**AWS Certified Developer Associate**

Contents

[**** **AWS Accounts** 1](#_Toc186207277)

[**** **Courses** 1](#_Toc186207278)

[**** **Notes** 2](#_Toc186207279)

[ **AWS Accounts and IAM** 4](#_Toc186207280)

[ **AWS Command Line Interface (CLI)** 8](#_Toc186207281)

[ **Amazon VPC, EC2, and ELB** 10](#_Toc186207282)

[ **Tips to answer question** 12](#_Toc186207283)

[ **Summary** 13](#_Toc186207284)

* **AWS Accounts**

aws.amazon.com/free

Account Root User:

email = zarod2019@gmail.com

pwd = Serafines@2024

alias = zar-training

account id = 436488467655

IAM User:

user = Zarbio

pwd = Serafines@2024

alias = zar-training

IAM User:

user = Joe

pwd = Joe@2024

* **Courses**
* AWS Certified **Developer Associate** Exam Training DVA-C02

<https://tcsglobal.udemy.com/course/aws-certified-developer-associate-exam-training/learn/lecture/35900716#overview>

<https://digitalcloud.training/aws-developer-associate-resources/>

* Resources:

<https://digitalcloud.training/aws-certified-developer-course-downloads/>

code, folder aws-dva-code: <https://github.com/nealdct/aws-dva-code/tree/main>

**AWS+Certified+Developer+Associate+Slides.pdf**

* **Notes**
* To build and deploy cloud apps use:

AWS Software Development Kits (AWS SDKs for Python, .Net, and Java)

Command Line Interface (AWS CLI)

AWS Management Console

* Amazon Web Services (AWS):

For General cloud engineering (DevOps), enterprise applications, web solutions.

Used for Startups and Web Applications.

Market leader in cloud.

* Jobs:

AWS Certified Developer

* Certifications:

Amazon Web Services Cloud Practitioner – 2023

valid 3 years

cost $100

AWS Certified Solutions Architect – Associate: for general cloud knowledge

AWS Certified **Developer** – **Associate**: for development

AWS Certified DevOps Engineer – Professional: for DevOps roles

* **AWS Certified Developer – Associate Exam**

A close-up of a certificate

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[**https://aws.amazon.com/certification/certified-developer-associate/**](https://aws.amazon.com/certification/certified-developer-associate/)

A screenshot of a survey

Description automatically generated

AWS-Certified-Developer-Associate\_Exam-Guide.pdf [**https://d1.awsstatic.com/training-and-certification/docs-dev-associate/AWS-Certified-Developer-Associate\_Exam-Guide.pdf**](https://d1.awsstatic.com/training-and-certification/docs-dev-associate/AWS-Certified-Developer-Associate_Exam-Guide.pdf)

Score of 100 - 1000, minimum passing score is 720

**A close up of text

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Last version is **DVA-C02** (57 services). Instead DVA-C01 (33 services).

* TDVA-C02 Exam:

Domain 1: Development with AWS Services

Develop code for applications hosted on AWS

Develop code for AWS Lambda

Use data stores in application development

Identify components and resources for security

Domain 2: Security

Implement authentication and/or authorization for applications and AWS services

Implement encryption by using AWS services

Manage sensitive data in application code

Domain 3: Deployment

Prepare application artifacts to be deployed to AWS

Test applications in development environment

Automate deployment testing

Deploy code by using AWS CI/CD services

Domain 4: Troubleshooting and Optimization  
 Assist in a root cause analysis  
 Instrument code for observability  
 Optimize applications by using AWS services and features

* AWS Service Names: <https://aws.amazon.com/certification/policies/general-information/#AWS_Service_Names>

AWS cheat sheets: <https://tutorialsdojo.com/aws-cheat-sheets/>

[**https://medium.com/@meghanaharishankara/how-to-get-aws-developer-associate-certified-in-just-5-weeks-26c022b4b142**](https://medium.com/@meghanaharishankara/how-to-get-aws-developer-associate-certified-in-just-5-weeks-26c022b4b142)

* Exams, courses, simulator:

**Jon Bonso’s practice exams**: <https://www.udemy.com/course/aws-certified-developer-associate-practice-exams-amazon-dva-c01/?couponCode=BFCPSALE24>

**AWS Certified Developer Associate Exam Training DVA-C02**

[**https://tcsglobal.udemy.com/course/aws-certified-developer-associate-exam-training/learn/lecture/35900716#overview**](https://tcsglobal.udemy.com/course/aws-certified-developer-associate-exam-training/learn/lecture/35900716#overview)

AWS Certified Developer Associate Practice Exams DVA-C02

[**https://tcsglobal.udemy.com/course/aws-developer-associate-practice-exams/learn/quiz/4852736#overview**](https://tcsglobal.udemy.com/course/aws-developer-associate-practice-exams/learn/quiz/4852736#overview)

<https://digitalcloud.training/aws-developer-associate-resources/>

Practice Exams | AWS Certified Developer Associate 2024

<https://tcsglobal.udemy.com/course/aws-certified-developer-associate-practice-tests-dva-c01/learn/quiz/4540356#overview>

AWS Certified Developer Associate DVA-C01 Exam Questions

<https://tcsglobal.udemy.com/course/simulado-amazon-aws-certified-developer-associate-2020/learn/quiz/4788484#overview>

* **AWS Accounts and IAM**
* AWS Free Tier account vs Sandbox

|  |  |
| --- | --- |
| AWS Free Tier | Sandbox / Challenge Labs |
| Create your own AWS free tier account | AWS account is hosted by a provider |
| Full control | Limited control |
| You’re responsible for bills, but we will operate in the free tier and set a billing alarm. | No cloud bills (no risk) |
| For Hands-On Lessons (HOL) | Scenario-based challenges. |

* AWS Account

Need:

Credit card

Dynamic email alias account: john {account alias 1} @gmail.com

Phone to receive SMS verification code

Account Root User: super account

* Create your AWS Free Tier Account:

12 months free

1. url: AWS Free Tier

aws.amazon.com/free

[https://aws.amazon.com/free/?all-free-tier.sort-by=item.additionalFields.SortRank&all-free-tier.sort-order=asc&awsf.Free%20Tier%20Types=\*all&awsf.Free%20Tier%20Categories=\*all](https://aws.amazon.com/free/?all-free-tier.sort-by=item.additionalFields.SortRank&all-free-tier.sort-order=asc&awsf.Free%20Tier%20Types=*all&awsf.Free%20Tier%20Categories=*all)

email = [zarod2019@gmail.com](mailto:zarod2019@gmail.com)

pwd = Serafines@2024

Sign in as a Root user

1. Sign in to the Console
2. Account Configuration and Create a Budget

Configure Account Alias: for IAM

Create Account Alias: ex: dct-tab-training, **zar-training** (created)

A screenshot of a web page

Description automatically generated

Enable access to billing for IAM users:

IAM Dashboard

A close up of a sign

Description automatically generated

Update billing preferences:

option Billing Preferences

A screenshot of a email

Description automatically generated

Create a budget and alarm:

option Budget, $5

User a template (simplified)

Monthly cost budget

Enter your budgeted amount ($): 5.00

option Cost Explorer

* AWS Identity and Access Management (IAM):

Used for **authentication** and **authorization**

Ways to manage AWS:

Console

Command Line Interface - CLI

API through SDKs

1. Authentication: login
2. **Authorization**: **allow** or **deny** access to resources

**Policy**: define what we are **allowed to do**

ex:

Performing API actions like run instances on EC2 that launches a virtual server

GetBucket: retrieves information about buckets

CreateUser: create a user in IAM

Core components of IAM:

Users

User groups: for adding users and applying permissions policies

Roles

Policy

IAM Users:

Best practice not to use the root user account, you must set a strong password and enable Multi-Factor Authentication (**MFA**), then we can create user accounts.

ARN (Amazon Resource Name):

A close up of a sign

Description automatically generated

* Creating IAM Users and Groups:

Create Group:

Policy: AdministratorAccess

Create User:

A screenshot of a computer

Description automatically generated

Because I don’t need single sign on in many cases.

**user = Zarbio**

**pwd = Serafines@2024**

**A screenshot of a login screen

Description automatically generated**

* IAM Authentication and MFA:

MFA:

Signing in with MFA requires an authentication code from an MFA device

Something you have: phone, token device

Something you are: retina scans, fingerprints

Used for Root account and individual IAM user accounts

* Setup Multi-Factor Authentication (MFA) for IAM User account:

2 types of users:

Root user

IAM user

Option User, tab Security credentials, Assign MFA device:

Authenticator app: Google Authenticator, AuthyPhone

* AWS Security Token Service - STS:

Provided temporary credentials.

Permissions Policy: allowed or denied to this specific entity

* Access Control Methods – RBAC & ABAC:

RBAC (Role-Based Access Control):

Job function policies = AWS managed policies

Policy documents can be pre-created by AWS

ABAC (Attribute-Based Access Control):

Using attributes, tags to define access to our resources

Permissions policy

Action = API action (RebootDBInstance, StartDBInstance, StopDBInstance)

* Switching IAM Roles:

Create an IAM role

user = Joe

pwd = Joe@2024

**EC2**:

Run **virtual servers in the Cloud** running Linux, Windows, Mac Os

Create Role:

AmazonEC2FullAccess: launch virtual servers in the cloud, permissions for load balancing EC2

Add permissions:

Users, Permissions policies, Add permissions, Create inline policy, JSON

{

"Version": "2012-10-17",

"Statement": [

{

"Sid": "Statement1",

"Effect": "Allow",

"Action": [],

"Resource": []

}

]

}

* **AWS Command Line Interface (CLI)**

Tools: AWS CLI, VS Code and Git

* Install the AWS Command Line Interface (CLI):

Install on a Linux/Windows instance

AWS CLI <https://docs.aws.amazon.com/cli/latest/userguide/getting-started-install.html>

In Windows open CMD:

commands:

aws

aws --version

aws s3 ls // don’t allowed

* Configure **Credentials** for the AWS CLI:

Configure a terminal for a user, to create an **access key** (long term credentials) for AWS CLI

Access key = Access key ID + Secret access key

In Windows Power Shell:

command:

aws configure

aws s3 ls // list buckets

A computer screen with white text

Description automatically generated

AKIAWLIF5OTDZ3R6FXUI

4P4Sb97Ct/ry6Nc21bVQgTp9Lv9SovQcnnLymz44

A black background with white text

Description automatically generated

Doesn’t exist any buckets, no errors

cat .aws/config // contents of the file

response:

region = us-east-1

cat .aws/credentials

response:

aws\_acess\_key\_id =

aws\_secret\_access\_key =

A screenshot of a computer

Description automatically generated

* Overview of Using the AWS CLI:

command:

aws help

aws ec2 help

aws ec2 describe-instances // show status of instances

aws s3 help

aws s3 mb s3://{bucket-name} // mb = make/create **bucket** (**container to upload files**)

aws s3 mb s3://mytestbucket43243jd33x

aws s3 ls // list buckets

Create and upload a file to a bucket:

command:

touch testfile.txt // linux, create a file

New-Item -Path "testfile.txt" -ItemType File -Force // windows, create a file

ls // list directories

aws s3 cp testfile.txt s3://{bucket-name} // cp = copy, upload file to a bucket

aws s3 ls s3://{bucket-name} // show content of file

aws s3 rb s3://{bucket-name} --force // remove bucket with content

aws s3 ls // list buckets

* Assuming IAM Roles (CLI):

Create IAM roles from CLI console

option Roles, EC2-Full-Access

Add profile:

A screenshot of a computer

Description automatically generated

Use arn of the role (don’t use access keys, don’t use credentials file)

command:

aws ec2 describe-instances

aws ec2 describe-instances --profile ec2-full-access // show status of instances

option Roles, S3FullAccess

command:

aws s3 ls // access denied

aws s3 ls --profile ec2-full-access

Create my own profile:

command:

aws configure --profile {name}

add access-key

aws configure --profile {name}

See config and credentials files in computer

* **Amazon VPC, EC2, and ELB**
* Amazon VPC, Security Groups, and NACLs

**Public subnets** are accessible to the outside world (**internet**). **Private** **subnets** **not**.

We control the **VPC router** using the **route table**

**NAT** instances and NAT gateways allow your instances in **private** **subnets** which only have private IP addresses to be able to connect to the internet.

Security Groups and Network ACLs: are firewalls to protect the network traffic that’s able to connect to our EC2 instances.

NACLs don’t apply to traffic within the subnet, is only the ingress and egress traffic.

Security Group are applied to the Elastic Network Interfaces that are attached to each of your EC2 instances.

Security Groups support allow rules only. **Stateful** (if traffic is outbound then any return traffic is the same).

Network ACLs also support deny rules. **Stateless** (need separate rule for outbound and the return traffic inbound)

* Amazon EC2 Overview:

EC2: run virtual servers in the cloud, IaaS (AWS manage the physical hardware and software (virtualization))

igw = Internet Gateway

* Create a Custom VPC:

VPC Console, option Your VPCs, Create VPC

option Subnets, Route tables

GitHub-Code/code/amazon-vpc/custom-vpc.md/Create Public and Private Subnets

EC2 Dashboard, in Network setting choose your VPC

* Amazon EBS and Instance Stores:

EBS = Elastic Block Store:

Block based storage system, not a File-based storage system

Have volumes

AZ = Availability Zone

**Instance Store volumes** are **ephemeral** (data is **non-persistent**). If the power is lost to this host server, all that data is gone forever.

Used for temporary data that can be recreated.

**EBS volumes** offer **persistent** storage. If you have long term data storage, you cannot afford to potentially lose your data.

Amazon EBS Snapshots: to do backups

AMI – Amazon Machine **Image** are backed by a snapshot, is a template contains software configuration (operating system, app server, apps) required to launch your instance. Snapshot ID

* Create and Attach an EBS Volume:

aws-dva-code\amazon-ebs\amazon-ebs-volumes.md

Snapshots are not stored in the availability zone, they’re store on Amazon S3 (regional service).

VPC -> ECS -> Instances -> Volumes, Snapshots

* Amazon Elastic File System (EFS):

Is shared file system, connect instances from multiple availability zones

NFS = Network File System: connection protocol

* Create an Amazon EFS Filesystem:

aws-dva-code\amazon-efs\working-with-efs.md

Create a File system using the Amazon elastic File system service.

EF2 = Managed File Storage for EC2

* Amazon EC2 User Data and Metadata:

**Instance metadata** = data about your EC2 instance

**User data** = way to run scripts when we start our instances the first time

**Metadata** = way that we can retrieve specific information about the instance itself

* Using User Data and Metadata:

aws-dva-code\amazon-ec2\user-data-metadata.md

* Access Keys and IAM Roles with EC2:

Using IAM Role is more secure than using IAM User. IAM Roles use the AWS Security Token Service - STS.

* Practice with Access Keys and IAM Roles:
* **Tips to answer question**

1. **Analyze the requirements:**

Scenario: resiliency, cost-effectiveness, retention policy

Constraints: 24-hour access, permanent deletion

Spot specific features: versioning enabled, event notifications

1. **Map Requirements to AWS Services and Features**

Core Service

For S3, understand versioning, lifecycle rules, storage classes, and event notifications.

**S3 Lifecycle rules** are ideal for automating object deletion based on **age**.

1. Eliminate incorrect options

unnecessary complexity (Lambda), no AWS best practices

1. Leverage AWS Best Practices

Cost-Effective

**Built-In** Automation

Resiliency

1. Practice Common Scenarios

**S3:** Lifecycle policies, storage classes, event notifications, versioning.

**IAM:** Policies, roles, least privilege.

**CloudFormation:** Drift detection, change sets.

**EC2:** Instance types, security groups.

* **Example Application:**

ZARBIO ROMULO ORDONEZ DAVILA-342789844-AWS Certified Developer – Associate (E) - 3.pdf – Q3:

**Requirement**: "Objects must be permanently removed 1 year after creation."

**Key Considerations**: S3 versioning, automation of retention.

**Mapping to AWS Features**: S3 Lifecycle rules can handle both current and noncurrent versions with minimal effort.

**Eliminate Options:**

Remove solutions involving custom Lambda code (adds complexity).

Focus on built-in features like lifecycle rules.

* **Summary**

NACLs = Network Access Control Lists

CIDR = Classless Inter-Domain Routing, ex. 10.0.0.0**/16**

**NAT** = Network Address Translation, when the instance with the private address wants to connect to the Internet, it will need a public address that can access the Internet.

**Role**: contains **permissions**/**policies** with **credentials**

Each **Profile** with **credential**

KMS = Key Manager Service

To encrypt the password of environment variables

IOPS = Input Output per second = performance for the disc

Use SQS FIFO queues for ordered processing

**User pool** can be used to **authenticate** but the **identity pool** is used to provide **authorized** access to AWS services.

**Idempotent** = performing it again (using the same inputs) does not change the result.

A diagram of a cloud computing system

Description automatically generated

reduce **cold starts**: latency when service initializes resources for the **first time**

NAT gateway: to enable outbound internet access for resources in private subnets

failover = method of protecting computer systems from a failure. ex.: the second server went into failover mode within a minute.

* **Stateful vs stateless:**

**Stateful**:

Maintains state (information): data or context from previous interactions is stored (memory, database).

Uses: Scenarios requiring **continuous context** (user authentication in a traditional login session, online games).

Ex: Database sessions, Desktop applications (remember user preferences or data), Chat apps.

Disadvantages: complex, harder to scale

**Stateless**:

No State Retention

Independent Request

Easy Scalable

Uses: High scalability and lightweight interactions (RESTful APIs for web services, serverless functions).

Ex: HTTP protocol (request/response is independent), RESTful APIs, Microservices.

Disadvantages: Less suited for workflows requiring persistent context.

A screenshot of a computer

Description automatically generated

* **Compute**
* **Amazon Elastic Compute Cloud - EC2**:

ecs-cli: Amazon Elastic Container Service

ec2 instance = terminal instance

**Web service** that provides **resizable compute capacity** in the cloud

Launch **virtual server** instances, is **not serverless**, these instances operate on **physical servers**.

Amazon Machine Images (**AMIs**) are templates for your instances (OS (Linux, Ubuntu, Windows Server, MacOS), software packages)

**EC2 instance profile:**

Role:

Policy: use IAM

Permission

Credential: each profile with credential

AWS credentials: use IAM for temporary credentials

AWS Secrets Manager: no long-term credentials

**Role > Credential**

Update the IAM **instance** **profile** that is attached to the EC2 instance to include the S3:ListBucket permission for the S3 bucket.

* **AWS Batch:**

Run batch jobs (for ML model training, simulation, analysis) at any scale, in Amazon ECS, EKS, Fargate

* **AWS Elastic Beanstalk:**

Run, deploy and manage **web apps**

Handles the deployment details of capacity provisioning, **load balancing**, **auto-scaling**, application **health** monitoring.

PaaS

**BatchGetItem** can return one or multiple items from one or more tables.

Deployment options:

**All at once**: **quickest** deployment, deploys the new version to all instances simultaneously.

**Rolling**: Update a few instances at a time (bucket), and then move onto the next bucket once the first bucket is healthy (downtime for 1 bucket at a time).

**Rolling with additional batch**: launches new instances in a batch ensuring that there is full availability.

**Immutable**: Launches new instances in a new ASG.

**Blue/Green deployment**: Zero downtime and release facility. Create a new “stage” environment and deploy updates there.

**Deploy a remote Docker image to Elastic Beanstalk**. Elastic Beanstalk uses the **docker-compose.yml** file to pull and run your image if you are using Docker Compose. Otherwise, Elastic Beanstalk uses the Dockerrun.aws.json instead.

* **AWS Lambda:**

Run code in response to events, without thinking about servers or clusters

Function can access:

AWS services or non-AWS services

AWS services running in VPCs (RedShift, Elasticache, RDS instances)

Non-AWS services running on EC2 instances in an AWS VPC

Access to local storage in the /**tmp** directory, 512 MB and 10,240 MB

For AWS Lambda function, the temporary storage /tmp up to 512 MB, **not durable**, and data is **lost** once the Lambda function execution ends.

Write and upload code as a .zip file or container image.

Use **environment variables** to adjust your function's behavior **without** updating **code**

Lambda **layer**: .zip file contains supplementary code or data (library dependencies, custom runtime, configuration files), contains shared dependencies.

Invoking a Lambda function asynchronously:

Amazon Simple Storage Service (Amazon S3) and Amazon Simple Notification Service (Amazon SNS) invoke functions asynchronously to process events.

You can configure how Lambda **handles errors**, and can send invocation records to a downstream resource such as Amazon Simple Queue Service (**Amazon SQS**) or Amazon **EventBridge** to chain together components of your application.

A diagram of a diagram

Description automatically generated with medium confidence

Introducing AWS Lambda Destinations:

Lambda asynchronous invocations can put an event or message on Amazon Simple Notification Service (**SNS**), Amazon Simple Queue Service (**SQS**), or Amazon **EventBridge** for further processing

<https://aws.amazon.com/blogs/compute/introducing-aws-lambda-destinations/>

Lambda function process a file/object created in S3:

1. Create AWS EventBridge rule to detect object created in S3.

2. Add trigger of type EventBridge to Lambda function.

To make your **AWS Lambda function idempotent**, you must design your function logic to correctly handle **duplicated events**. Idempotent function logic can help reduce the following issues:

Unnecessary API calls

Code processing time

Data inconsistency

Throttles

Latency

**Lambda aliases**: for **traffic** **splitting (traffic shifting)**, **gradual** **deployment** (**canary**), automatic rollback.

Function URLs do not support weighted traffic shifting

**Weighted aliases** allow you to **route traffic** to different versions of a function based on weights that you assign.

* **Container**
* **Amazon Elastic Container - ECS**:

Container Management Service, highly secure, reliable, and scalable way to run **containers**

run applications on a managed cluster of Amazon EC2 instances

Supports:

**Docker** containers

**Task placement strategies**: algorithm for selecting instances for task placement/termination.

**binpack**: place tasks based on the **least available amount** of **CPU** or memory. **Minimizes** the number of **instances** in use.

random: place tasks randomly

**spread**: place tasks based on the specified value (**instaceId**).

+AWS Fargate serverless compute for containers

* **Amazon Elastic Container Service for Kubernetes (EKS):**

run, and scale **Kubernetes** without thinking about **cluster** management

**Amazon ECS vs Amazon EKS**

* **AWS Copilot:**

deploying and managing **containerized** applications on AWS (ECS, AWS Fargate)

automate deployments using **AWS CodePipeline**, which integrates with services like **AWS CodeCommit**, **AWS CodeBuild**, and **AWS CodeDeploy**.

Infrastructure-as-code (IaC) templates

A screenshot of a computer

Description automatically generated

* **Amazon Fargate:**

Serverless compute engine for **containers** for **ECS** and **EKS**

there is **no EC2 host** to **install** the CloudWatch agent on. Applies to ECS on EC2 but not ECS on Fargate.

Uses:

Run containers without having to manage servers or clusters of Amazon EC2 instances.

Manage your **applications**, not infrastructure

Improve security through isolation for Amazon **ECS tasks** and Amazon EKS pods.

A screenshot of a computer

Description automatically generated

**run your tasks and services with the Fargate launch type**: you package your application in containers, specify the CPU and memory requirements, define networking and IAM policies, and launch the application. Each **Fargate task** has its own **isolation** boundary and does not share the underlying kernel, CPU resources, memory resources, or elastic network interface with another task.

**Amazon ECS with the Fargate launch type**: The workloads are highly variable and therefore the company prefers to be charged **per running task**.

* **Elastic Container Registry (Amazon ECR):**

**fully managed container registry** that stores **container** **images**.

Package the application into a container image by using the Docker CLI. Upload the image to Amazon Elastic Container Registry (Amazon ECR).

* **Analytics**
* **Amazon Athena:**

Query data in **S3** using **SQL**, for data stored in **relational**, **non-relational**, object, custom data sources.

**Amazon Athena <–> S3**

* **Amazon Maci:**

automated scanning and pattern matching

Use to run a job on the S3 buckets that contain the affected data. Filter the findings by using the SensitiveData:S3Object/Financial finding type.

* **Amazon CloudSearch -> Amazon OpenSearch Service:**

Managed Search service

Use to search, log analytics, real-time application monitoring, observability, **dashboard**.

* **Amazon Kinesis:**

Analyze **real-time** **video** and data **streams**

Uses:

Real-time apps (monitoring, fraud detection, live leaderboards)

From batch to real-time analytics

Analyze IoT device data: to send real-time alerts, thresholds

Video analytics apps: video playback, security monitoring, face detection, ML

**ProvisionedThroughputExceededException**: the request rate for the stream is too high, or the requested data is too large for the available throughput. You must reduce the frequency or size of your requests.

* **Amazon Kinesis Data Firehose:**

Real-time streaming delivery for any data, at any scale, at low-cost

Uses:

**Data Transformation**: invoke your **Lambda** function to **transform** incoming source data and deliver the **transformed data** to destinations (S3, HTTP endpoint)

* **Application Integration**
* **AWS Step Functions:**

**Visual** workflows for distributed applications

A Step Functions execution receives a **JSON** text as input and passes that input to the first state in the workflow. Individual states receive JSON as input and usually pass JSON as output to the next state.

In the **Amazon States Language**, these fields filter and control the flow of JSON from state to state:

InputPath

OutputPath

ResultPath

Parameters

ResultSelector

Uses:

Automate workflows without code

Orchestrate microservices

Create data and machine learning (ML) pipelines

AWS Step Functions Local with **mocked** service integrations

**To state machine to reference the API Gateway endpoint**: Configure the CloudFormation template to reference the API endpoint in the **DefinitionSubstitutions** property for the **AWS::StepFunctions::StateMachine** resource.

* **Amazon API Gateway:**

Create, publish, maintain, monitor and secure **REST APIs** and WebSocket APIs.

Does **not** support **SOAP APIs**. Cannot process the XML SOAP data.

supports **mock** integrations for API methods.

Authorize access to your APIs with AWS Identity, Access Management (IAM), Amazon Cognito

**API Gateway Stage Variables**: environment configuration (dev, test, prod).

* **Amazon EventBridge:**

Serverless event bus for SaaS apps & AWS services

**EventBridge (formerly Amazon CloudWatch Events):** help you to respond to **state changes** in your **AWS resources**. When your resources change state, they automatically send events into an **event stream**.

<https://docs.aws.amazon.com/eventbridge/latest/userguide/eb-cwe-now-eb.html>

**Amazon EventBridge rule that runs on a regular schedule to invoke the Lambda function.**

AWS Lambda function to be invoked every 10 minutes

Uses:

**event-driven architectures**

create point-to-point integrations

* **Amazon Simple Notification Service - SNS:**

Fully managed **messaging** service

Exchange of messages between **distributed systems**, **microservices** or applications using **Pub/sub** (publish/subscribe), **SMS**, **email** and **mobile** **push** **notifications**

FIFO messaging

Encrypt messages with AWS Key Management Service (KMS)

Amazon SNS topic

* **Amazon Simple Queue Service - SQS:**

Managed message **queues** for **microservices**, distributed systems, serverless apps

**FIFO** queues

Security with AWS Key Management (**KMS**), HTTPS/TLS

Supports **dead-letter queues** (**DLQ**), which other queues (**source queues**) can target for messages that can't be processed (consumed) successfully.

* **AWS AppSync:**

Fully-managed, scalable **GraphQL APIs**

Connect applications to events, data, AI models

to access data from **multiple databases**, **micro-services**, and AI models with a **single** GraphQL API request

GraphQL for **DynamoDB** and **Aurora** databases

* **Database**
* **Amazon Aurora:**

Manage **relational** database for MySQL and PostgreSQL

has 5x the throughput of MySQL and 3x of PostgreSQL

data durable across 3 AZs (customers only pay for 1 copy)

Replication:

Global Database: best replication performance

**binlog-based replication**: with external MySQL databases

* **Amazon DynamoDB:**

Managed **NoSQL** database

**key-value** and document database

serverless

data synchronously replicated across 3 AZs in a region

used for **storing session data**

**DynamoDB** **Streams**:

build serverless **event-driven** applications

captures a time-ordered sequence of item-level modifications in any DynamoDB table and stores this information in a log for up to 24 hours.

AWS Lambda triggers: code automatically respond to events in DynamoDB Streams

**DynamoDB** **DAX**: increase **performance** of **DynamoDB** tables and offload read requests. **Cannot** used in front of an Amazon **RDS** database.

**Local Secondary Index (LSI)**: querying with **same** **partition** **key**, **different** **sort** **key**. **Strongly consistent reads** (retrieves the most-up-to-date data). Can be added during the **table** **creation**.

**Global Secondary Index (GSI)**: querying with a **different** **partition** **key and sort key**. **Eventually** consistent reads (**not return the latest data**). Can be added to **existing tables**.

**AWS SDKs for DynamoDB automatically retry requests** that receive an exception.

* **Amazon ElastiCache:**

**In-memory** **database** **cache** used in front of Amazon **RDS**

web service to deploy and run **Memcached** or **Redis** server nodes (replication) in the cloud.

**low latency** (in-memory database) than **DynamoDB**

is not durable

**does not** offer the same durability and **consistency** guarantees as **DynamoDB**.

2 types of ElastiCache engine:

**Memcached**: simplest model, scaled in and out, can cache objects such as DBs, **not** support **encryption** or high availability. **Multithreaded** caching solution that can be used to **offload heavy read traffic** from Amazon RDS instances. For **temporary** data, **not** for **persistent** **idempotency** checks.

**Redis**: complex model, master/slave replication, cross AZ (AH), automatic **failover** and backup/restore, for **encryption** and **high availability** use ElastiCache **Redis** with **cluster mode** enabled.

Uses:

For **storing session state data (key/value)**, low latency, high performance

Lowest latency

Real-time application **data caching: Real-time performance** for **real-time applications**

Real-time session stores: session data for gaming, e-commerce, social media, online apps

A screenshot of a computer

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<https://digitalcloud.training/amazon-elasticache/>

**Caching strategy**:

**TTL strategy cache**: Time-To-Live. By expiring items

**write-through cache**: most recent value for each data item. The cached data must populate real-time dashboards.

**lazy loading cache**: data is loaded into the cache only when it is requested by the application

**read-through cache**: to cache frequently read data

**write-behind cache:** for improving write performance but with a tradeoff in consistency

* **Amazon RDS - Relational Database Service:**

Managed relational database service for PostgreSQL, MySQL, MariaDB, SQL Server, Oracle, Db2

Amazon Aurora: MySQL, PostgreSQL

* **Developer Tools**

code, build, test and deploy app

SDKs, code editors, CI/CD

* **AWS Cloud9:**

Write, run, and debug code on a cloud IDE

* **AWS CloudShell:**

Browser-based shell environment

AWS CLI in browser, **Linux**

<https://aws.amazon.com/cloudshell/?nc2=h_ql_prod_dt_cs>

* **AWS Command Line Interface - CLI:**

Unified tool to manage AWS services

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

<https://docs.aws.amazon.com/cli/latest/userguide/cli-configure-sso.html>

* **AWS CodeBuild:**

Build and test code

Specify a local cache in CodeBuild. Add the cache folder path to the buildspec.yaml file for the build project

* **AWS CodeCommit:**

Managed **version control** service

host private Git repositories

commit packages

Store code in private Git repositories

* **AWS CodeDeploy:**

Automate code deployments

**2 deployment type**:

**in-place**: **cannot** used by **ECS**

**blue/green**: AWS Lambda, Amazon **ECS**

**run order of the hooks for in-place deployments:**

ApplicationStop -> BeforeInstall -> AfterInstall -> ApplicationStart

* **AWS CodePipeline:**

Delivery pipeline to deliver application

Release software using **continuous delivery**

Integrated with:

AWS **CodeBuild:** to **test** and **build**

AWS **CodeDeploy:** to **deploy** the app

AWS **CodeCommit** repository: is triggered by changes to the **main branch**

* **AWS X-Ray:**

Analyze and **debug** your applications

Analyze the behavior of their production, distributed applications with **end-to-end tracing capabilities**. To identify performance **bottlenecks**, **edge case errors**, **detect issues**.

Instrument the application by using the X-Ray SDK for Python. Install the X-Ray SDK for all the services that the application uses.

If you add **annotations** with the **X-Ray SDK**, you can also **filter** based on the presence of an annotation key or the value of a key.

Install **X-Ray daemon** on the **on-premises servers** (**local**)

* **Management & Governance**
* **Amazon CloudWatch:**

**Monitoring** service for AWS cloud **resources** and **applications**, on premises, and on other clouds

Used to trigger actions based on changes in the state of AWS services, collect and track **metrics**, collect and monitor **log files**, and set **alarms**. Provides **insights** into operational **health.**

A diagram of a cloud watch

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CloudWatch observability

AWS X-Ray (**traces**) > Amazon CloudWatch (**metrics, logs**)

AWS X-Ray is useful for **tracing** requests across AWS services, but it doesn’t focus on detailed execution and access **logs** for **API Gateway**.

**CloudWatch Logs**:

can use **filter expressions. Metric filters** can be used to **trigger CloudWatch alarms**.

only publishes **metric data** for **events** **no** **count** **exceptions** in the application.

The **awslogs** **log driver** allows containers running in Amazon **ECS** to send their logs directly to **Amazon CloudWatch Logs.**

* **AWS CloudFormation:**

Create and manage **resources** with **templates**

IaaC, manage infrastructure with **DevOps**: automate, test, and deploy infrastructure templates with continuous integration and delivery (**CI/CD**) **automations**, **Rollback** Support.

Use **helper scripts** for software installation and application setup.

**CloudFormation template**: a template file (.yaml or .json) to define infrastructure (**S3** bucket and **EC2** instance).

Creates Amazon VPC security groups, Amazon EC2 security groups

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Add the relevant key and bucket to the **S3Bucket** and **S3Key** properties in the CloudFormation template

**Ref**: to reference **resources** within the **same** **stack**

**ImportValue**: importa el valor de un recurso de otro template

**Resources**:

**AllowedValues**: to create a parameter with the list of EC2 instance types

**Mapping**: for **static** configuration values, not for **dynamically**

**StackSets:** to **manage** **resources** across multiple **AWS Regions**.

**AWS CLI** **create-stack-set** command to create/deploy and run a stack set in **multiple** **Regions**

**AWS CLI deploy** command to deploy in a **single** **Region**

**CloudFormation stack**: is created when deploy a the template

**drift detection:** detect changes of security groups

* **AWS Cloud Development Kit (AWS CDK):**

open-source software development framework to define cloud infrastructure using programming languages (TypeScript, JavaScript, Python, Java, C#, Go).

Simplifies the process of creating, managing and deploying AWS resources through code.

**CDK code** is converted into **CloudFormation templates** for provisioning **AWS resources**.

**CDK assertions module** for unit testing.

**CDK Aspects class** to enforce security rules.

**Commands:**

**cdk synth**: to convert the code into a **CloudFormation template** (JSON or YAML).

**cdk bootstrap**: to set up **prerequisite infrastructure** in your AWS account.

**cdk deploy**: to deploy the incremental changes.

* **AWS CloudTrail:**

Track **user activity**, **API usage**, **API calls**

service that enables **governance**, compliance, operational **auditing**, and auditing of your AWS account.

CloudTrail logs, CloudTrail Insights

* **AWS AppConfig:**

Managing application configurations for large-scale configuration.

Assess, audit, and evaluate **configurations** of your **resources**

Track resources inventory and changes

**Feature Flags** configuration profile: to require selective activation of specific features

* **Networking & Content Delivery**
* **Amazon Virtual Private Cloud - VPC:**

Isolated cloud resources

Define and launch AWS resources in a logically isolated virtual network

Customize your virtual network by choosing your own **IP address range**, creating **subnets**, and configuring **route tables**.

VPC -> EC2 + RDS, VPCs across accounts, Availability Zones, or AWS Regions

* **Amazon CloudFront:**

Global Content Delivery Network (**CDN**) with **HTTPS** communication

IaaS (Infrastructure as a Service)

Distribution of **static content of web service**

used for **caching content** for better global performance

CloudFront Functions for **customizing** **URL behavior**.

S3 bucket policy to allow CloudFront OAC with read and write access -> Origin Access Control (OAC) in CloudFront

**Lambda@Edge:**

is a feature of Amazon CloudFront that allows developers to **run** **AWS** **Lambda** **functions** closer to the **end user**, at AWS edge locations worldwide.

Integrates with AWS Security Token Service (AWS **STS**)

dynamically **optimizes photos** based on the device's request

**Uses cases:**

Custom Authentication and Authorization

Content Personalization: viewer characteristics (geolocation, device type, or cookies)

A/B Testing

* **Amazon Route 53:**

Scalable domain name system (**DNS**)

Route end users to Internet apps

provides highly available and scalable [Domain Name System (DNS)](https://aws.amazon.com/route53/what-is-dns/), [domain name registration](https://aws.amazon.com/blogs/networking-and-content-delivery/benefits-of-domain-registration-with-amazon-route-53/), and [health-checking](https://docs.aws.amazon.com/Route53/latest/DeveloperGuide/dns-failover.html) cloud services

* **AWS VPN:**

Securely access your network resources

Connect your on-premises networks and remote workers to the cloud

* **Elastic Load Balancing (ELB):**

Distribute incoming traffic across multiple targets

Security: Secure your applications with SSL/TLS termination, integrated certificate management, and client certificate authentication.

**Automatic scaling**

* **Security, Identity, & Compliance**

**AWS credentials**: use **IAM** (AWS Identity and Access Management)

**Encryption keys**: use **KMS** (AWS Key Management Service)

**KMS** provides **audit** functionalities

SSH keys: use Amazon EC2 Instance Connect

**Private keys and certificates**: use AWS Certificate Manager

**AWS Secrets Manager:** Rotate, manage, and retrieve secrets (**database credentials**, **API keys**, **token,** OAuth)

**AWS Systems Manager Parameter Store**: Secure String. for storing and retrieving non-sensitive configuration data (API URL) across environments (development, testing, production), credentials. **Less cost than AWS Secrets Manager**.

* **AWS Identity and Access Management (IAM):**

Securely manage access to services and resources

Grant **temporary security credentials** for workloads that access your AWS resources

IAM policies: east-privilege policies

* **Amazon Cognito:**

Management service for **authentication** and **authorization**

Customized sign-up and sign-in

Identity management for your apps

Leverages **IAM roles** to generate **temporary credentials** for your application’s users

**Amazon Cognito user pools**: for external identity providers

**User pool**: to **authenticate**

**Identity pool**: to **authorized** access to AWS services

* **AWS Secrets Manager:**

**Rotate**, manage, and retrieve secrets (**database credentials**, **API keys**, **token,** OAuth).

Used for storing secret information such as **database connections strings** and **passwords** with **API access**.

increase security, use this instead of **environment variables** to **store database credentials** (for long-term credentials) and other sensitive information, retrieve them at runtime **without** using **long-term credentials**.

Support **secret replication** for disaster recovery scenarios.

Use AWS Identity and Access Management (**IAM**) permissions **policies** to manage access to your **secrets**.

Integrate secrets with AWS logging, monitoring, and notification services.

* **AWS Private Certificate Authority (CA):**

provides strong security and restrictive **access controls**.

allowing more permissive access and bulk certificate issuance for subordinate CAs lower on the chain.

**create** **private** **certificates** to identify resources and protect data.

create versatile **certificate** and CA **configurations** to **identify** and protect your **resources** (servers, applications, users, devices, and containers).

direct integration with **AWS IAM** (IAM policies)

Support:

Managed Public Key Infrastructure (**PKI**)

  IAM integration.

      Auditing with AWS CloudTrail.

Private certificates.

      Subordinate certificate authorities (CAs).

* **AWS Key Management Service:**

used to create and manage the **encryption** **keys** used for encrypting data at rest.

* **AWS Certificate Manager:**

used for issuing **SSL/TLS certificates**

Create, store, renew **SSL/TLS X.509 certificates**

Single domains, multiple domain, names and wildcards

Integrates with:

Elastic Load Balancing

Amazon CloudFront

AWS Elastic Beanstalk

AWS Nitro Enclaves

AWS CloudFormation

Public certificates are signed by the AWS public Certificate Authority

Create a Private CA with ACM

Issue private certificates

<https://digitalcloud.training/aws-certificate-manager/>

* **Environment variables:**

To store secrets securely and adjust your function’s behavior without updating the code.

* **presigned URLs:**

to grant **time-limited access** to objects in Amazon **S3** without updating your **bucket policy**

* **Storage**
* **Amazon Simple Storage Service - S3:**

**object-based** storage: **key-value** pairs rather than in a file or block structure

Stores data as objects within **buckets**

**Object**: file and **metadata** that describes the file

**Bucket**: container for objects

Support versioning

**doesn’t** support **HTTPS** for website endpoints.

S3 -> CodeDeploy

SQL queries

bucket: logs

**S3 Lifecycle rules** for **automating** object **deletion** based on **age**.

Uses:

**Data lakes**: centralized repository to store structured and unstructured data

**backup** (databases)

**archiving** (files)

**Content Delivery** (images, videos, documents)

**static websites** (HTML, CSS, JavaScript)

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The **S3 storage classes** include **S3 Intelligent-Tiering** for automatic cost savings for data with unknown or changing access patterns:

S3 Standard: for frequently accessed data

S3 Express One Zone: for your most **frequently** accessed data

S3 Standard-Infrequent Access (S3 Standard-IA) and S3 One Zone-Infrequent Access (S3 One Zone-IA): for **less frequently** accessed data

**S3 Glacier Instant Retrieval**: for archive data that needs **immediate access**

S3 Glacier Flexible Retrieval (formerly S3 Glacier): for **rarely** accessed **long-term** data that does not require immediate access

**Amazon S3 Glacier Deep Archive** (S3 Glacier Deep Archive): for long-term archive and digital preservation with retrieval in hours at the lowest cost storage in the cloud.

**S3 Glacier Deep Archive with standard retrieval**: **24**-hour access requirement

**S3 Glacier Deep Archive with bulk retrieval**: Can take up to **48** hours

<https://aws.amazon.com/s3/storage-classes/>

**Amazon S3** **Event Notifications** can be configured to trigger an AWS Lambda function when specific events occur in an S3 bucket, such as object creation or deletion. For **Real-Time Updates.**

Configure **CORS** to **access the resources in other domains.**

**S3 Object Lambda:**

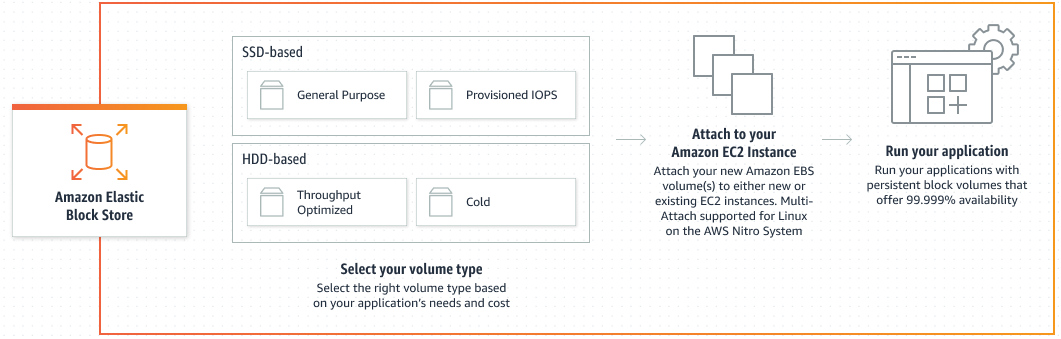
is a new feature that allows the developer to add custom code to S3 GET requests. The developer can create an S3 Object Lambda function to **remove** the PII from the document and configure S3 to use the function whenever an object is requested from a specific access point.

* **Amazon Elastic Block Store (EBS):**

**EC2** **block storage** **volumes**

Uses:

Run relational or NoSQL databases



* **Amazon Elastic File System (EFS):**

Fully managed file system for **EC2**

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Uses:

Simplify DevOps

Accelerate data science: for machine learning (ML) and big data analytics workloads

Enhance Content Management Systems (CMS)

* **Others**
* **Amazon Inspector:**

Automated security assessment service that helps improve the security and compliance of applications deployed on AWS.

* **Amazon RDS Proxy:**

**Manage database** **connections** in serverless environments (AWS Lambda) using connection pool **reduces** the number of direct connections to the database.

* **Dead Letter Queue (DLQ):**

Configure this on **AWS Lambda** to give you more control over message handling for all **asynchronous** **invocations**, including those delivered via **AWS events** (**S3**, **SNS**, **IoT**). Saves **discarded events** for further processing.

Set the dead-letter queue as an **event source** for the Lambda function.

Used for **debugging** your application or messaging system because they let you isolate unconsumed messages to determine why their processing doesn't succeed.

* **AWS Serverless Application Model (AWS SAM):**

<https://aws.amazon.com/serverless/sam/>

**simplifies the development and deployment** of serverless applications.

Define and manage your **infrastructure** **code** with **AWS SAM templates**. Define serverless resources in **YAML**.

Perform **real-time debugging** and **testing** in the cloud with **AWS SAM Accelerate**.

consists of two parts:

**AWS SAM templates**: IaC

**AWS SAM CLI**: create, develop, debug, and deploy serverless applications. Provides tools specifically for **local** **testing** of AWS Lambda functions.

**Commands**:

**sam build** and **sam deploy**: to prepare your application for deployment and deploy to AWS.

**sam sync**: to watch for **local changes** and **quickly deploy** those changes to AWS. Then, use **sam remote invoke** to test your lambda functions in the cloud.

Deploy incremental changes to the AWS environment.

Avoid a full application deployment for every change.

Accelerate the feedback loop for testing.

**sam pipeline**: to create or modify pipelines for your continuous integration and continuous delivery (CI/CD) system.

**sam local invoke**: with the function's logical ID in the synthesized template to **test the function locally**.

**sam local start-lambda**: to **simulate** the Lambda **runtime** environment locally and is useful for integration testing with other services. However, it is not intended for invoking a single function directly for testing.

**SAML directory:** You cannot provide access to an on-premises SAML directory using a VPC endpoint.

* **AWS Amplify Hosting:**

**build** and **deploy** an **application**

Add a test phase to the **amplify.yml** build settings for the application

**is an all in one** service

* **AWS Application Integration Services:**

<https://digitalcloud.training/aws-application-integration-services/>

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