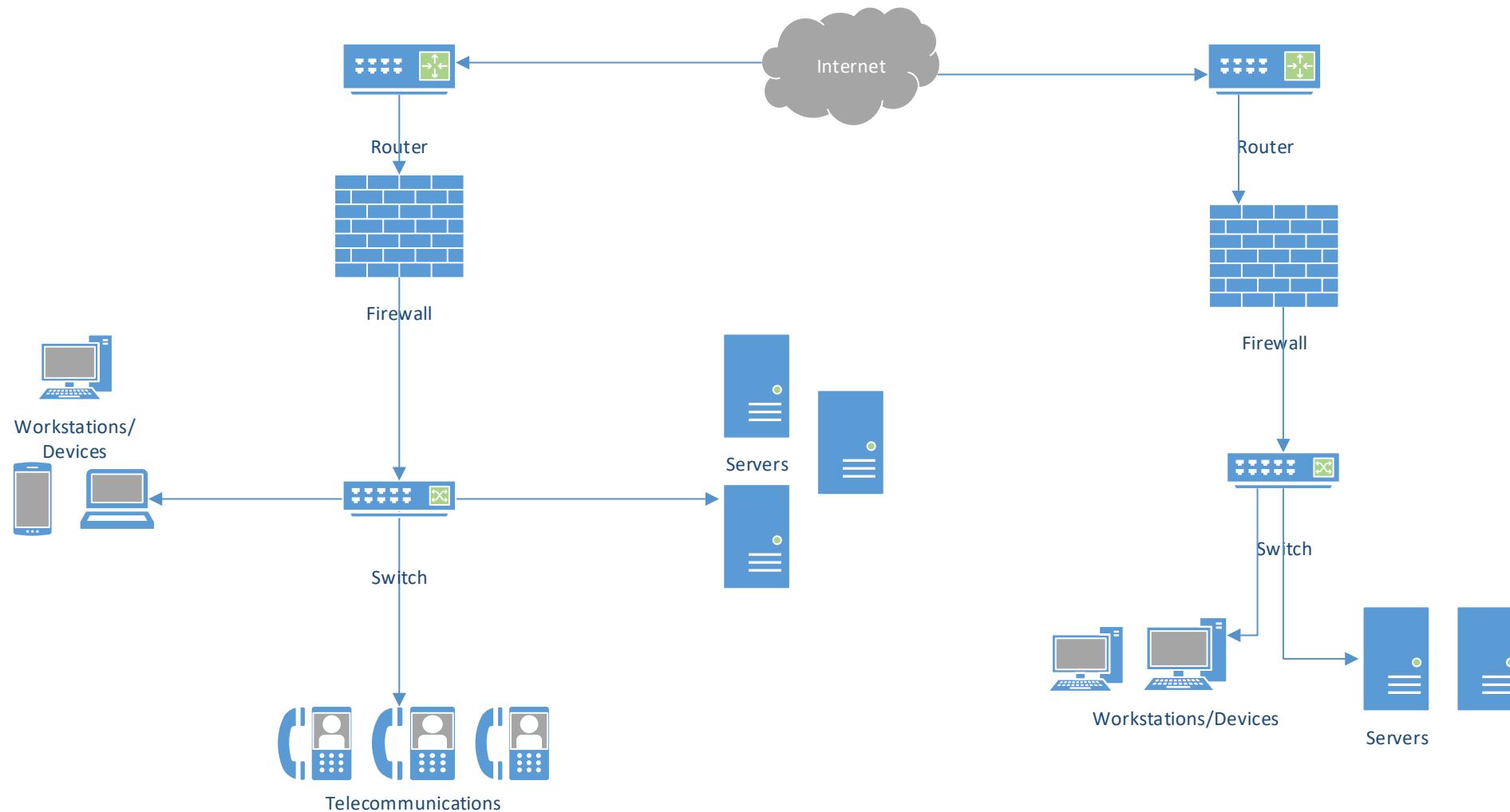
- Local Area Network (LAN)
- Wide Area Network (WAN)
- Virtual Private Network (VPN)



# Physical vs. Logical Topology

- A physical topology defines how the systems are physically connected.
- A logical topology defines how the systems communicate across the physical topologies.

# Physical Network Hardware/Devices



# Amazon VPC

# Networking in Your VPC



You can use the following components to configure networking in your VPC:

- IP addresses
- Elastic network interfaces
- Route tables
- Internet gateways
- Network Address Translation (NAT)
- Dynamic Host Configuration Protocol (DHCP) options sets
- Domain Name System (DNS)
- VPC peering
- VPC endpoints
- VPC flow logs



# Module 3 Appendix Security, Identity, and Access Management

# Data Center Security

# Physical & Environmental Security



- Lock your data center.
- Only provide access to those who need it.
- Keep track of access.
- Mount servers on racks with locks.
- Have redundant utilities.
- Build your data center with security in mind.

# Network Security

- Identification & Authentication
- Firewalls
- Patching
- Virus Protection
- Encryption

# AWS IAM

## Advanced Concepts

# AWS Resource-Based Policies



- Are an alternative to IAM and supported by some services.
- Grant cross-account access to your resources.
- Use a principal to uniquely identify accounts in the policy.
- Supported AWS services include :
  - Amazon S3 Bucket Policy
  - Amazon SNS Topic Policy
  - Amazon SQS Queue Policy
  - Amazon Glacier Vault Policy
  - AWS OpsWorks Stack Policy
  - AWS Lambda Function Policy

# Access to AWS Resources



## Temporary Security Credentials

- Security Token Service
- AssumeRole
- AssumeRoleWithSAML
- AssumeRoleWithWebIdentity

# AWS Services support for IAM Roles



- AWS CLI on Amazon EC2
- AWS CloudTrail logs to Amazon S3
- Amazon Elastic Transcoder access to Amazon S3
- AWS Elastic Beanstalk access to AWS services
- AWS Lambda code access to AWS services
- Many more ...



## Module 4 Appendix Databases

# Security Groups

- Allow access to IP address ranges or Amazon EC2 instances you specify.
- Use VPC security groups to control access to a DB instance inside a VPC.

# DB Parameter & Option Groups

## DB parameter groups:

- Contain engine configuration values that can be applied to one or more DB instances of the same instance type.
- Are applied by Amazon RDS by default when you create DB instance, which contains defaults for the specific database engine and instance class of the DB instance.

## DB option groups:

- Tools that simplify database management
- Currently available for:
  - Oracle
  - Microsoft SQL Server
  - MySQL 5.6



# Amazon DynamoDB: Supported Operations



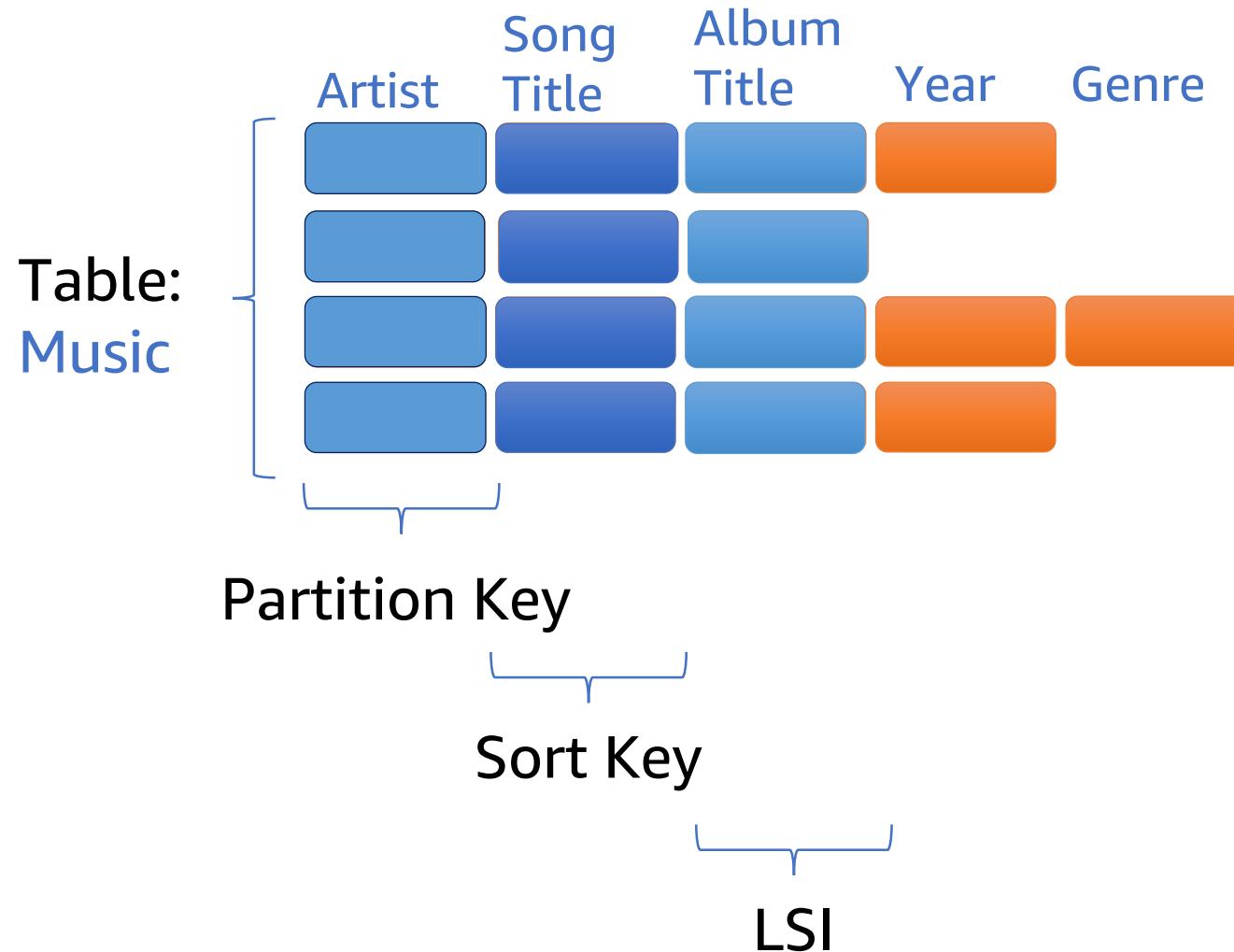
## Table Operations:

- Create, update, and delete tables.
- After creation, you can increase or decrease provisioned throughput.
- Retrieve the table's status, the primary key, and when the table was created.
- List all tables in your account for a region.

## Item Operations:

- Add, update, and delete items from a table.
- Add, update, and delete existing attributes from an item.
- Perform conditional updates.
- Retrieve a single item or multiple items.

# Local Secondary Index



# Global Secondary Index

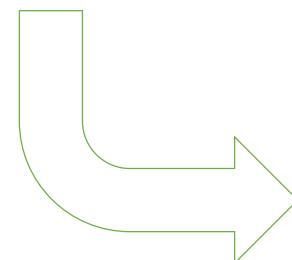
Table:  
Music

Artist	Song Title	Album Title	Year	Genre

Table: Music

Partition Key: Artist

Sort Key: Song Title



Choose which attributes  
to project (if any)

Genre	Year	Song Title

GSI: MusicGSI

Partition Key: Genre

Sort Key: Year



# Module 5 Appendix

## AWS Elasticity and Management Tool

# AutoScaling Advanced Concepts

# Scaling Plans

## Auto Scaling Minimum

Health Check monitors running instances within an Auto Scaling group.

If an unhealthy instance is found, it can be replaced.

## Manual Scaling

Specify a new minimum for your Auto Scaling group.

Manually invoke Auto Scaling policies.

## Scheduled Scaling

Scaling functions are performed as a function of time and date.

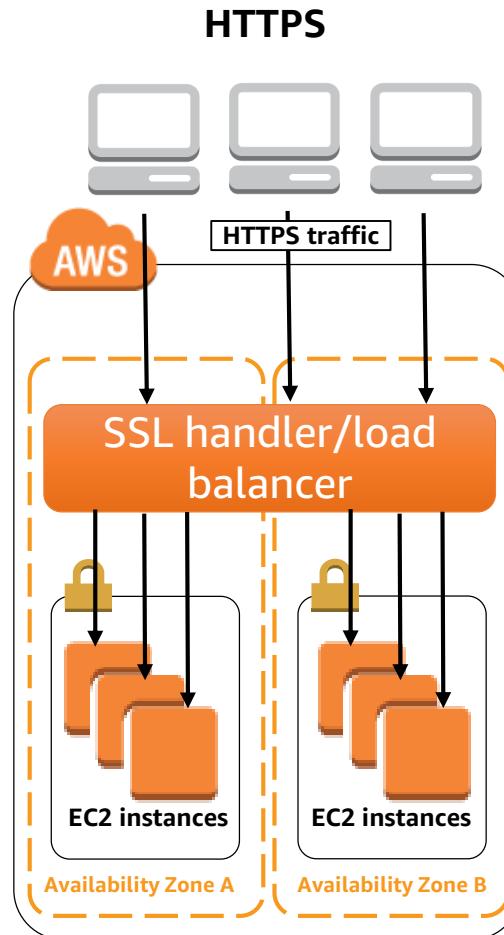
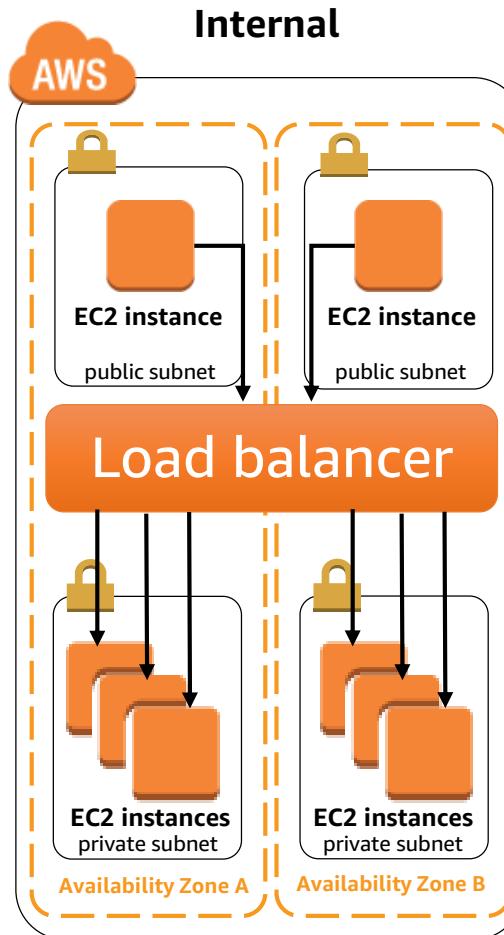
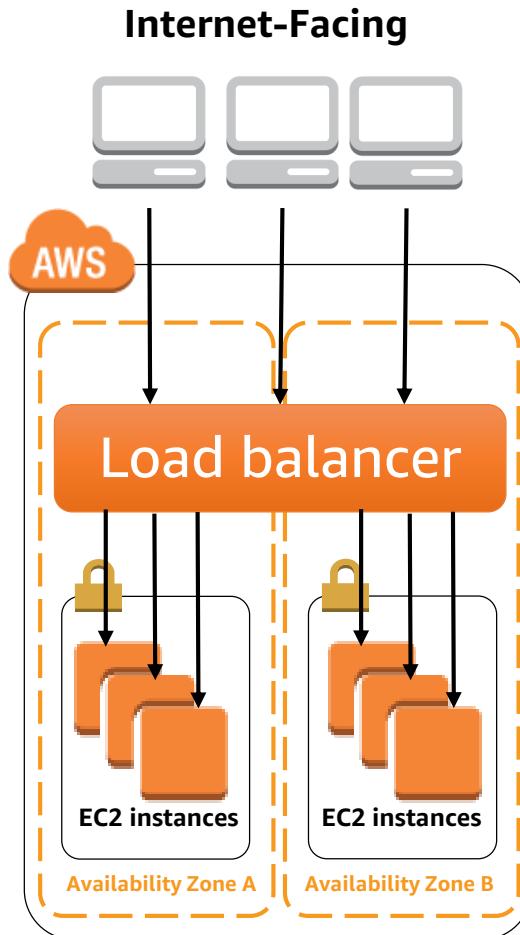
## On Demand Scaling

You create a policy to scale your resources.

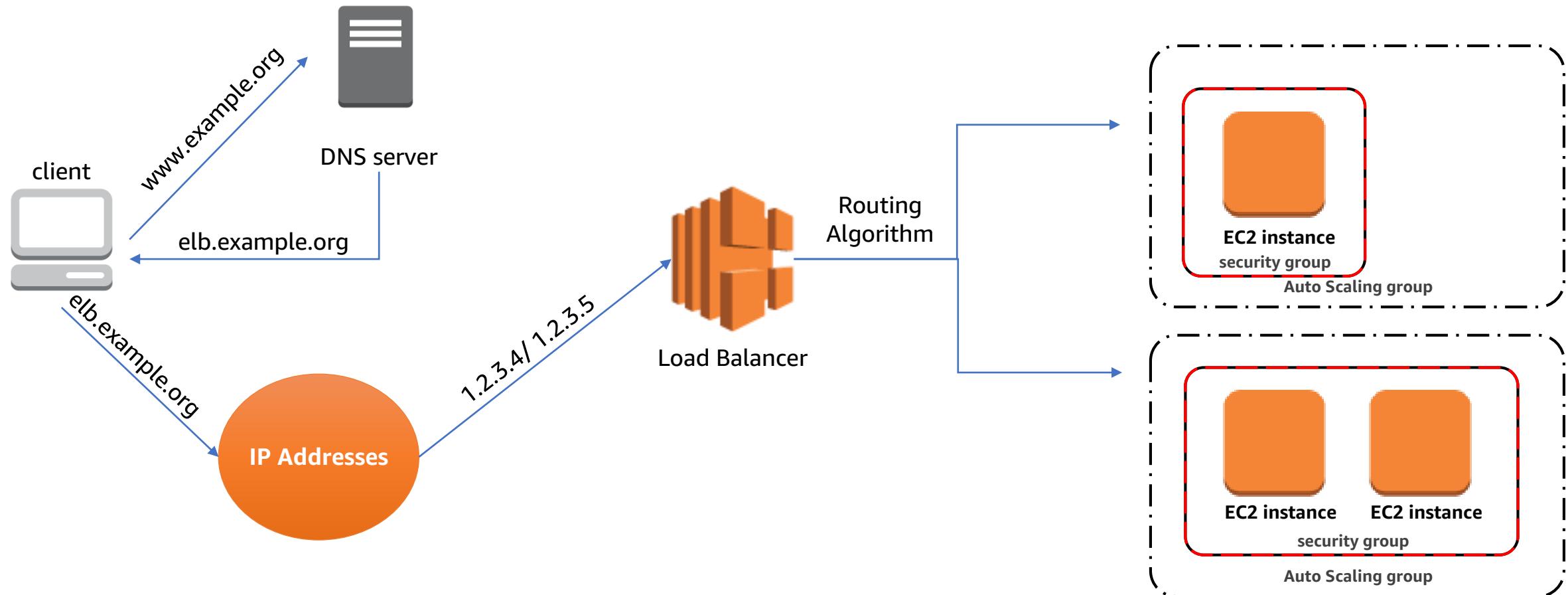
Define when to scale using CloudWatch Alarms.

# Elastic Load Balancing Advanced Concepts

# Load Balancer Types



# Request Routing



- A listener is a process that checks for connection requests.
- Front-end connections are:
  - Client to load balancer connections.
  - Configured with a protocol and a port.
- Back-end connections are:
  - Load balancer to back-end instance connections.
  - Configured with a protocol and a port .
- ELB supported protocols:
  - HTTP
  - HTTPS
  - TCP
  - SSL

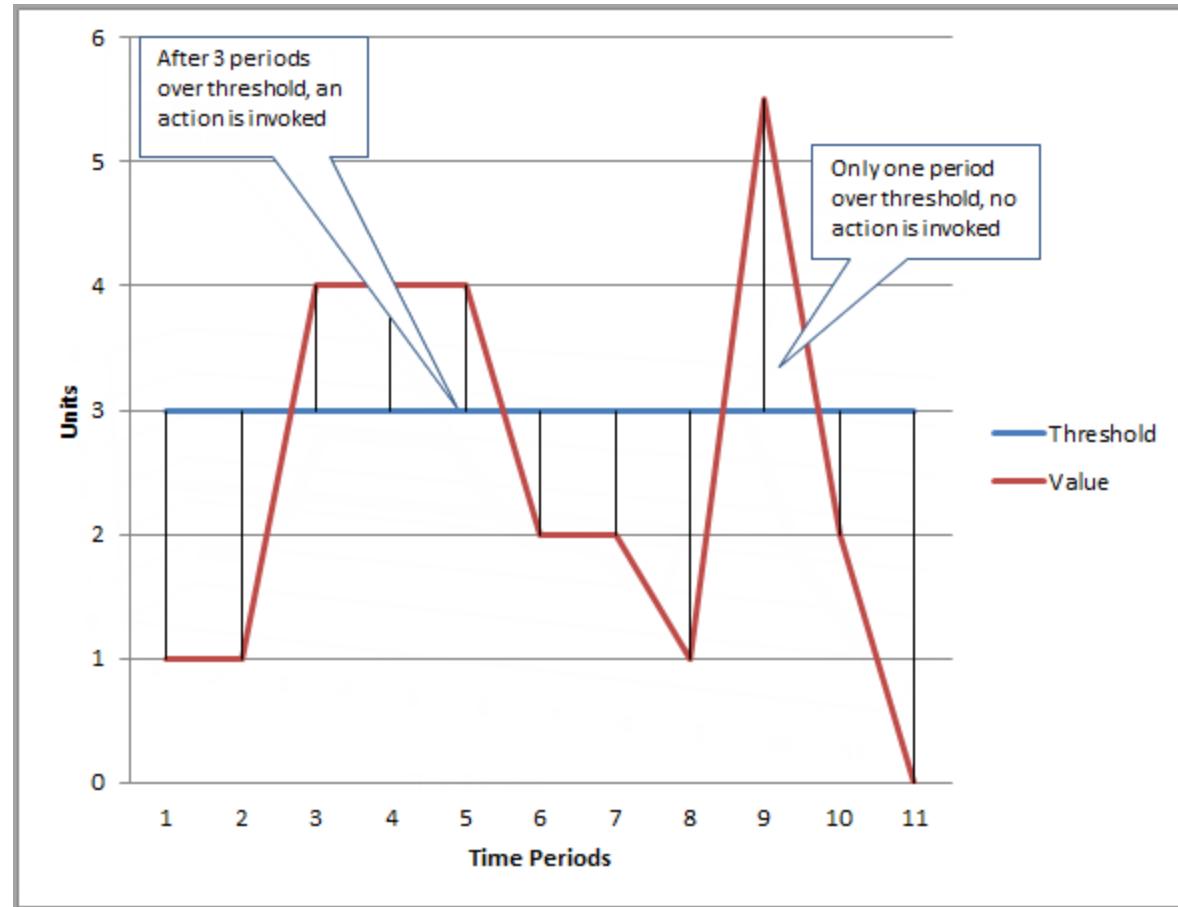
# Back-end Instances for Your Load Balancer



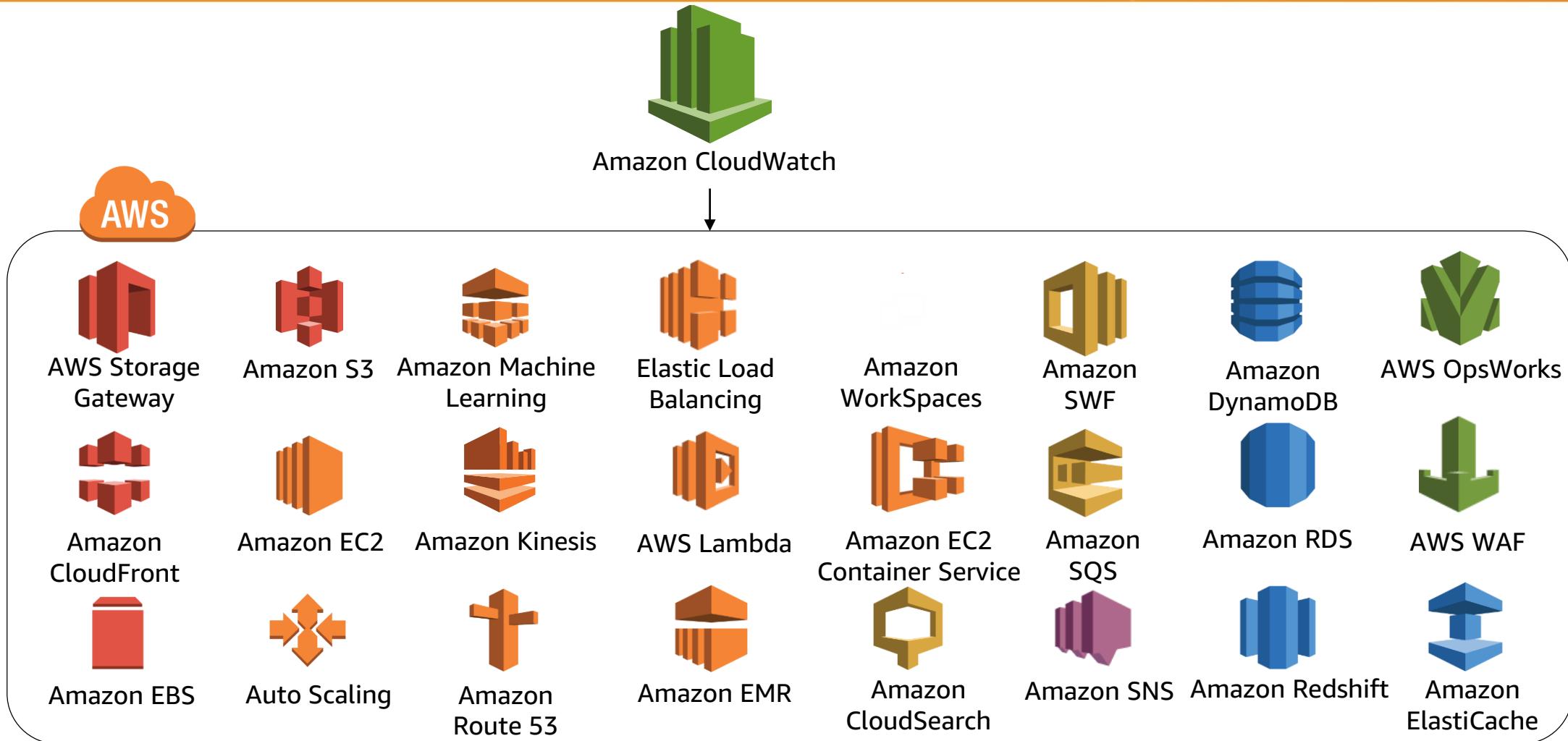
- Health checks
- Security groups
- Subnets
- Register
- De-register instances

# CloudWatch Advanced Concepts

# CloudWatch Alarms



# Supported AWS Services





# Module 6 Appendix

## Course Wrap-Up

# AWS Support

# Case Severity & Response Times



	Critical	Urgent	High	Normal	Low
<b>Enterprise Plan (24 x 7)</b>	15 minutes or less	1 hour or less	4 hours or less	12 hours or less	24 hours or less
<b>Business Plan (24 x 7)</b>		1 hour or less	4 hours or less	12 hours or less	24 hours or less
<b>Developer Plan (Business hours)</b>				12 hours or less	24 hours or less

# Support Pricing

Basic	Developer	Business	Enterprise
Included	\$29/month -or- 3% of monthly AWS spend	Greater of \$100 -or- 10% of monthly AWS usage for the first \$0-\$10K 7% of monthly AWS usage from \$10K-\$80K 5% of monthly AWS usage from \$80K-\$250K 3% of monthly AWS usage over \$250K	Greater of \$15,000 -or- 10% of monthly AWS usage for the first \$0-\$150K 7% of monthly AWS usage from \$150K-\$500K 5% of monthly AWS usage from \$500k-\$1M 3% of monthly AWS usage over \$1M

# Pricing Examples

## Business Pricing Example

- For \$85K in AWS monthly usage:
  - $\$10,000 \times 10\% = \$1,000$
  - (10% of the first \$0 - \$10K of usage)
  
  - $+\ \$70,000 \times 7\% = \$4,900$
  - (7% of usage from \$10K - \$80K)
  
  - $+\ \$5,000 \times 5\% = \$250$
  - (5% of usage from \$80K - \$250K)
  
  - $+\ \$0 \times 3\% = \$0$
  - (3% of usage over \$250K)
  - Total: \$6,500

## Enterprise Pricing Example

- For \$1.2M in AWS monthly usage:
  - $\$150,000 \times 10\% = \$15,000$
  - (10% of the first \$0 - \$150K of usage)
  
  - $+\ \$350,000 \times 7\% = \$24,500$
  - (7% of usage from \$150K - \$500K)
  
  - $+\ \$500,000 \times 5\% = \$25,000$
  - (5% of usage from \$500K - \$1M)
  
  - $+\ \$200,000 \times 3\% = \$6,000$
  - (3% of usage over \$1M)
  - Total: \$70,500



# Thanks for participating!

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