AWSome Day

Getting Started on AWS

Version 4.2

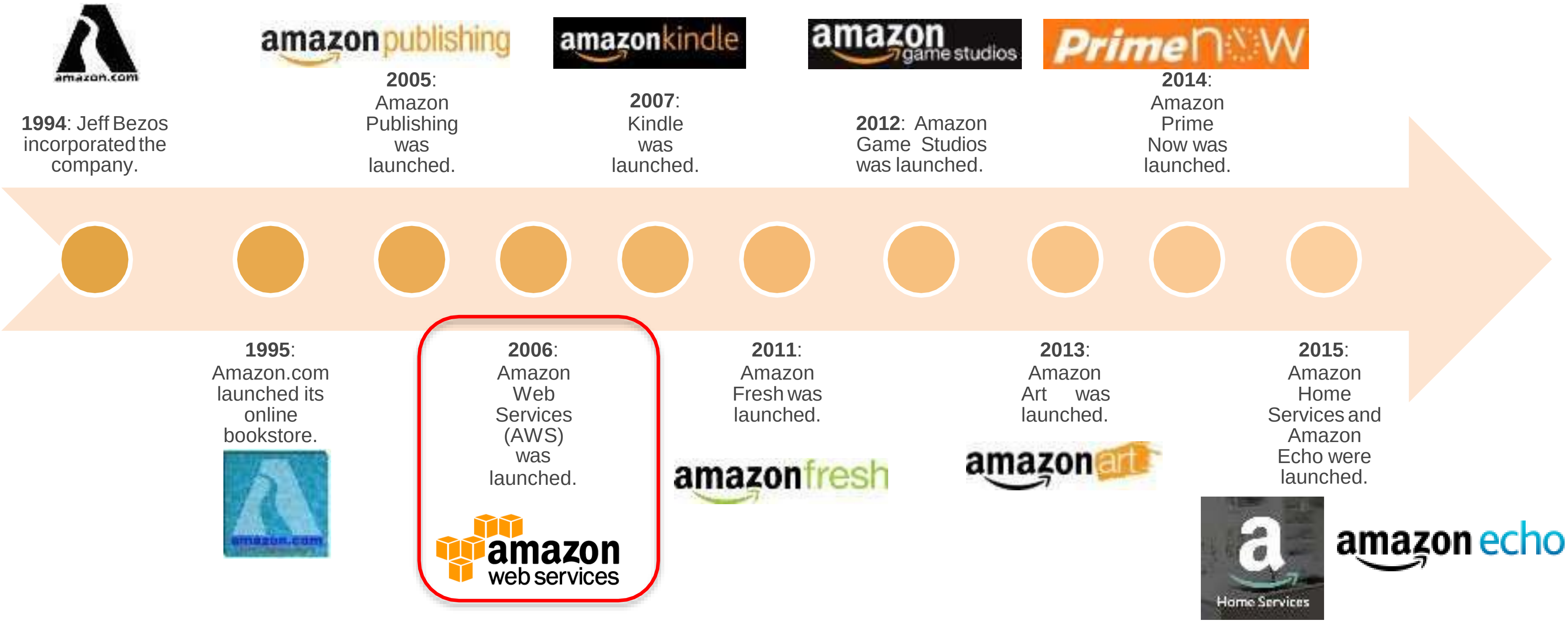
amazon web services | Training and Certification

Module Layout

- Module 1: **Introduction** and History of AWS
- Module 2: **Foundational Services** – Amazon EC2, Amazon VPC, Amazon S3, Amazon EBS
- Module 3: **Security, Identity, and Access Management** - IAM
- Module 4: **Databases** – Amazon DynamoDB and Amazon RDS
- Module 5: **AWS Elasticity and Management Tools** – Auto Scaling, Elastic Load Balancing, Amazon CloudWatch, and AWS Trusted Advisor
- Module 6: Course Wrap-Up

Module 1
Introduction and History of AWS

Amazon History



1994: Jeff Bezos incorporated the company.

1995: Amazon.com launched its online bookstore.

2005: Amazon Publishing was launched.

2006: Amazon Web Services (AWS) was launched.

2007: Kindle was launched.

2011: Amazon Fresh was launched.

2012: Amazon Game Studios was launched.

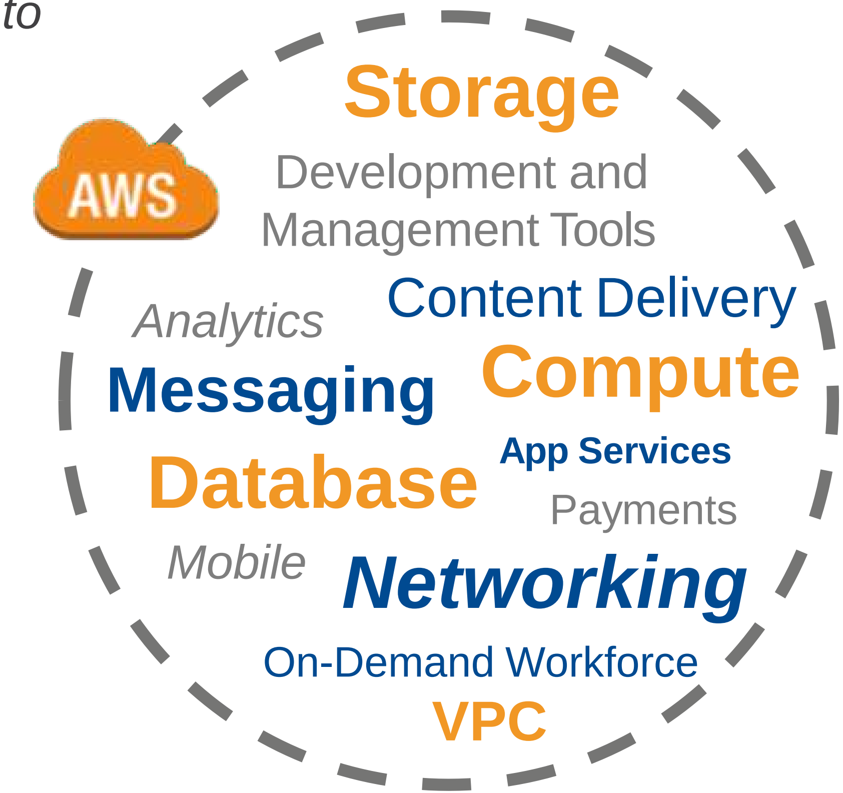
2013: Amazon Art was launched.

2014: Amazon Prime Now was launched.

2015: Amazon Home Services and Amazon Echo were launched.

Amazon Web Services (AWS)

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



Storage

Development and Management Tools

Content Delivery

Analytics

Messaging

Compute

App Services

Database

Payments

Mobile

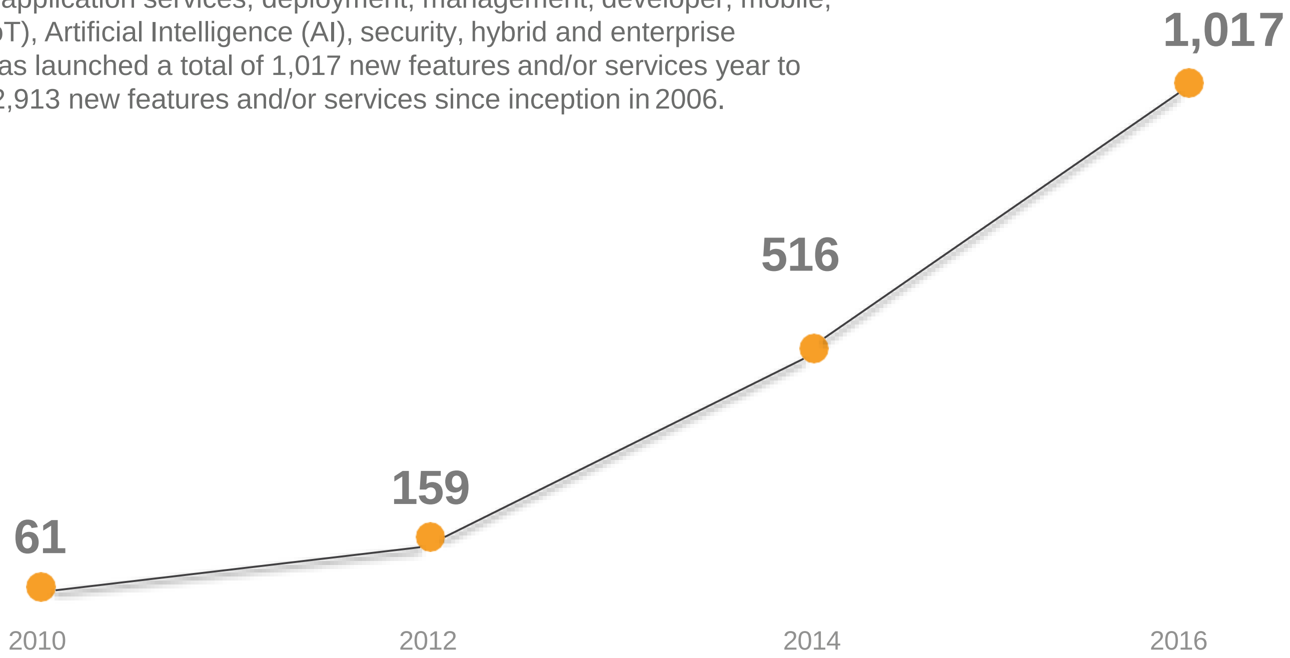
Networking

On-Demand Workforce

VPC

AWS Pace of Innovation

AWS has been continually expanding its services to support virtually any cloud workload, and it now has more than 90 services that range from compute, storage, networking, database, analytics, application services, deployment, management, developer, mobile, Internet of Things (IoT), Artificial Intelligence (AI), security, hybrid and enterprise applications. AWS has launched a total of 1,017 new features and/or services year to date* - for a total of 2,913 new features and/or services since inception in 2006.



*As of 1 January 2017

GovCloud

Import/Export Snowball

AWS Storage Gateway

Amazon Cognito

AWS OpsWorks

CodeCommit

EC2 Container Service

AWS CodeDeploy

Amazon ElastiCache

Amazon Config

Amazon CloudTrail

Amazon SES

Amazon Kinesis

CloudHSM

Elasticsearch Service

AWS Elastic Beanstalk

Elastic Transcoder

EC2 Container Registry

Amazon WorkMail

AWS Certificate Manager

AWS CodePipeline

Amazon EFS

Amazon Route 53

Redshift

2,913

Lambda

Identity & Access Management

AWS CloudFormation

Amazon AppStream

AWS Device Farm

Dynamo DB

QuickSight

Directory Service

Amazon RDS for Aurora

AWS Data Pipeline

AWS WAF

Amazon SWF

RDS for MariaDB

AWS Mobile Hub

Amazon SNS

Amazon API Gateway

AWS KMS

WorkSpaces

CloudSearch

WorkDocs

AWS IoT

CloudWatch Logs

Mobile Analytics

Glacier

Amazon Machine Learning

AWS Direct Connect

AWS Service Catalog

AWS Import/Export

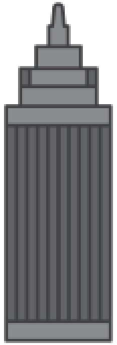
Amazon Inspector

*As of 1 January 2017

AWS Customers

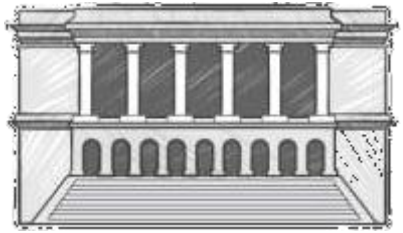
Enterprise Customers

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



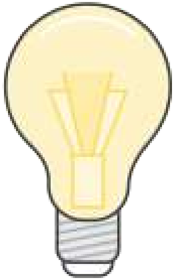
Public Sector

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.

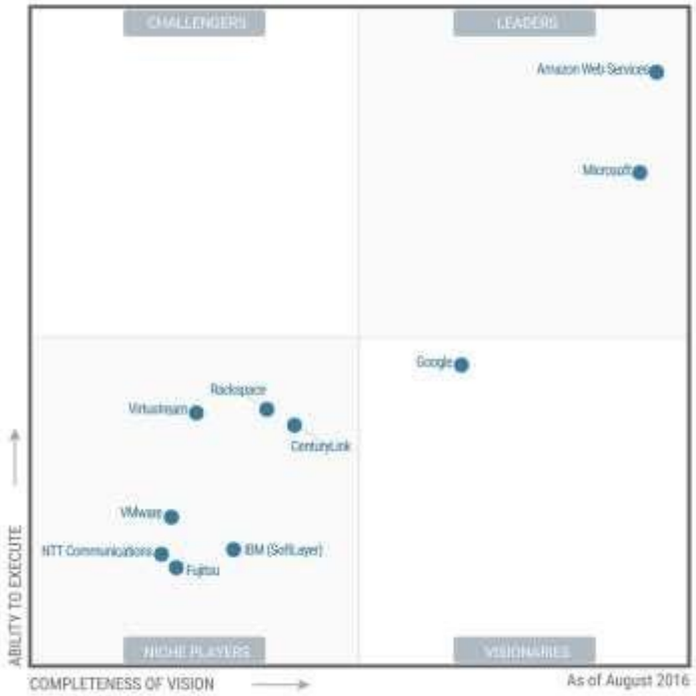
Stop spending money on running and maintaining data centers.

Go global in minutes.

AWS Positioned as a Leader in the Gartner Magic Quadrant for Cloud Infrastructure as a Service, Worldwide*

AWS is positioned highest in execution and furthest in vision within the Leaders Quadrant

Figure 1. Magic Quadrant for Cloud Infrastructure as a Service, Worldwide



Source: Gartner (August 2016)

*Gartner, Magic Quadrant for Cloud Infrastructure as a Service, Worldwide, Leong, Lydia, Petri, Gregor, Gill, Bob, Dorosh, Mike, August 32016

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http://www.gartner.com/doc/reprints?id=1-2G2O5FC&ct=150519&st=sb
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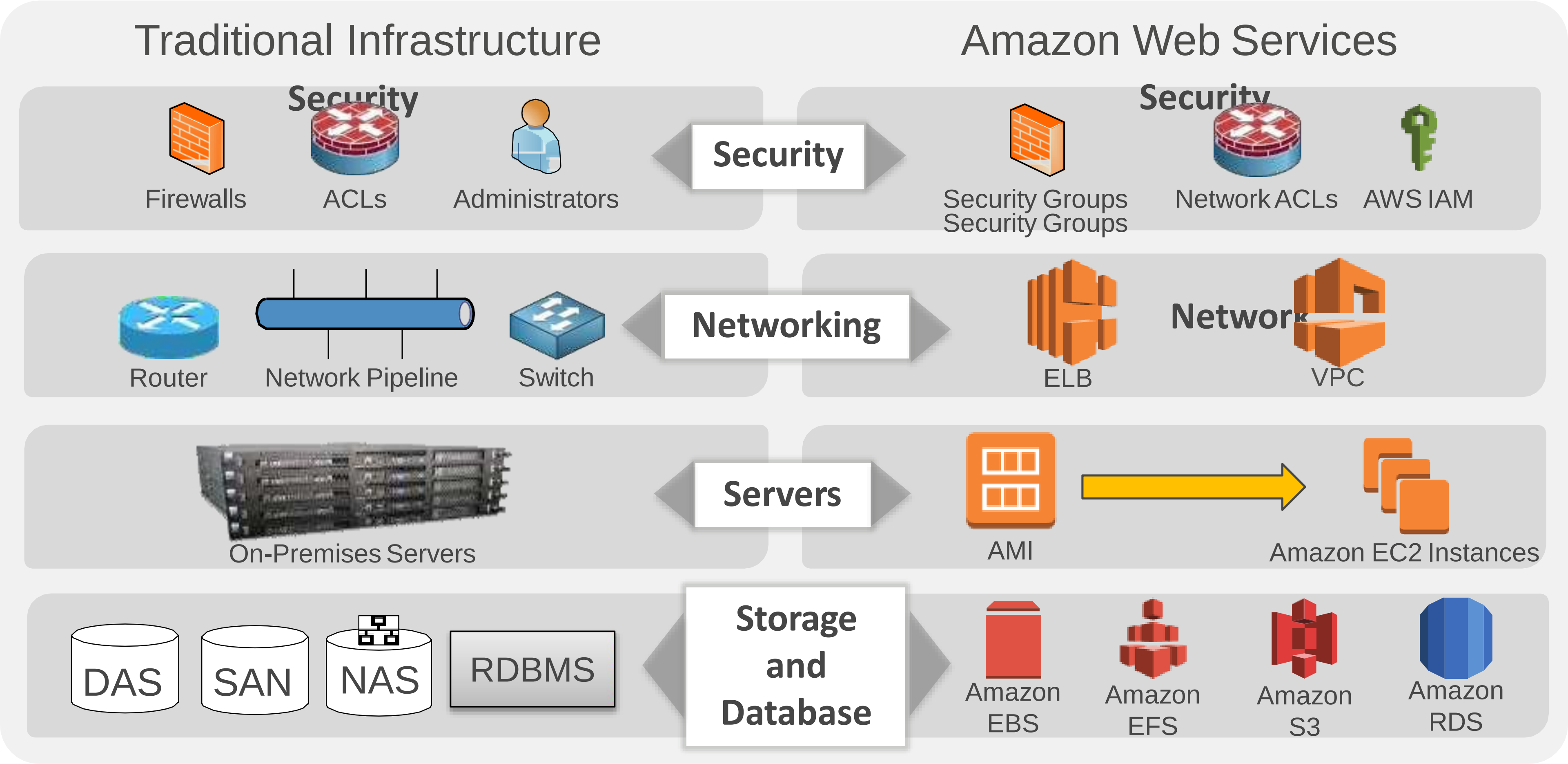
AWS Core Infrastructure and Services



Traditional Infrastructure

Amazon Web Services

Security

Firewalls

ACLs

Administrators

Security

Security

Security Groups
Security Groups

Network ACLs

AWS IAM

Router

Network Pipeline

Switch

Networking

ELB

Network

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 Foundation Services

Compute

- Amazon EC2
- Amazon EC2 Container Registry
- Amazon EC2 Container Service
- Amazon Lightsail
- Amazon VPC
- AWS Batch
- AWS Elastic Beanstalk
- AWS Lambda
- Elastic Load Balancing

Network

- Amazon CloudFront
- Amazon Route 53
- Amazon VPC
- AWS Direct Connect
- Elastic Load Balancing

Storage

- Amazon EFS
- Amazon Glacier
- Amazon S3
- AWS Snowball
- AWS Storage Gateway

Security & Identity

- Amazon Inspector
- AWS Artifact
- AWS Certificate Manager
- AWS CloudHSM
- AWS Directory Service
- IAM
- AWS KMS
- AWS Organizations
- AWS Shield
- AWS WAF

Applications

- Amazon WorkDocs
- Amazon WorkMail
- Amazon AppStream
- Amazon WorkSpaces

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AWS Platform Services

Databases

- Amazon DynamoDB
- Amazon ElastiCache
- Amazon RDS
- Amazon Redshift

Analytics

- Amazon Athena
- Amazon CloudSearch
- Amazon EMR
- Amazon ES
- Amazon Kinesis
- Amazon QuickSight
- Amazon Redshift

Application Services

- Amazon API Gateway
- Amazon AppStream 2.0
- Amazon Elastic Transcoder
- Amazon SWF
- AWS Step Functions

Management Tools

- Amazon CloudWatch
- AWS CloudFormation
- AWS CloudTrail
- AWS Config
- AWS Managed Services
- AWS OpsWorks
- AWS Service Catalog
- AWS Trusted Advisor

Developer Tools

- AWS CodeBuild
- AWS CodeCommit
- AWS CodeDeploy
- AWS CodePipeline
- AWS X-Ray

Mobile Services

- Amazon API Gateway
- Amazon Cognito
- Amazon Mobile Analytics
- Amazon Pinpoint
- AWS Device Farm
- AWS Mobile Hub

Internet of Things

- AWS IoT
- AWS Greengrass

AWS Global Infrastructure

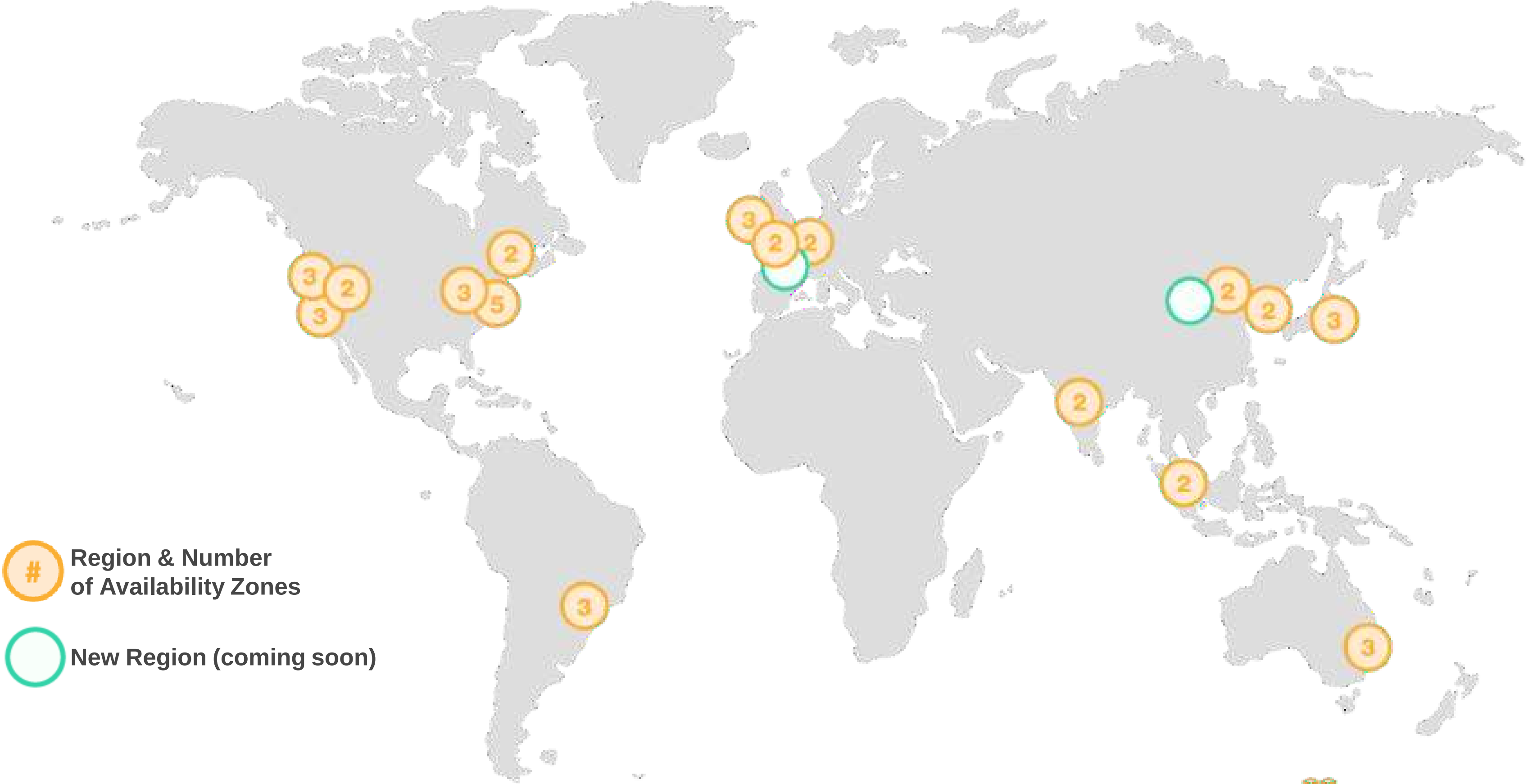
Regions

- 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



● Region & Number of Availability Zones

○ New Region (coming soon)

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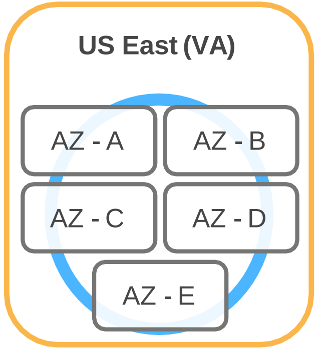
AWS Global Infrastructure

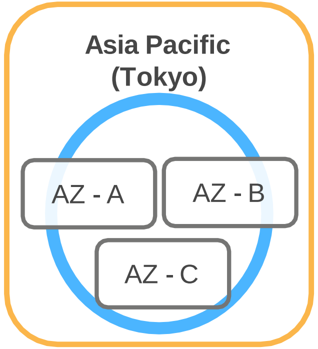
At least 2 Availability Zones per region.

Examples:

- US East (N. Virginia)
  - us-east-1a
  - us-east-1b
  - us-east-1c
  - us-east-1d
  - us-east-1e



- Asia Pacific (Tokyo)
  - ap-northeast-1a
  - ap-northeast-1b
  - ap-northeast-1c



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

AWS Global Infrastructure – Edge Locations

- 70* edge locations
- Local points of presence that support AWS services like:

Amazon Route 53

Amazon CloudFront

AWS WAF

AWS Shield

*as of March 2017

Module 2
AWS Foundational Services

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Module 2 Layout

- Amazon Elastic Compute Cloud (EC2)
- Amazon Virtual Private Cloud (VPC)
- Amazon Storage Services
    - Amazon Simple Storage Service (S3)
    - Amazon Elastic Block Store (EBS)

Amazon Elastic Compute Cloud (EC2)

Amazon Elastic Compute Cloud (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

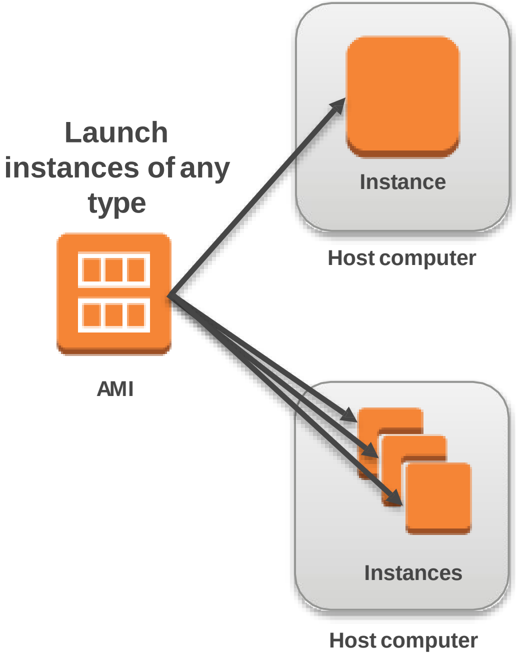
Launching an Amazon EC2 Instance via the Management Console

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

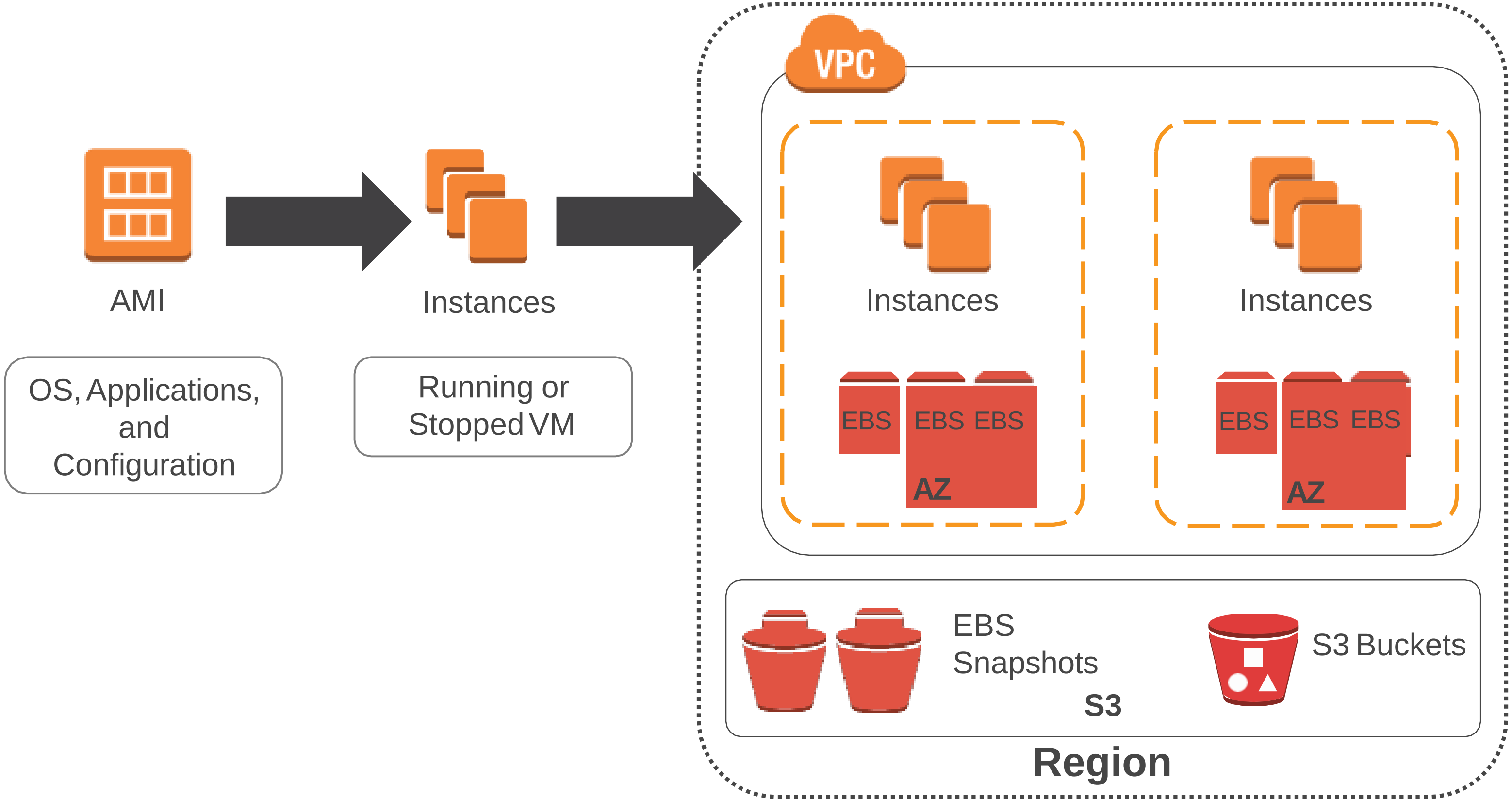
Instances and AMIs

Select an AMI based on:

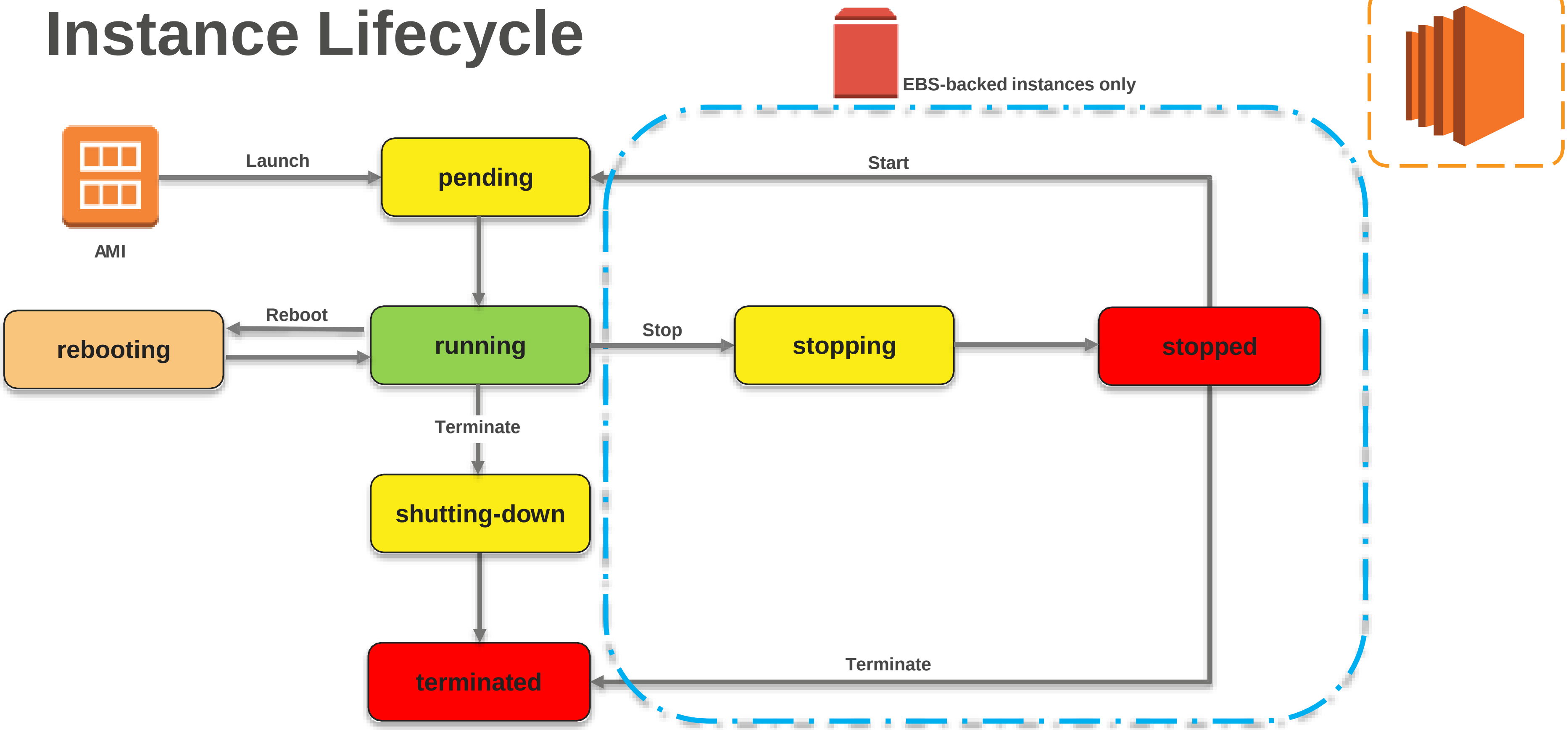
- Region
- Operating system
- Architecture (32-bit or 64-bit)
- Launch permissions
- Storage for the root device



Amazon EC2 Instances



Instance Lifecycle

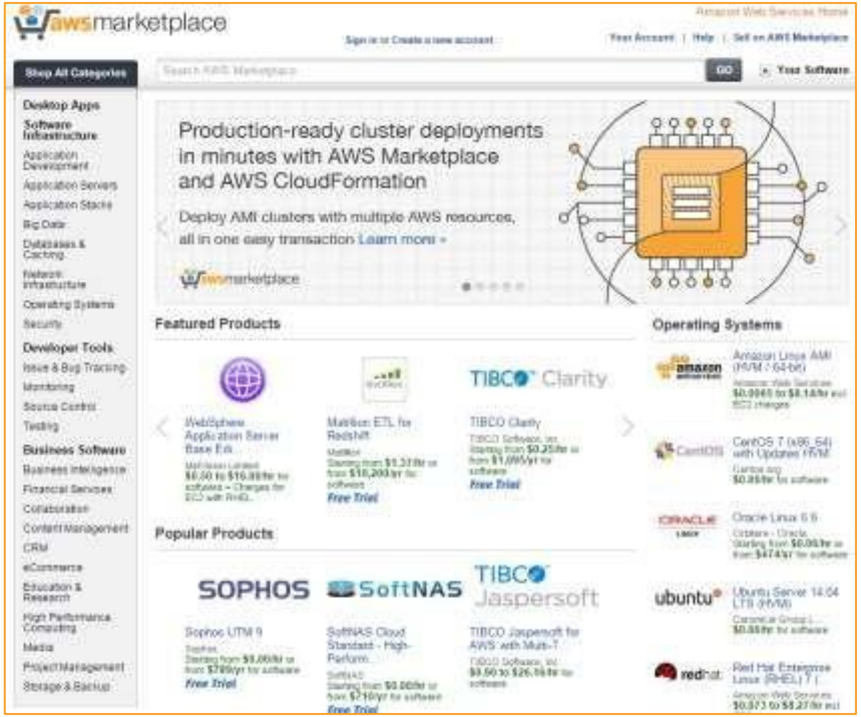


AWS Marketplace – IT Software Optimized for the Cloud

- Online store to discover, purchase, and deploy IT software on top of the AWS infrastructure.
- Catalog of **2700+** IT software solutions including 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.

https://aws.amazon.com/marketplace



Production-ready cluster deployments in minutes with AWS Marketplace and AWS CloudFormation

Deploy AMI clusters with multiple AWS resources, all in one easy transaction Learn more »

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Free Trial

TIBCO Jaspersoft for AWS with Multi-T...
TIBCO Software, Inc.
$0.50 to $26.09/hr for software

Operating Systems

Amazon Linux AMI (HVM / 64-bit)
Amazon Web Services
$0.0065 to $8.14/hr incl EC2 charges

CentOS 7 (x86_64) with Updates HVM
Centos.org
$0.00/hr for software

Oracle Linux 6.6
Orbitera - Oracle
Starting from $0.06/hr or from $474/yr for software

Ubuntu Server 14.04 LTS (HVM)
Canonical Group L...
$0.00/hr for software

Red Hat Enterprise Linux (RHEL) 7 (...
Amazon Web Services
$0.073 to $8.27/hr incl

Choosing the Right Amazon EC2 Instance

AWS uses Intel® Xeon® processors to provide customers with high performance and value. EC2 instance types are optimized for different use cases, workload requirements and come in multiple sizes.

Consider the following when choosing your instances:

- Core count
- Memory size
- Storage size and type
- Network performance
- CPU technologies

X1 Instance - Tons of Memory

The X1 instance:

- Features up to 2TB of memory and 100 vCPU.
- Uses Intel E7 v3 Haswell processors.
- Is designed for demanding enterprise workloads, including production installations of SAP HANA, Microsoft SQL Server, Apache Spark, and Presto.

Current Generation Instances

Instance Family	Some Use Cases
General purpose (t2, m4, m3)	• Low-traffic websites and web applications • Small databases and mid-size databases
Compute-optimized (c4, c3)	• High performance front-end fleets • Video-encoding
Memory-optimized (r3)	• High performance databases • Distributed memory caches
Storage-optimized (i2, d2)	• Data warehousing • Log or data-processing applications
GPU instances (g2)	• 3D application streaming • Machine learning

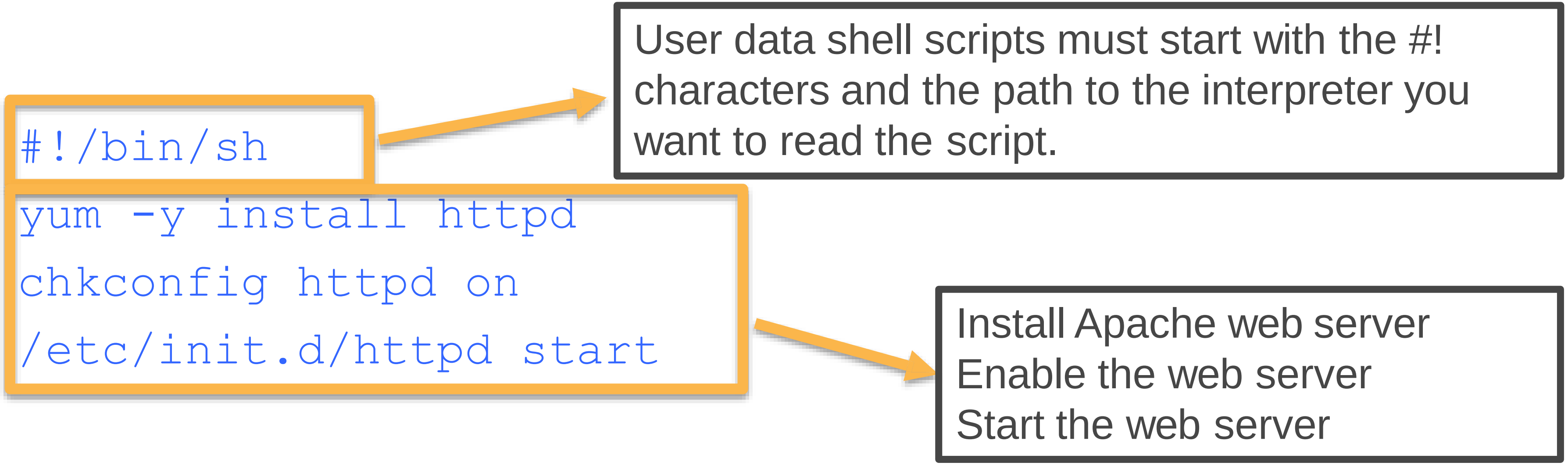
Instance Metadata

- Is **data** about your **instance**.
- Can be used to **configure or manage** a running instance.

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.

User Data Example Linux



```
#!/bin/sh
yum -y install httpd
chkconfig httpd on
/etc/init.d/httpd start
```

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

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

User Data Example Windows

```
<powershell>
Import-Module ServerManager

Install-WindowsFeature web-server, web-webserver
Install-WindowsFeature web-mgmt-tools
</powershell>
```

Import the Server Manager module for Windows PowerShell.

Install IIS
Install Web Management Tools

Amazon EC2 Purchasing Options

On-Demand Instances

Pay by the **hour**.

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.

Networking
Amazon VPC

Amazon Virtual Private Cloud (VPC)

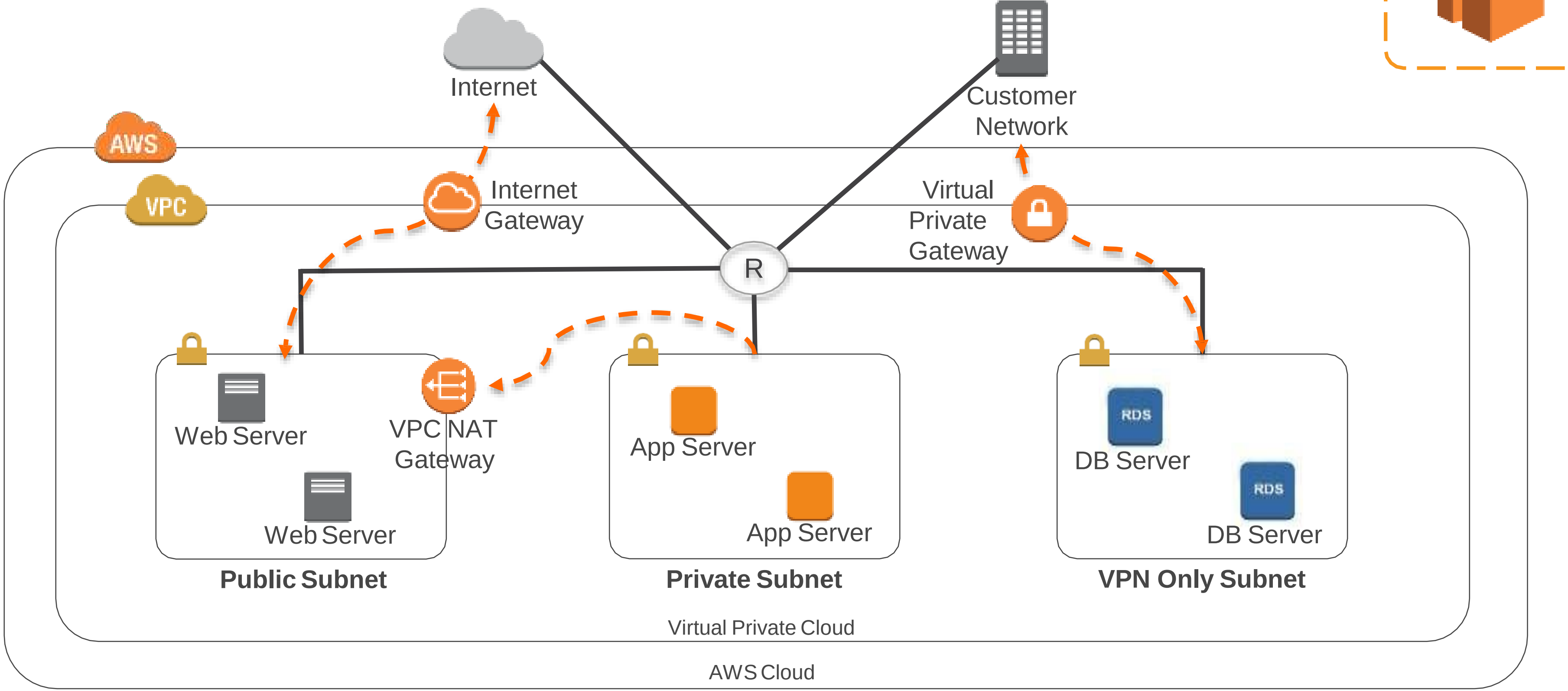
Amazon VPC

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

VPCs and Subnets

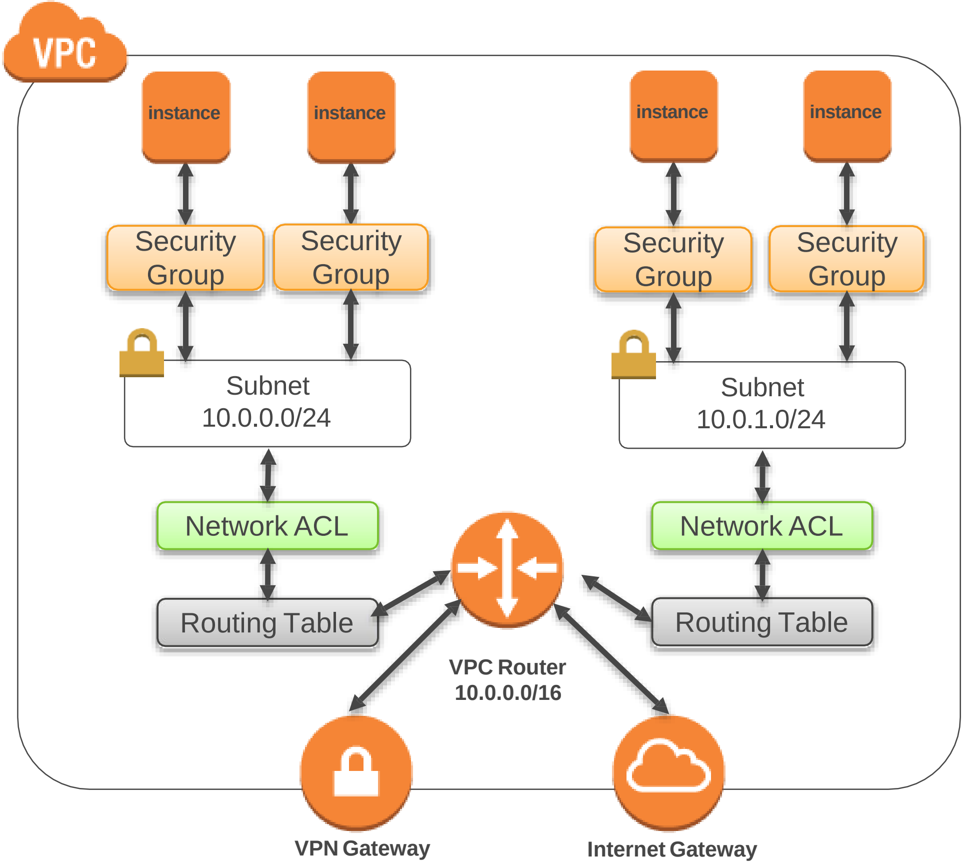
- A **subnet** defines a range of IP addresses in your VPC.
- You can launch AWS resources into a subnet that you select.
- A **private subnet** should be used for resources that won’t be accessible over the Internet.
- A **public subnet** should be used for resources that will be accessed over the Internet.
- 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 **dedicated private** connection from a remote network to your VPC.
AWS **VPN** CloudHub	You can create multiple **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 VPN appliance**.

Storage Services
Amazon S3 and Amazon EBS

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

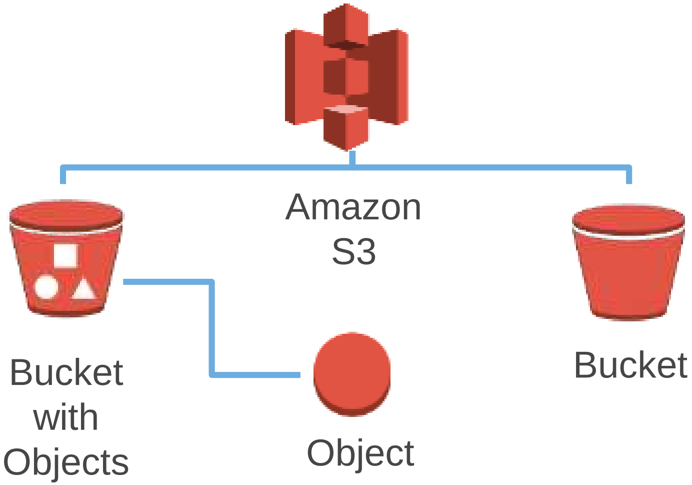
Amazon S3 Facts

- Can store an **unlimited number of objects** in a bucket
- Objects can be **up to 5 TB**; no bucket size limit
- Designed for **99.999999999%** 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
- Is 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

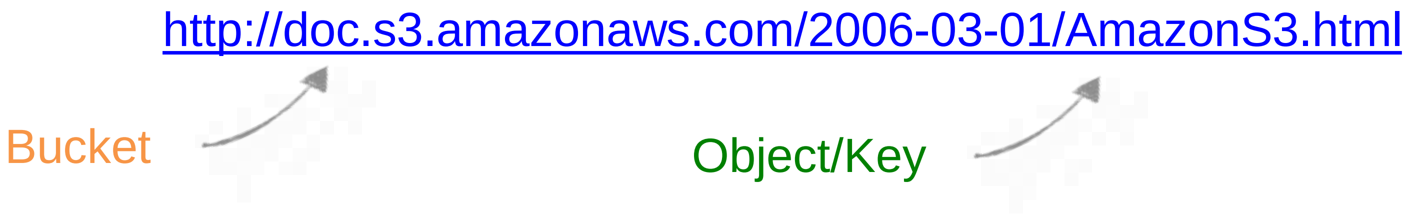
Amazon S3 Concepts



- 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 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 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 Glacier

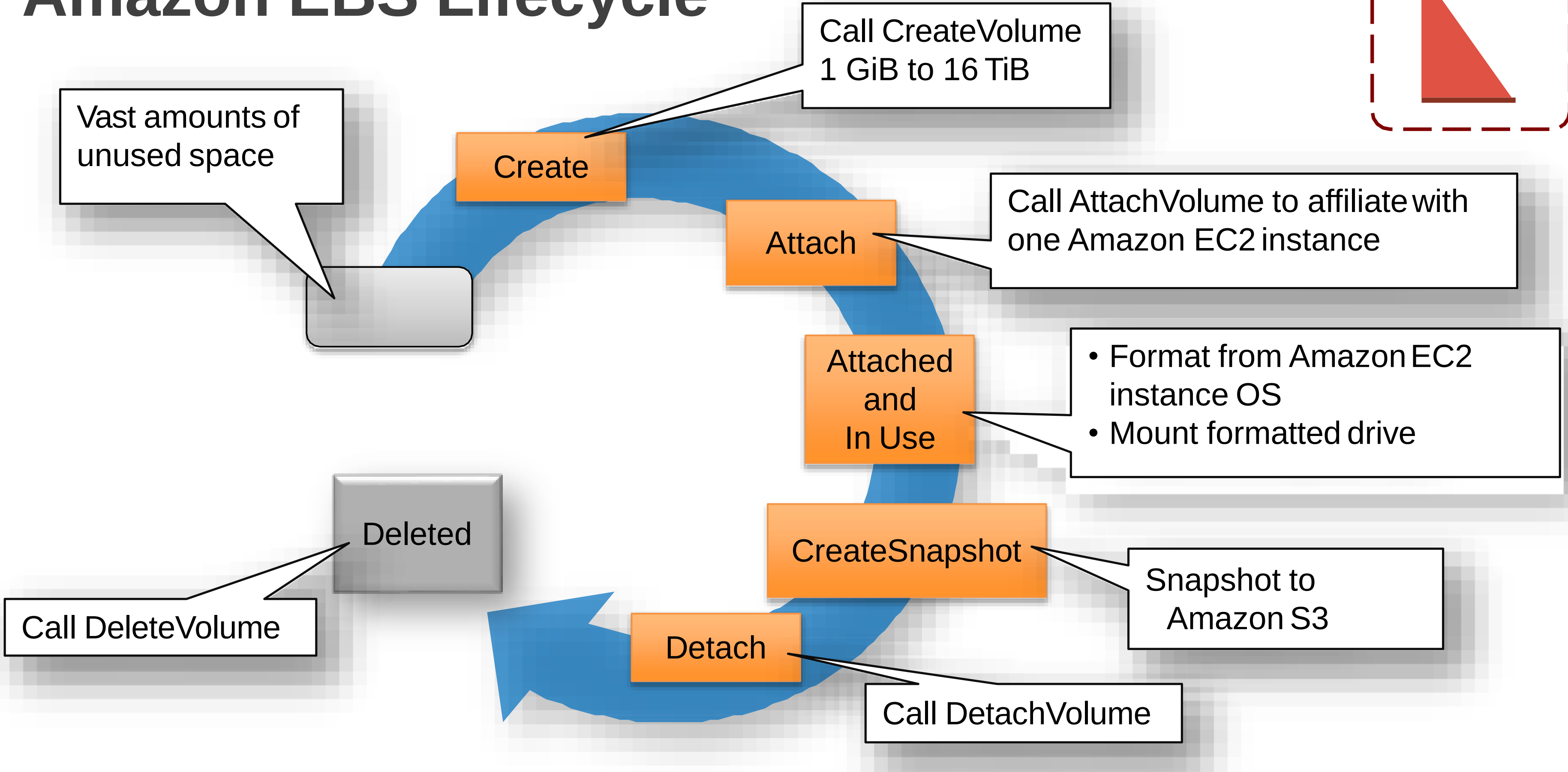
- Long term low-cost archiving service
- Optimal for infrequently accessed data
- Designed for 99.999999999% durability
- Three to five hours’ retrieval time*
- Less than $0.004 per GB/month (depending on region)

Amazon Elastic Block Store (EBS)

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



Vast amounts of unused space

Call CreateVolume
1 GiB to 16 TiB

Call AttachVolume to affiliate with one Amazon EC2 instance

- Format from Amazon EC2 instance OS
- Mount formatted drive

Snapshot to Amazon S3

Call DetachVolume

Call DeleteVolume

Amazon EBS Volume Types

- SSD-backed volumes are
  - Optimized for **transactional** workloads that involve **frequent read/write** operations with **small I/O** size.
  - Dominant in **IOPS** performance.
- HDD-backed volumes are
  - Optimized for **large streaming** workloads.
  - Dominant in **throughput** (measured in 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

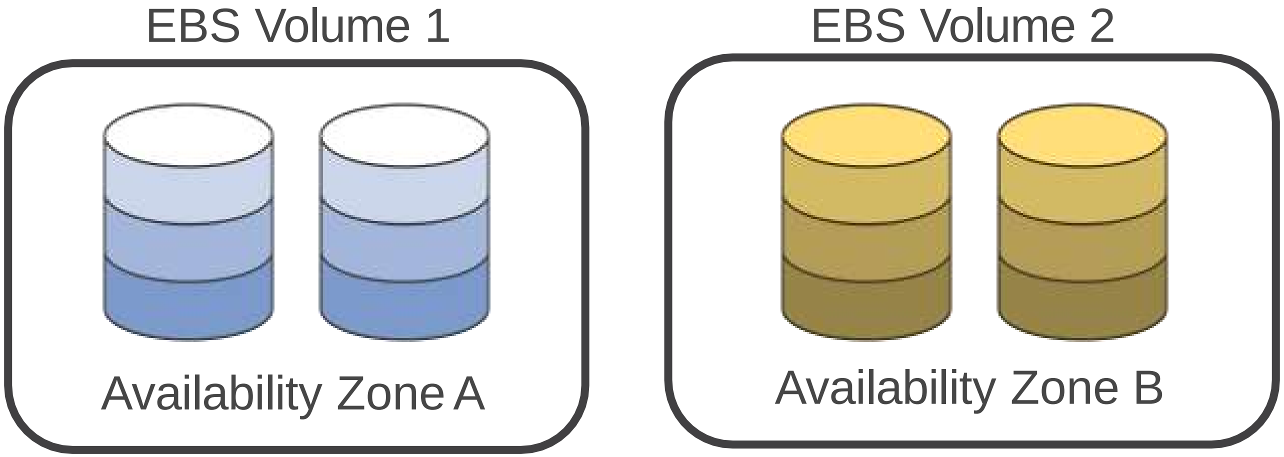
Pay for what you provision:

- 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

Availability Zone A

EBS Volume 2

Availability Zone B

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

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**.
- A**utomatically 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**.

Module 3
Security, Identity, and Access Management

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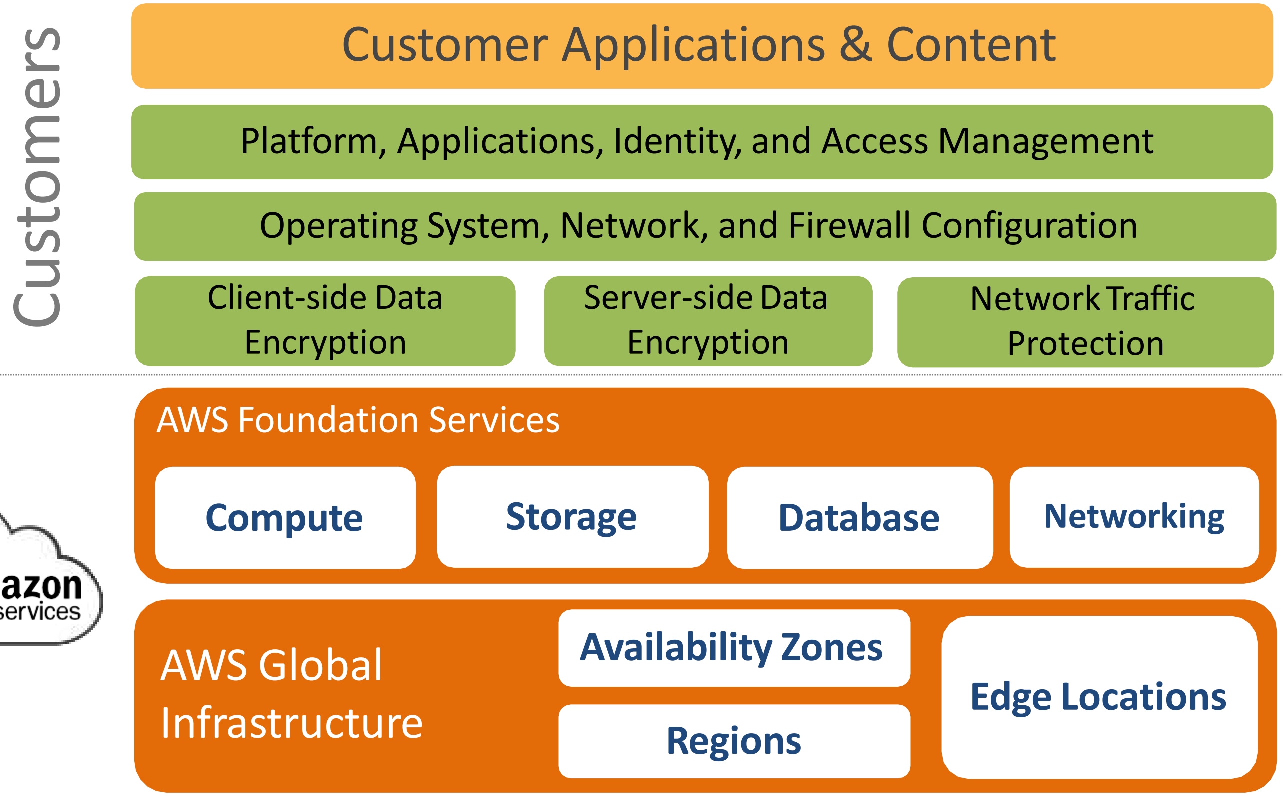
AWS Shared Responsibility Model



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

AWS Foundation Services

Compute

Storage

Database

Networking

AWS Global Infrastructure

Availability Zones

Regions

Edge Locations

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

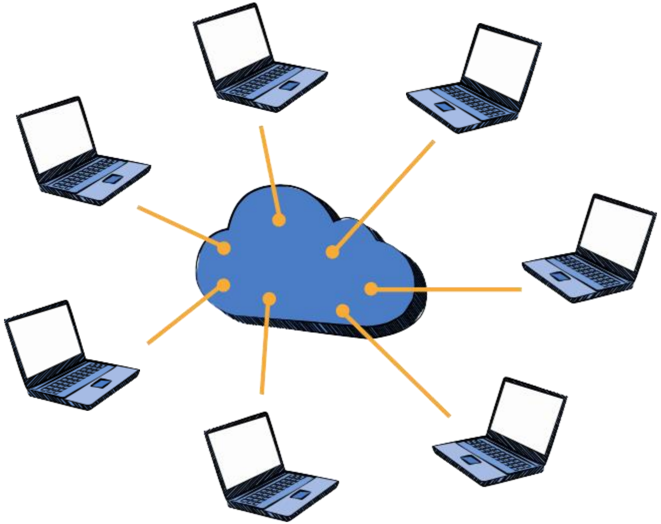
AWS is responsible for the security **OF** the cloud

Physical Security

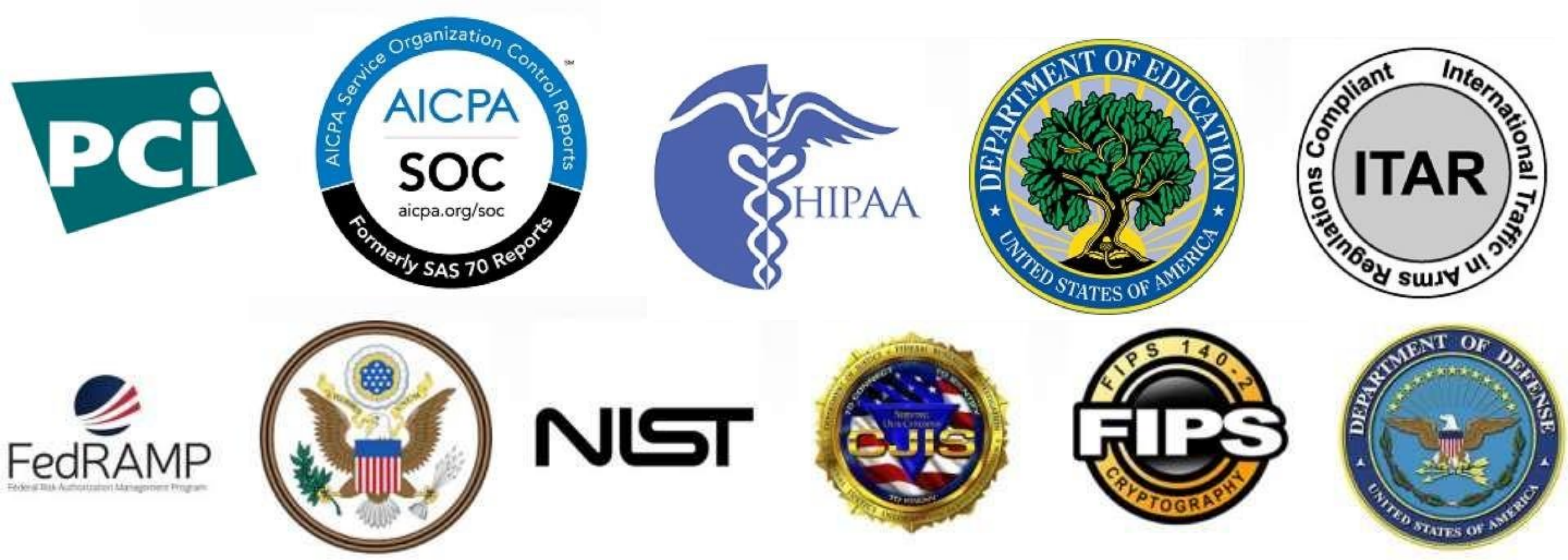
- 24/7 trained **security staff**
- AWS data centers in **nondescript** and **undisclosed** facilities
- **Two-factor authentication** for authorized staff
- **Authorization** for data center access

Hardware, Software, and Network

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



Certifications and Accreditations



ISO 9001, ISO 27001, ISO 27017, ISO 27018, IRAP (Australia), MLPS Level 3 (China), MTCS Tier 3 Certification (Singapore) and more …

SSL Endpoints

SSL Endpoints	Security Groups	VPC
Secure Transmission	**Instance Firewalls**	**Network Control**
Use secure endpoints to establish secure communication sessions (HTTPS).	Use security groups to configure firewall rules for instances.	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	Security Groups	VPC
Secure Transmission	**Instance Firewalls**	**Network Control**
Use secure endpoints to establish secure communication sessions (HTTPS).	Use security groups to configure firewall rules for instances.	Use public and private subnets, NAT, and VPN support in your virtual private cloud to create low-level networking constraints for resource access.

Amazon Virtual Private Cloud (VPC)

SSL Endpoints

Secure Transmission

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

Security Groups

Instance Firewalls

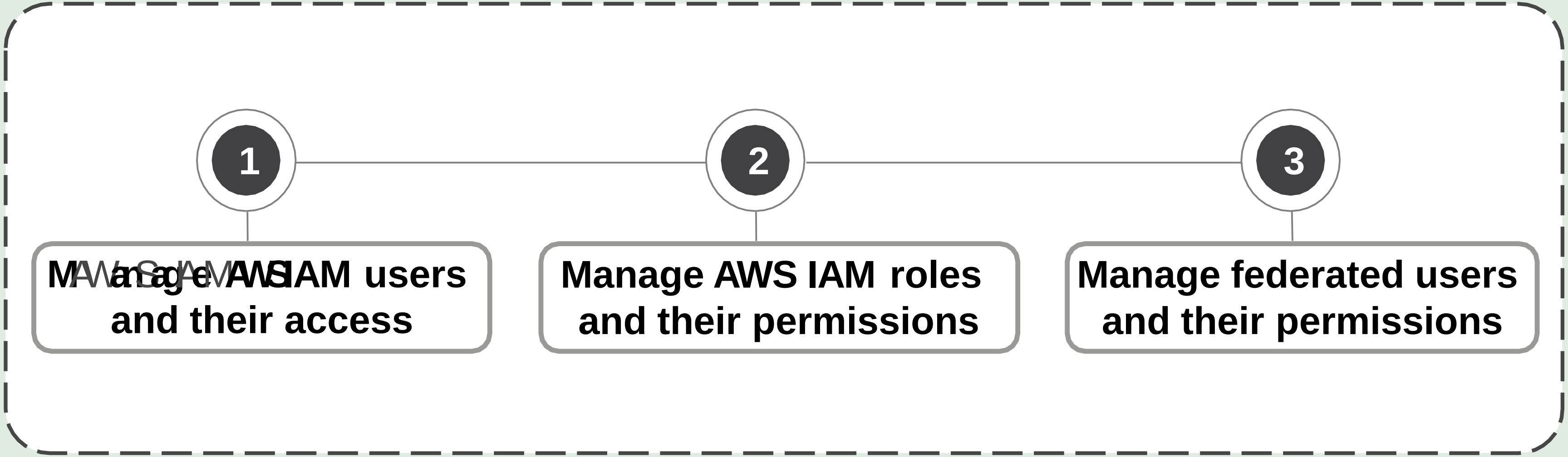
Use security groups to configure firewall rules for instances.

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 (IAM)

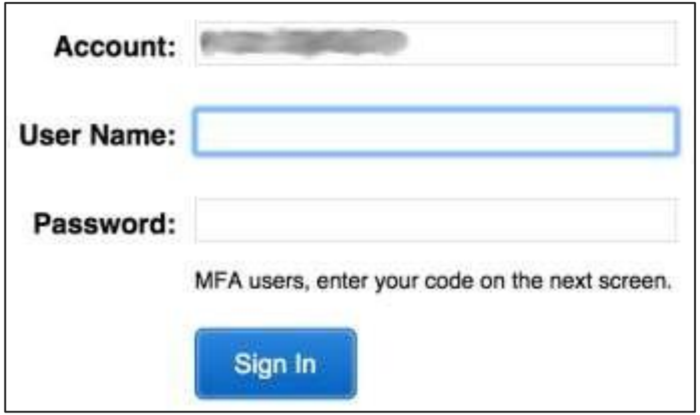


1. Manage AWS IAM users and their access
2. Manage AWS IAM roles and their permissions
3. Manage federated users and their permissions

AWS IAM Authentication

- **Authentication**
- **AWS Management Console**
  - User Name and Password

IAM User



Account:	[redacted]
User Name:	
Password:	

MFA users, enter your code on the next screen.

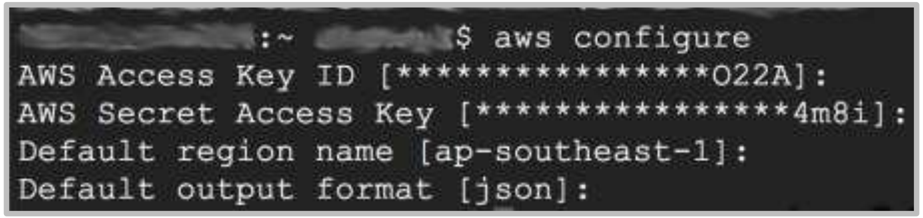
AWS IAM Authentication

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

IAM User

```
Access Key ID: AKIAIOSFODNN7EXAMPLE
Secret Access Key: wJalrXUtnFEMI/K7MDENG/bPxRfiCYEXAMPLEKEY
```

AWS CLI



```
[redacted]:~ [redacted]$ aws configure
AWS Access Key ID [****************O22A]:
AWS Secret Access Key [****************4m8i]:
Default region name [ap-southeast-1]:
Default output format [json]:
```

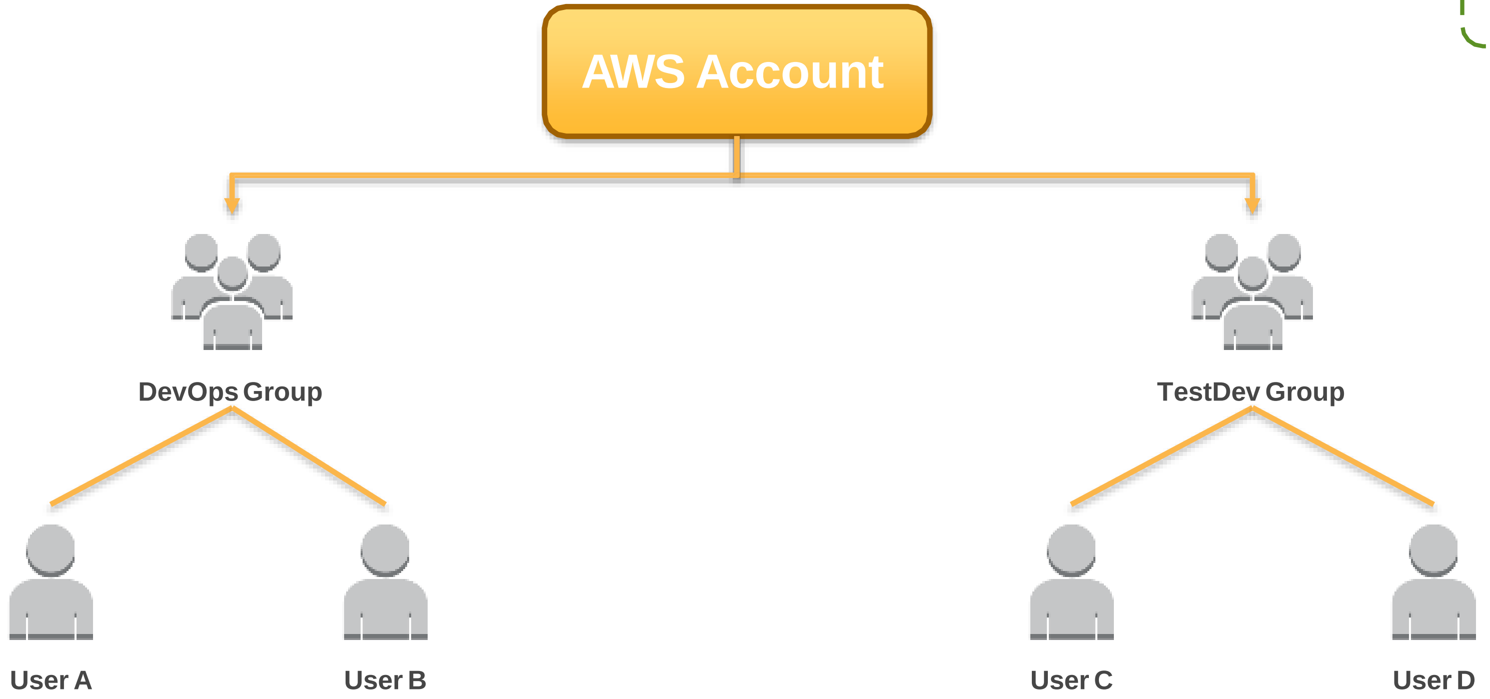
AWS SDK & API

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.

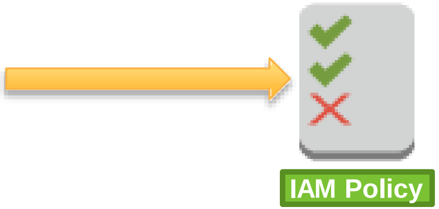
IAM User

IAM Group

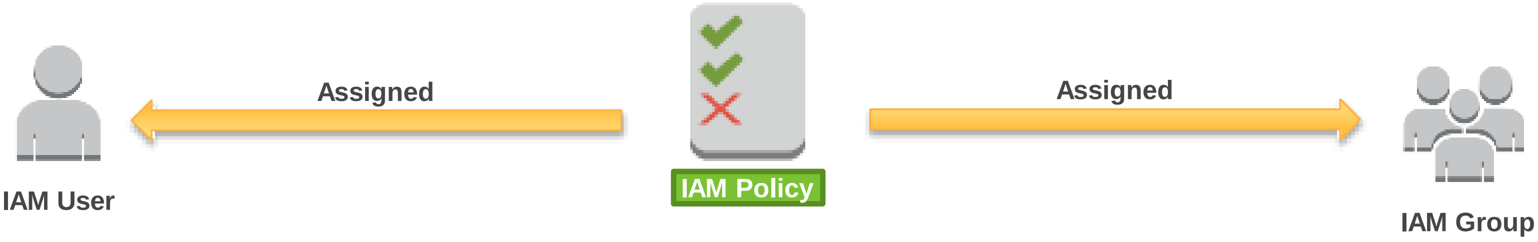
IAM Roles

AWS IAM Policy Elements

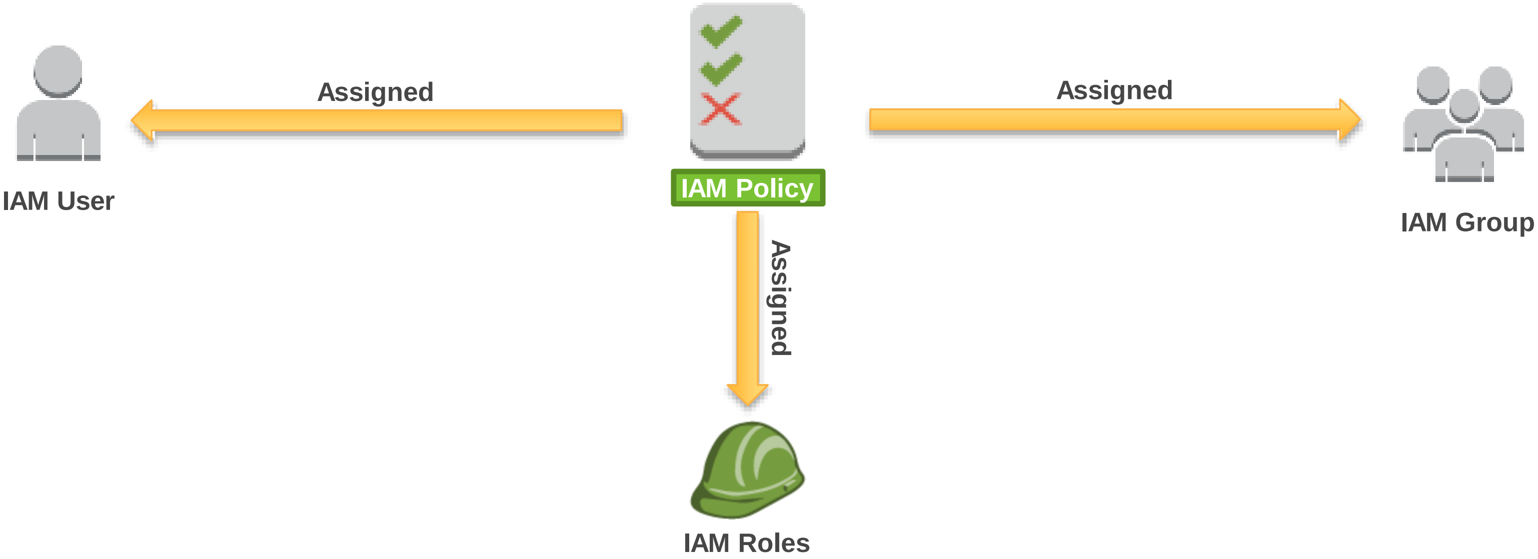
```
{
   "Version": "2012-10-17",
   "Statement": [
     {
       "Sid": "Stmt1453690971587",
         "Action": [
          "ec2:Describe*",
          "ec2:StartInstances",
          "ec2:StopInstances”
          ],
          "Effect": "Allow",
          "Resource": "*",
          "Condition": {
  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



AWS IAM Policy Assignment



AWS IAM Policy Assignment

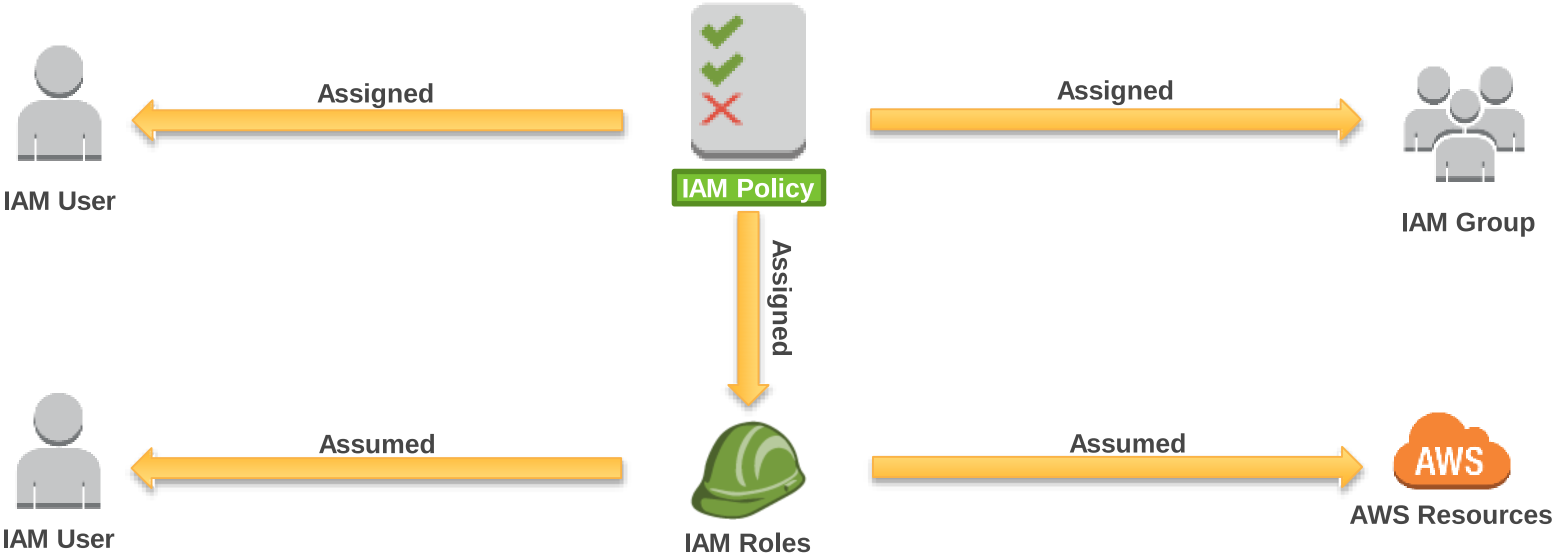


AWS IAM Roles

- 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

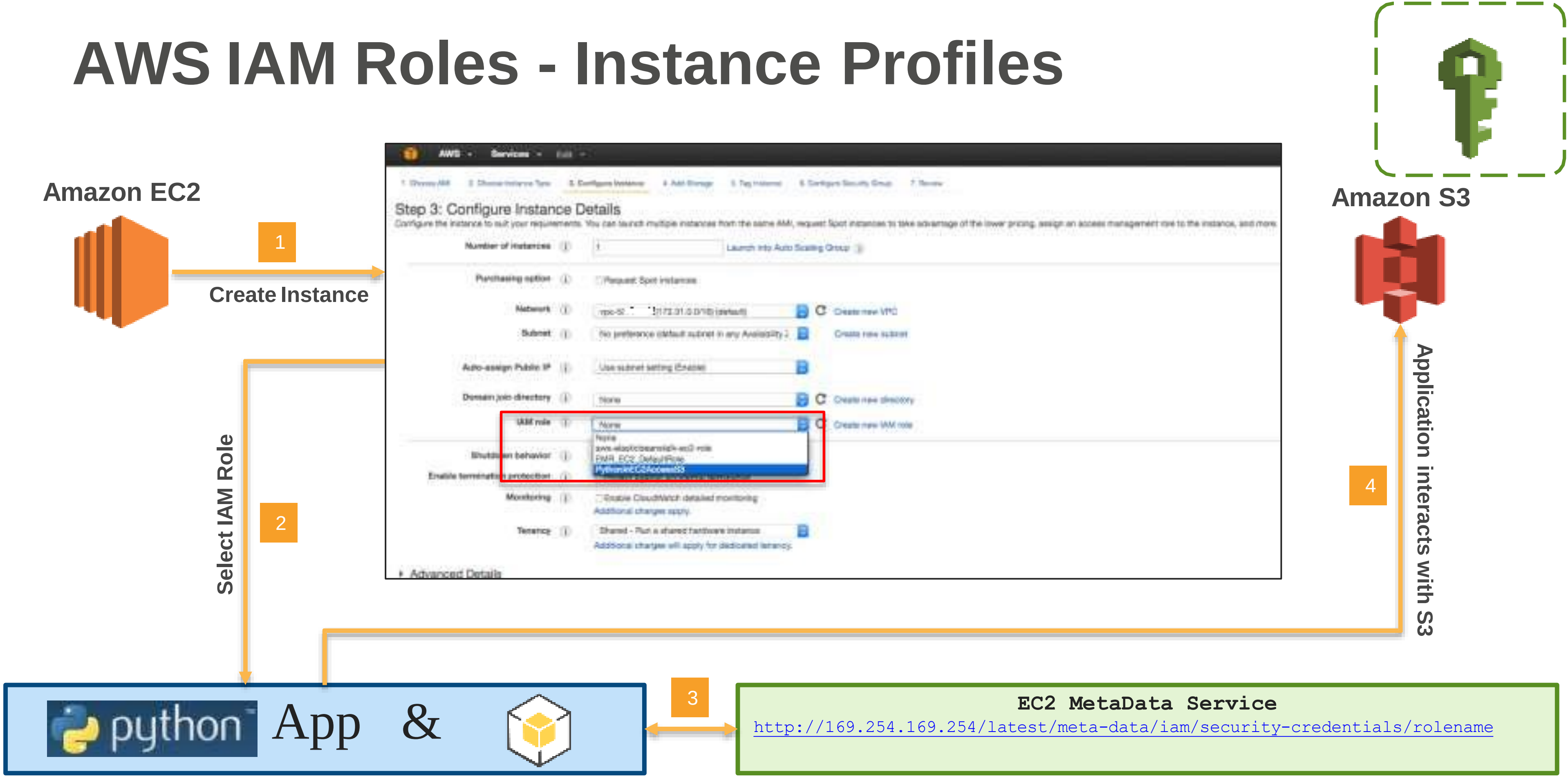


Example: Application Access to AWS Resources

- 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



Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances: 1 — Launch into Auto Scaling Group

Purchasing option: □ Request Spot instances

Network: vpc-5[redacted] | 172.31.0.0/16 (default) — Create new VPC

Subnet: No preference (default subnet in any Availability Zone) — Create new subnet

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

Domain join directory: None — Create new directory

IAM role: None — Create new IAM role

- None
- aws-elasticbeanstalk-ec2-role
- EMR_EC2_DefaultRole
- PythonInEC2AccessS3

Shutdown behavior

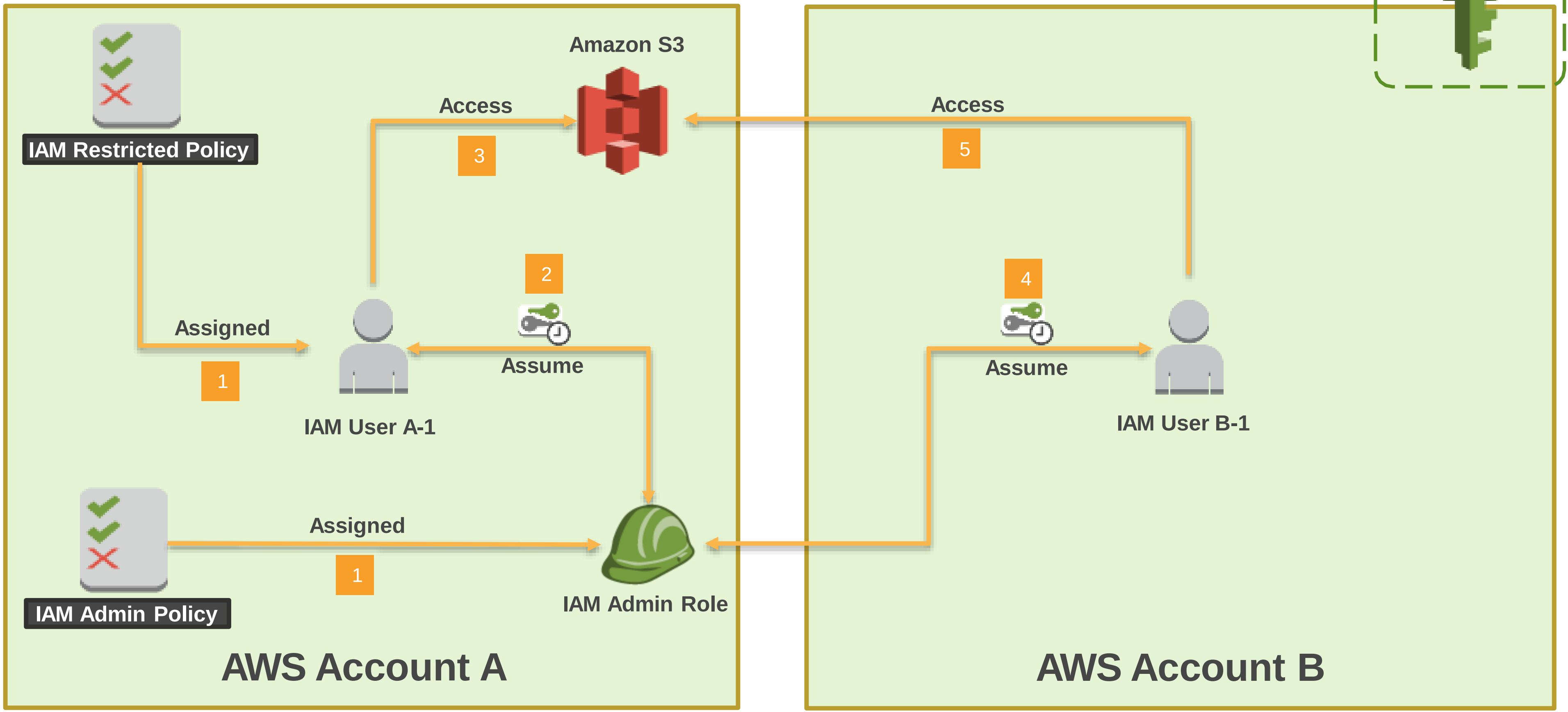
Enable termination protection

Monitoring: □ Enable CloudWatch detailed monitoring — Additional charges apply.

Tenancy: Shared - Run a shared hardware instance — Additional charges will apply for dedicated tenancy.

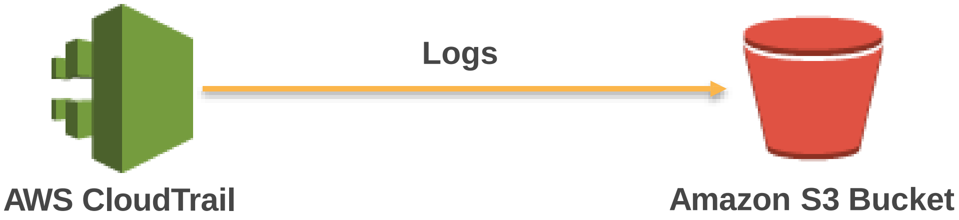
▸ Advanced Details

AWS IAM Roles – Assume Role



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.



Module 4: Databases

SQL and NoSQL Databases

	SQL	NoSQL
Data Storage	Rows and Columns	Key-Value
Schemas	Fixed	Dynamic
Querying	Using SQL	Focused on 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

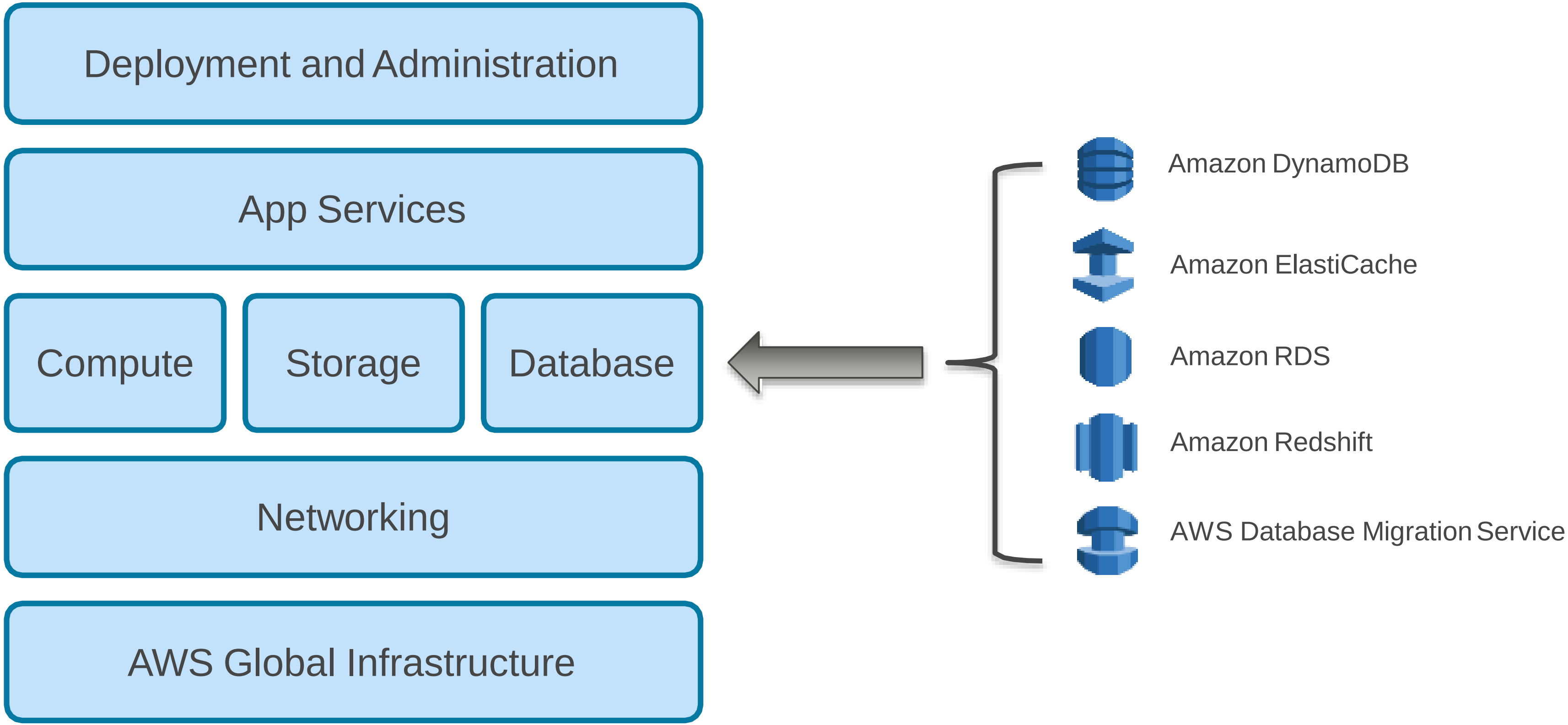
NoSQL

```
{
      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 Managed Database Services



Deployment and Administration

App Services

Compute

Storage

Database

Networking

AWS Global Infrastructure

Amazon DynamoDB

Amazon ElastiCache

Amazon RDS

Amazon Redshift

AWS Database Migration Service

Amazon Relational Database Service (RDS)

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

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

MySQL

PostgreSQL

Microsoft SQL Server

MariaDB

Amazon Aurora

ORACLE

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.

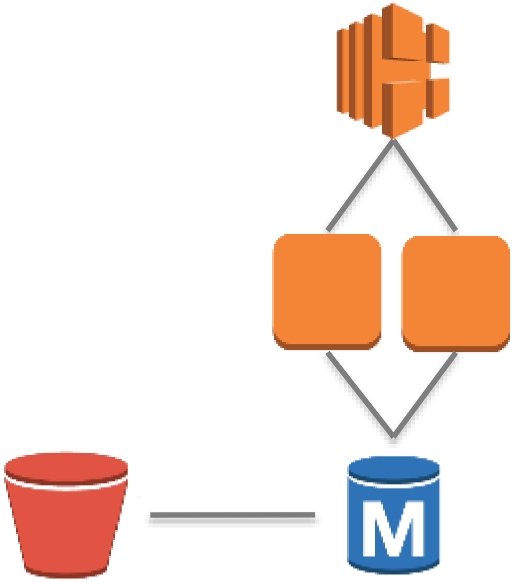
Cross-Region Snapshots

- 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.

A Simple Application Architecture



Elastic Load Balancing load balancer instance

Amazon EC2 Application Servers

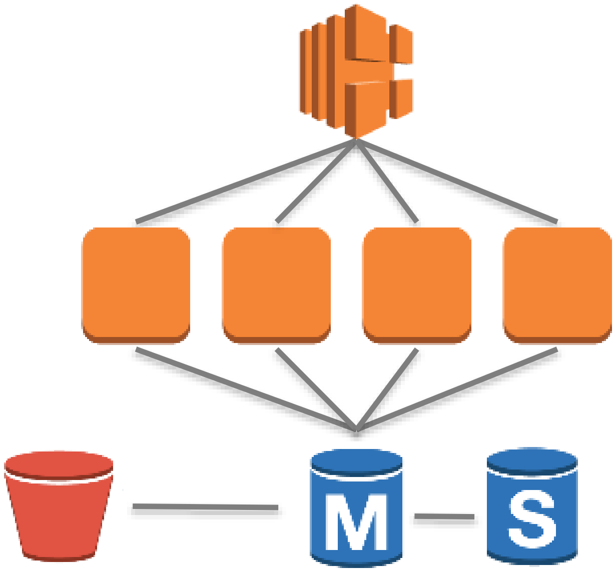
Amazon RDS database instance

DB snapshots in Amazon S3

Multi-AZ RDS Deployment

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

A Resilient, Durable Application Architecture



Elastic Load Balancing load balancer instance

Application, in Amazon EC2 instances

Amazon RDS database instances: Master and Multi-AZ standby

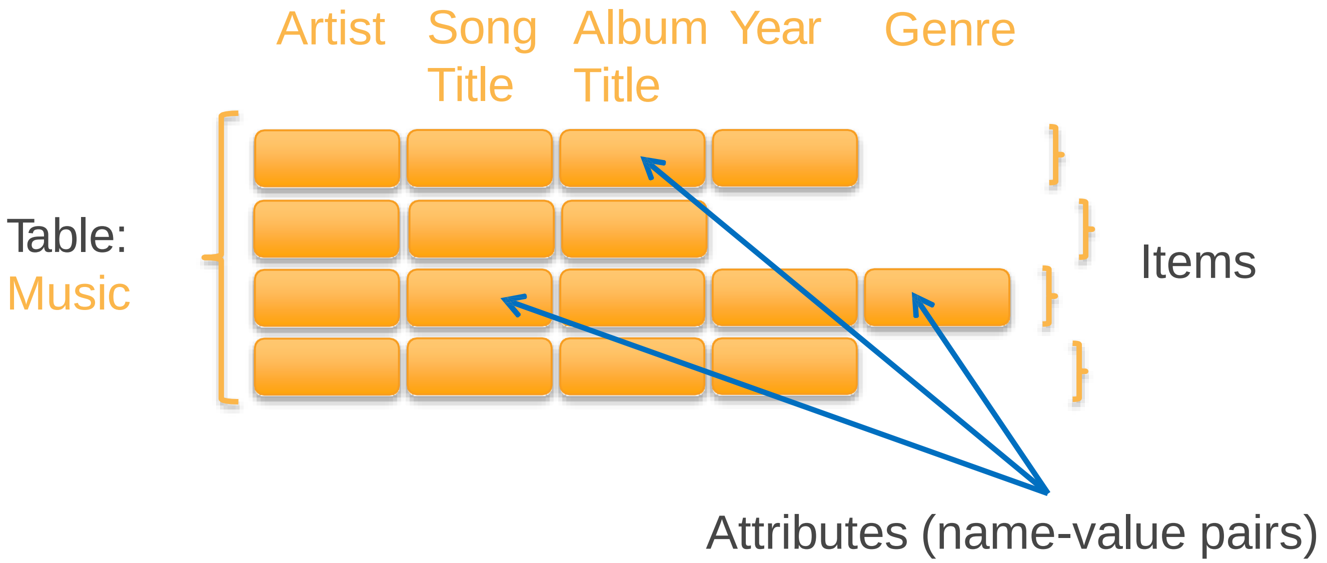
DB snapshots in Amazon S3

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.

DynamoDB Data Model



Primary Keys

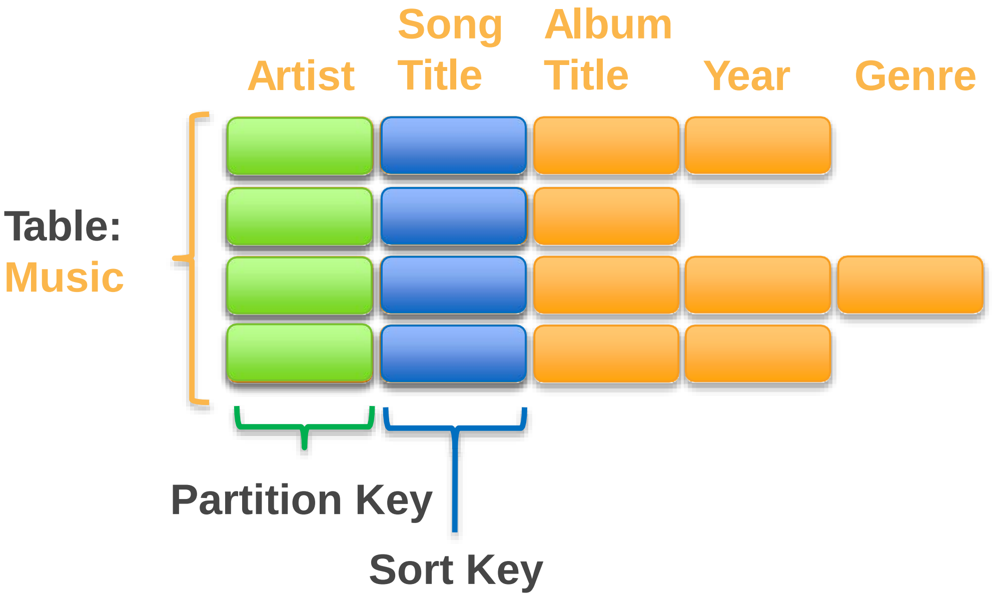


Table: Music
Partition Key: Artist
Sort Key: Song Title

(DynamoDB maintains a sorted index for both keys)

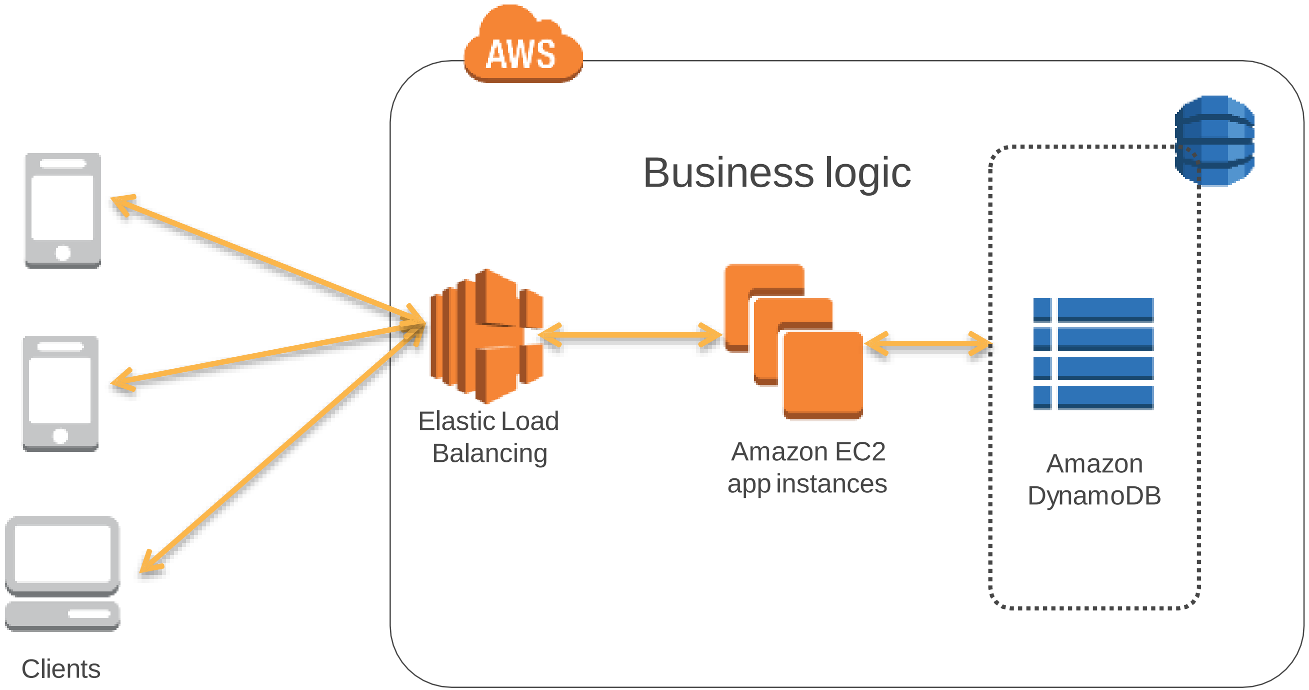
Provisioned Throughput

- 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



Database Considerations

If You Need	Consider Using
A relational database service with minimal administration	**Amazon RDS** • Choice of Amazon Aurora, MySQL, MariaDB, Microsoft SQL Server, Oracle, or PostgreSQL database engines • Scale compute and storage • Multi-AZ availability
A fast, highly scalable NoSQL database service	**Amazon DynamoDB** • Extremely fast performance • Seamless scalability and reliability • Low cost
A database you can manage on your own	Your choice of **AMIs** on Amazon EC2 and Amazon EBS that provide scale compute and storage, complete control over instances, and more.

Module 5
AWS Elasticity and Management Tools

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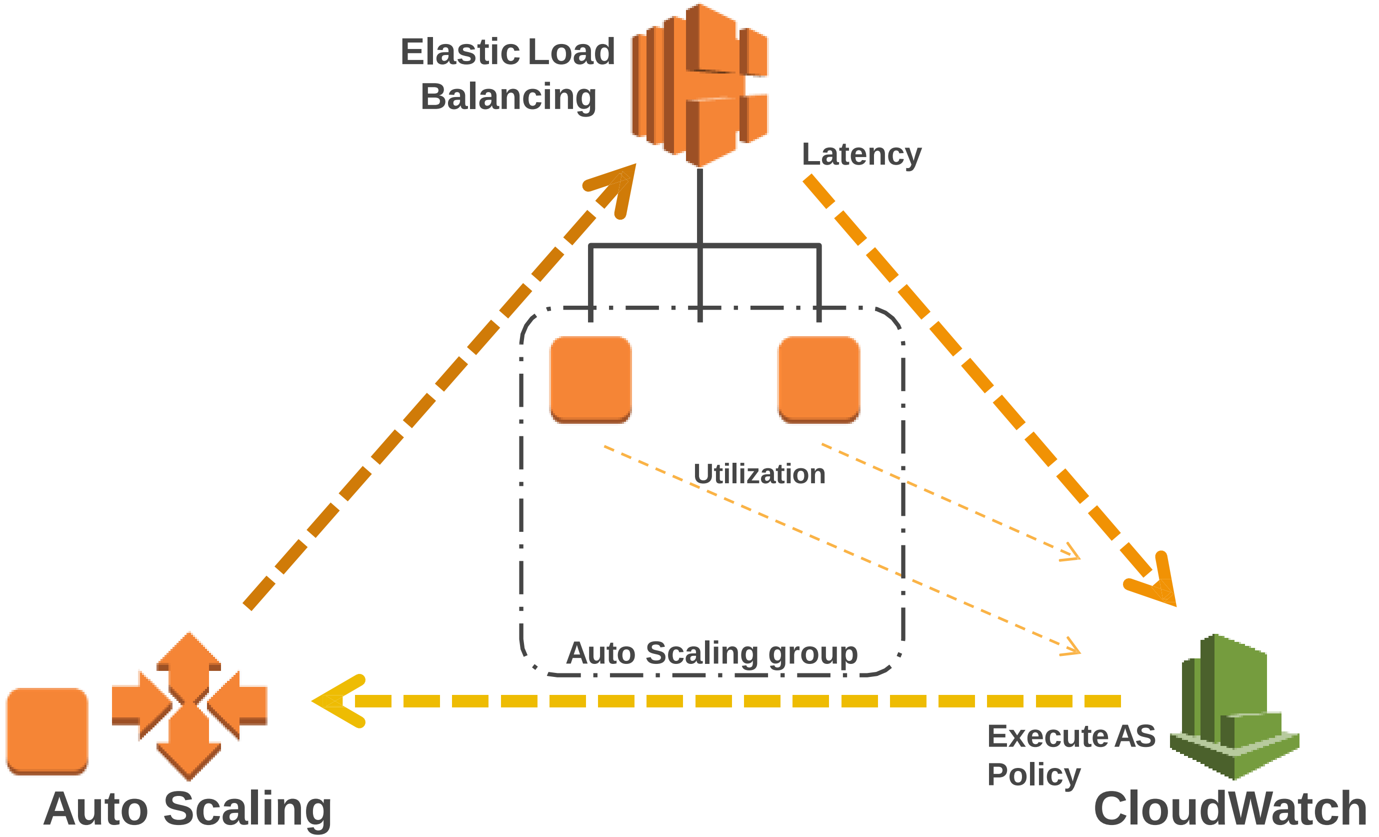
Triad of Services



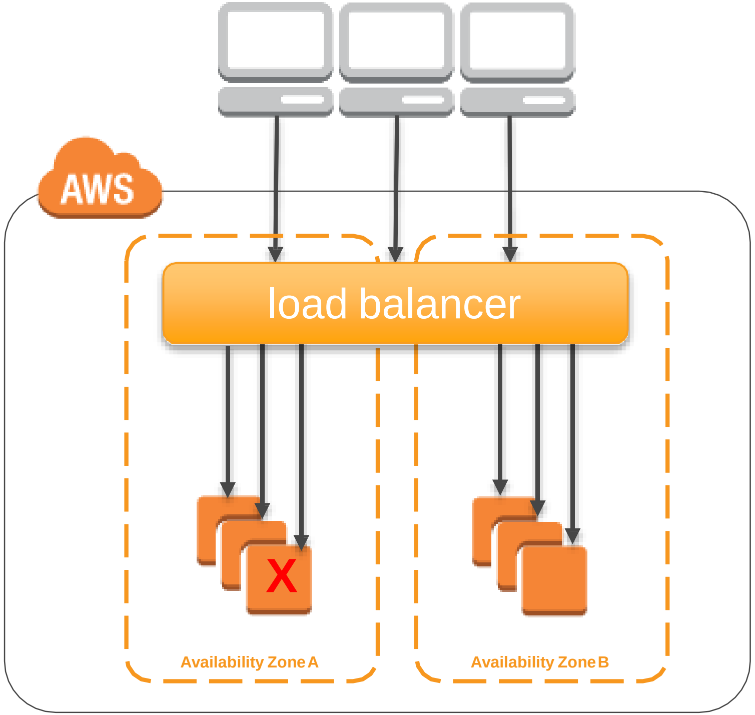
Elastic Load Balancing

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

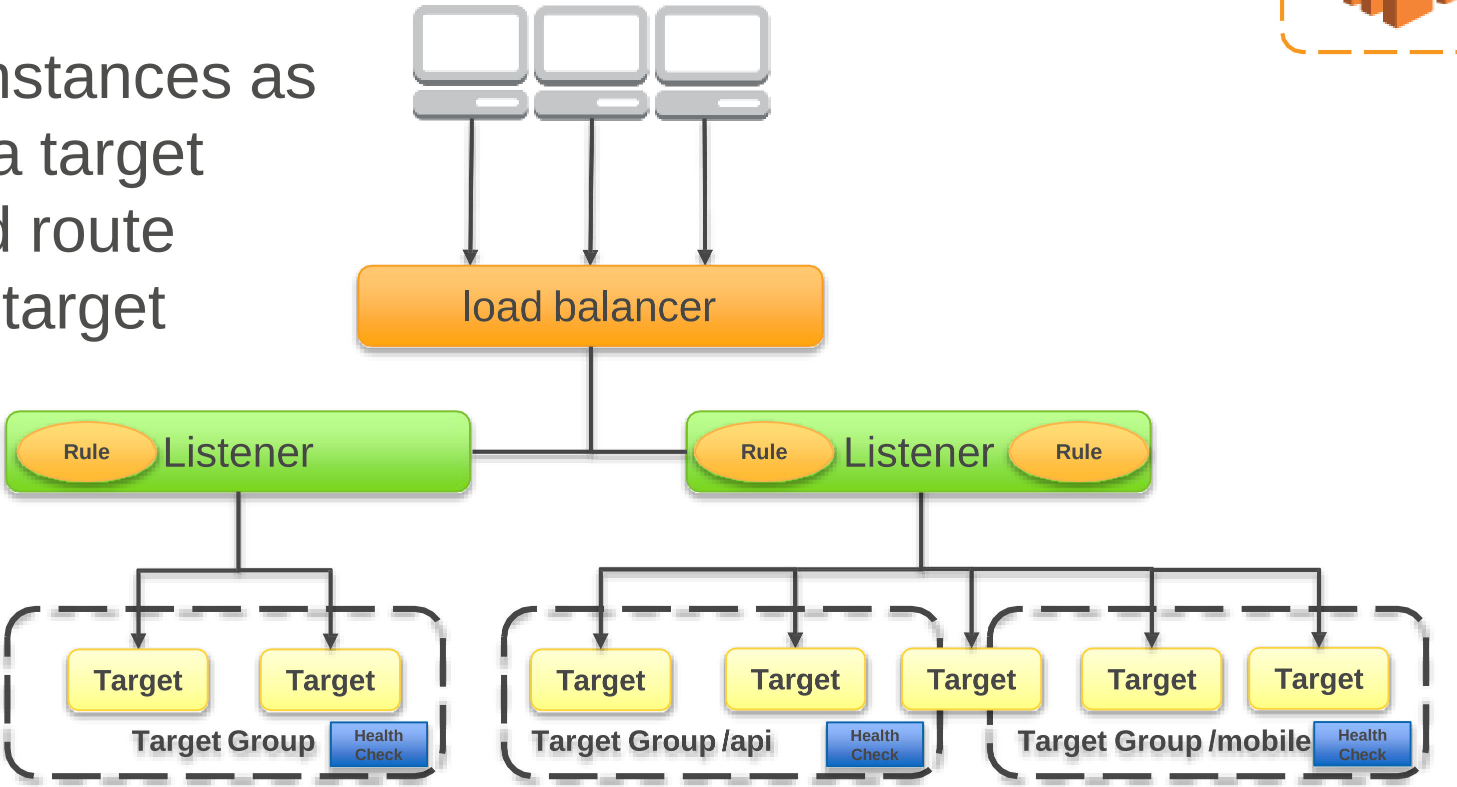
Classic Load Balancer - How It Works

Register instances with your load balancer.



Application Load Balancer – How It Works

Register instances as targets in a target group, and route traffic to a target group.



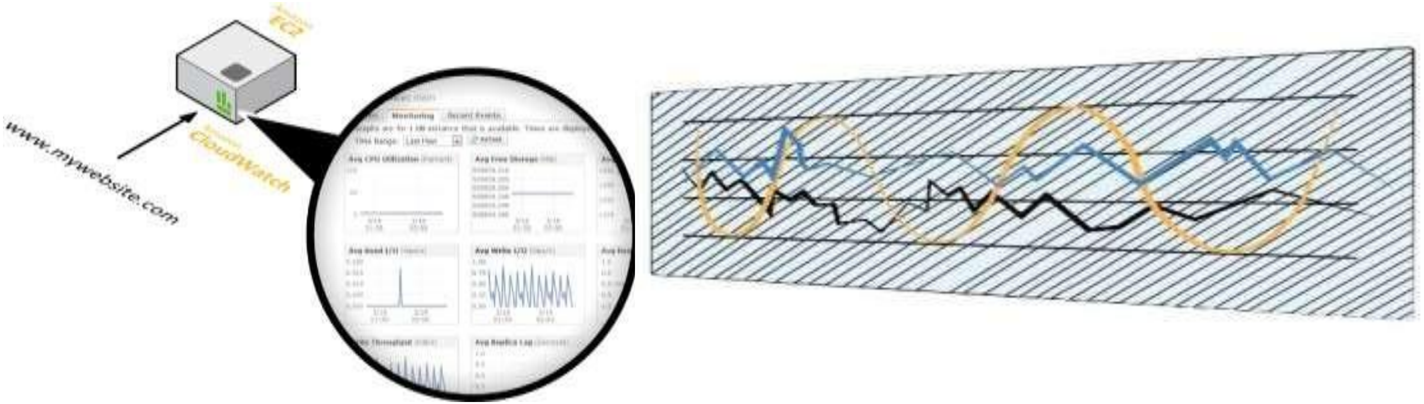
Amazon CloudWatch

Amazon CloudWatch

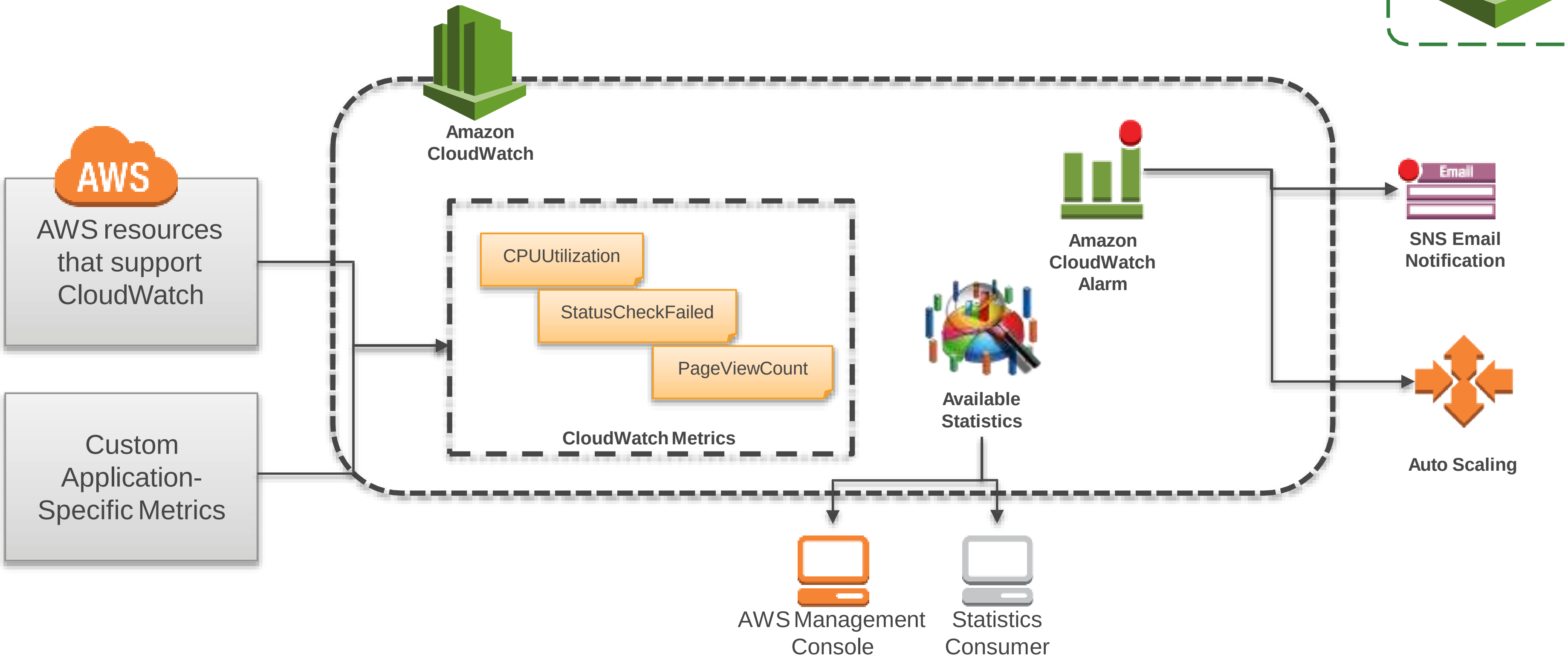
- A **monitoring service** for AWS cloud resources and the applications you run on AWS
- **Visibility into** resource utilization, operational performance, and overall demand patterns
- **Custom application-specific** metrics of your own
- **Accessible** via AWS Management Console, APIs, SDK, or CLI

Amazon CloudWatch Facts

- Monitor other AWS resources
  - View graphics and statistics
- Set Alarms



Amazon CloudWatch Architecture

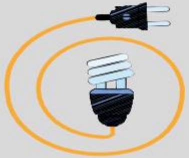


Auto Scaling

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



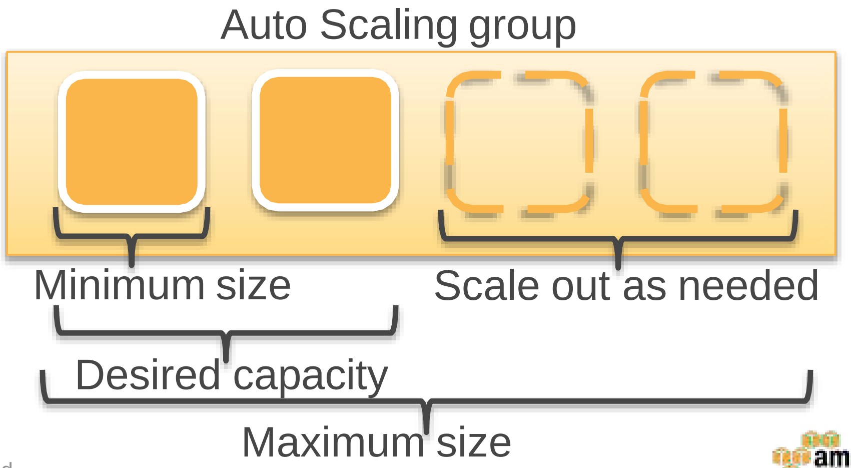
Better Availability

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

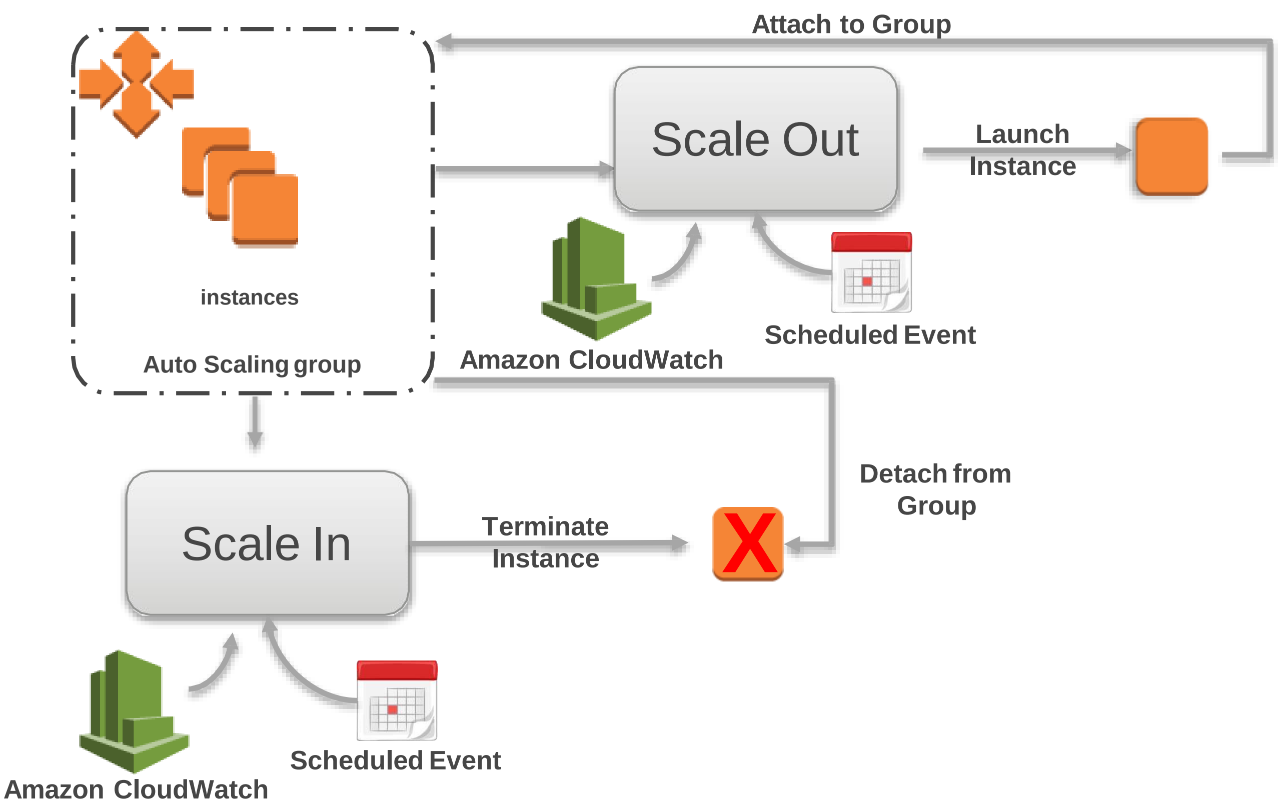
- Contain a collection of EC2 instances that share similar characteristics.
- Instances in an Auto Scaling group are treated as a **logical grouping** for the purpose of instance scaling and management.



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 toAmazon CloudWatch.
  - Your own **custom metrics**.

Auto Scaling Basic Lifecycle



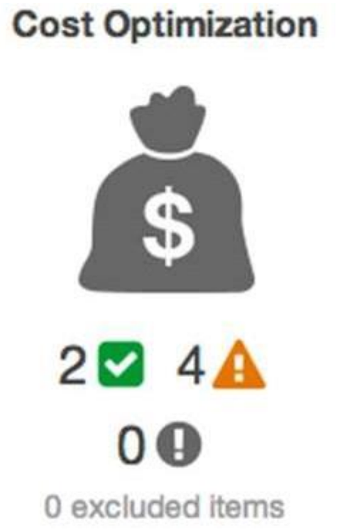
AWS Trusted Advisor

AWS Trusted Advisor

- **Best practice** and recommendation engine.
- Provides AWS customers with performance and security recommendations in four categories:
  - **Cost optimization**
  - **Security**
  - **Fault tolerance**
  - **Performance improvement**.

Cost Optimization

- Amazon EC2 Reserved Instance Optimization
- Low-utilization Amazon EC2 Instances
- Idle load balancers
- Underutilized Amazon EBS volumes
- Unassociated Elastic IP addresses
- Amazon RDS idle DB instances



Cost Optimization

2 ✓ 4 ⚠

0 !

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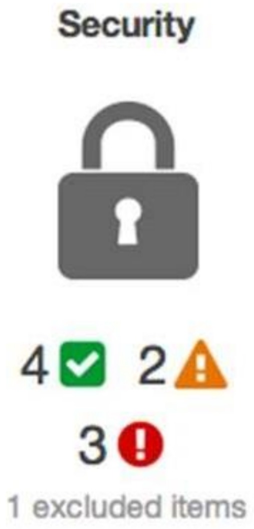
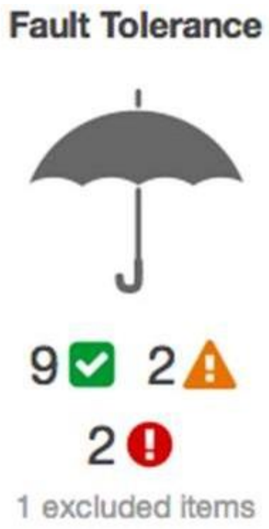
Security

- Security groups
- AWS IAM use
- Amazon S3 bucket permissions
- MFA on Root Account
- AWS IAM password policy
- Amazon RDS security group access risk



Fault Tolerance

- Amazon EBS Snapshots
- Load balancer optimization
- Auto Scaling Group Resources
- Amazon RDS Multi-AZ
- Amazon Route 53 name server delegations
- ELB connection draining



Fault Tolerance

9 ✓ 2 ⚠

2 ❗

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Performance Improvement

- High-utilization Amazon EC2 instances
- Service limits
- Large number of rules in EC2 security group
- Over-utilized Amazon EBS magnetic volumes
- Amazon EC2 to EBS throughput optimization
- Amazon CloudFront alternate domain names

Performance

8 ✓ 0 ⚠

0 ❗

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Module 6
Course Wrap-Up

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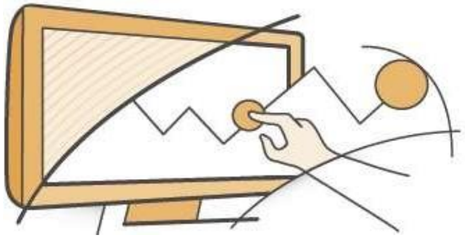
Expand Your Cloud Skills with AWS

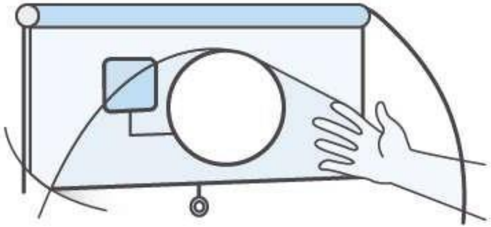
Online videos and labs



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

aws.amazon.com/training/self-paced-labs

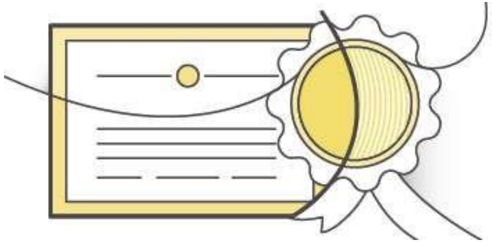
Instructor-led courses



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

aws.amazon.com/training

Certification



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

aws.amazon.com/certification

amazon web services | Training and 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

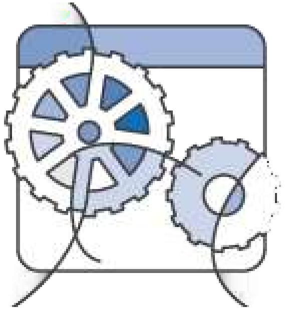
For more information, see aws.amazon.com/training/self-paced-labs/.

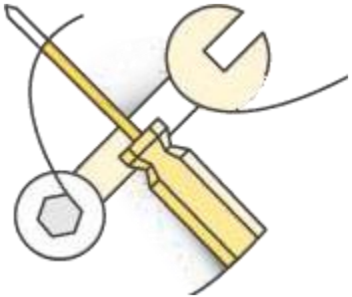
AWS ILT Training Courses

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





AWS Certified Solutions Architect - Associate

AWS Certified Developer - Associate

AWS Certified SysOps Administrator- Associate

AWS Certified Solutions Architect - Professional

AWS Certified DevOps Engineer - Professional

For more information, see aws.amazon.com/certification.

Preparing for AWS Certification

For resources to help you prepare for the certification exam, see aws.amazon.com/certification.

AWS Technical Training

Exam Guides & Sample Questions

AWS Whitepapers & FAQs

AWS-Authored Study Guide

AWS Documentation & Reference Architectures

Self-Paced Labs on qwikLABS

Practice Exams

AWS Support

Support Comparison

	Enterprise	Business	Developer	Basic
Customer Service 24x7x365	✓	✓	✓	✓
Support Forums	✓	✓	✓	✓
Documentation, White Papers, Best Practice Guides	✓	✓	✓	✓
AWS Trusted Advisor	Full Checks	Full Checks	Basic Checks	Basic Checks
Access to Technical Support	Phone, chat, email, live screen sharing, TAM (24/7)	Phone, chat, email, live screen sharing	Email (local business hours)	Support for Health Checks
Primary Case Handling	Sr. Cloud Support Engineer	Cloud Support Engineer	Cloud Support Associate	Technical Customer Service Associate
Users who can create Technical Support cases	Unlimited (IAM supported)	Unlimited (IAM supported)	1 (account credentials only)	
Case Severity/Response Times	Critical: < 15 minutes Urgent: < 1 hour High: < 4 hours Normal: < 12 hours Low: < 24 hours	Urgent: < 1 hour High: < 4 hours Normal: < 12 hours Low: < 24 hours	Normal: < 12 hours Low: < 24 hours	
Architecture Support	Application Architecture	Use case guidance	Building blocks	
Best Practice Guidance	✓	✓	✓	
Client-Side Diagnostic Tools	✓	✓	✓	
AWS Support API	✓	✓		
Third-Party Software Support	✓	✓		
Infrastructure Event Management	✓	Available at additional cost		
AWS Concierge	✓			
Direct access to Technical Account Manager (TAM)	✓			
Prioritized Case Routing	✓			
Management Business Reviews	✓			

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Instructor Demo

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Other questions? Contact us at
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