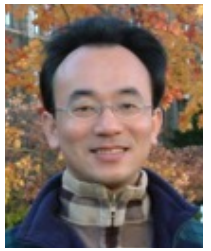
企業雲端運算入門
(Foundation of Business Cloud Computing)
雲端概念概述
(Cloud Concepts Overview)

企業雲端運算入門 (Foundation of Business Cloud Computing) (BA4, NTPU) (Spring 2023)
(AWS Academy Cloud Foundations; ACF) (AWS Certified Cloud Practitioner)
(BA4, NTPU) (3 Credits, Elective) (U4010) (自主學習課程)(商業智慧與大數據分析學士學分學程)
(1112) (國立台北大學企管系4A, 4B) (選修3學分) (授課教師：謝榮桂，戴敏育) (2023.02 - 2023.06)
(週三 Wed, 6, 7, 8, 14:10-17:00) (台北大學三峽校區 商3F10)

謝榮桂 (Jung-Kuei Hsieh), 戴敏育 (Min-Yuh Day)

National Taipei University

國立臺北大學



2023-02-22

NTPU

國立臺北大學

National Taipei University

+ aws academy

國立臺北大學
111學年度第2學期 課程大綱
Spring 2023 (2023.02 - 2023.06)

https://tinyurl.com/ntpuawsapp

- 課程名稱 ：企業雲端運算入門
  (Foundation of Business Cloud Computing)
- 應修系級 Major：企業管理學系4A , 4B,
  商業智慧與大數據分析學士學分學程
- 授課教師 Instructor：謝榮桂　戴敏育
- 選修類別 Required/Elective：選 (Elective)
- 學　　分 Credit(s) ：3 學分
- 週三 Wed, 6, 7, 8, 14:10-17:00
- (台北大學三峽校區 商3F10)

（自主學習課程）

教學目標

- 本課程主要介紹亞馬遜公司的雲端運算服務 Amazon Web Services (AWS)，
  對於想要全面瞭解企業雲端運算概念的同學，
  本課程將詳細介紹
  雲概念、
  AWS 核心服務、
  安全性、
  架構、
  定價和相關支援等服務，
  並以通過認證 AWS Certified Cloud Practitioner為目標。

Course Objectives

- This course introduces Amazon Web Services (AWS), the cloud computing service of Amazon.
- For students who want to fully understand the concept of enterprise cloud computing, this course will introduce the AWS Academy Cloud Foundations.
- Topics include Cloud Concepts Overview, Cloud Economics and Billing, AWS Global Infrastructure Overview, AWS Cloud Security, Networking and Content Delivery, Cloud Compute, Cloud Storage, Cloud Databases, Cloud Architecture, Cloud Automatic Scaling and Monitoring.
- The course objective is training students to pass the certification of AWS Certified Cloud Practitioner.

內容綱要

- 說明如何使用 AWS 帳戶的最佳實務
- 說明AWS架構完善的框架和設計原則
- 說明AWS高可用性和可靠性
- 描述AWS設計決策的業務影響
- 描述AWS如何設置組織結構以簡化帳單和提高帳戶可見性
- 說明AWS替代支援選項和功能

Course Outline

1. Cloud Concepts Overview
2. Cloud Economics and Billing
3. AWS Global Infrastructure Overview
4. AWS Cloud Security
5. Networking and Content Delivery
6. Cloud Compute
7. Cloud Storage
8. Cloud Databases
9. Cloud Architecture
10. Cloud Automatic Scaling and Monitoring

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2023/02/22	雲端概念概述 (Cloud Concepts Overview)
2	2023/03/01	雲端經濟與計費 (Cloud Economics and Billing)
3	2023/03/08	AWS全球基礎設施概述 (AWS Global Infrastructure Overview)
4	2023/03/15	AWS雲端安全 (AWS Cloud Security)
5	2023/03/22	網路和內容交付 (Networking and Content Delivery)
6	2023/03/29	雲端計算 (Cloud Compute)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2023/04/05	放假一天 (No Classes)
8	2023/04/12	雲端儲存 (Cloud Storage)
9	2023/04/19	雲端數據庫 (Cloud Databases)
10	2023/04/26	雲端架構 (Cloud Architecture)
11	2023/05/03	雲端自動擴展和監控 (Cloud Automatic Scaling and Monitoring)
12	2023/05/10	學生自主學習 (Self-learning)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2023/05/17	學生自主學習 (Self-learning)
14	2023/05/24	雲端專案成果報告與討論 (Cloud Project Presentation and Discussion)
15	2023/05/31	學生自主學習 (Self-learning)
16	2023/06/07	期末專案成果報告 (Final Project Presentation)
17	2023/06/14	學生自主學習 (Self-learning)
18	2023/06/21	學生自主學習 (Self-learning)

評量方式 (Evaluation Methods)

- 課堂參與 (Class Participation): 20 %
- 個人報告 (Individual Presentation): 80 %
- 其他評量方式(Other Evaluation Methods): AWS認證成績

其他參考資料 (Other References)

- https://aws.amazon.com/training/awsacademy/
- https://aws.amazon.com/education/awseducate/
- https://www.aws.training/
- **AWS Cloud Practitioner Essentials (Second Edition)**
  - https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/
- **AWS Certified Cloud Practitioner**
  - https://aws.amazon.com/certification/certified-cloud-practitioner/
- **Architecting on AWS**
  - https://aws.amazon.com/training/course-descriptions/architect/
- **AWS Certified Solutions Architect – Associate**
  - https://aws.amazon.com/certification/certified-solutions-architect-associate/
- Ben Piper and David Clinton (2019), **AWS Certified Solutions Architect Study Guide: Associate SAA-C01 Exam**, 2 edition, Sybex, 2019

Available AWS Certifications

Professional

Two years of comprehensive experience designing, operating, and troubleshooting solutions using the AWS Cloud

Associate

One year of experience solving problems and implementing solutions using the AWS Cloud

2

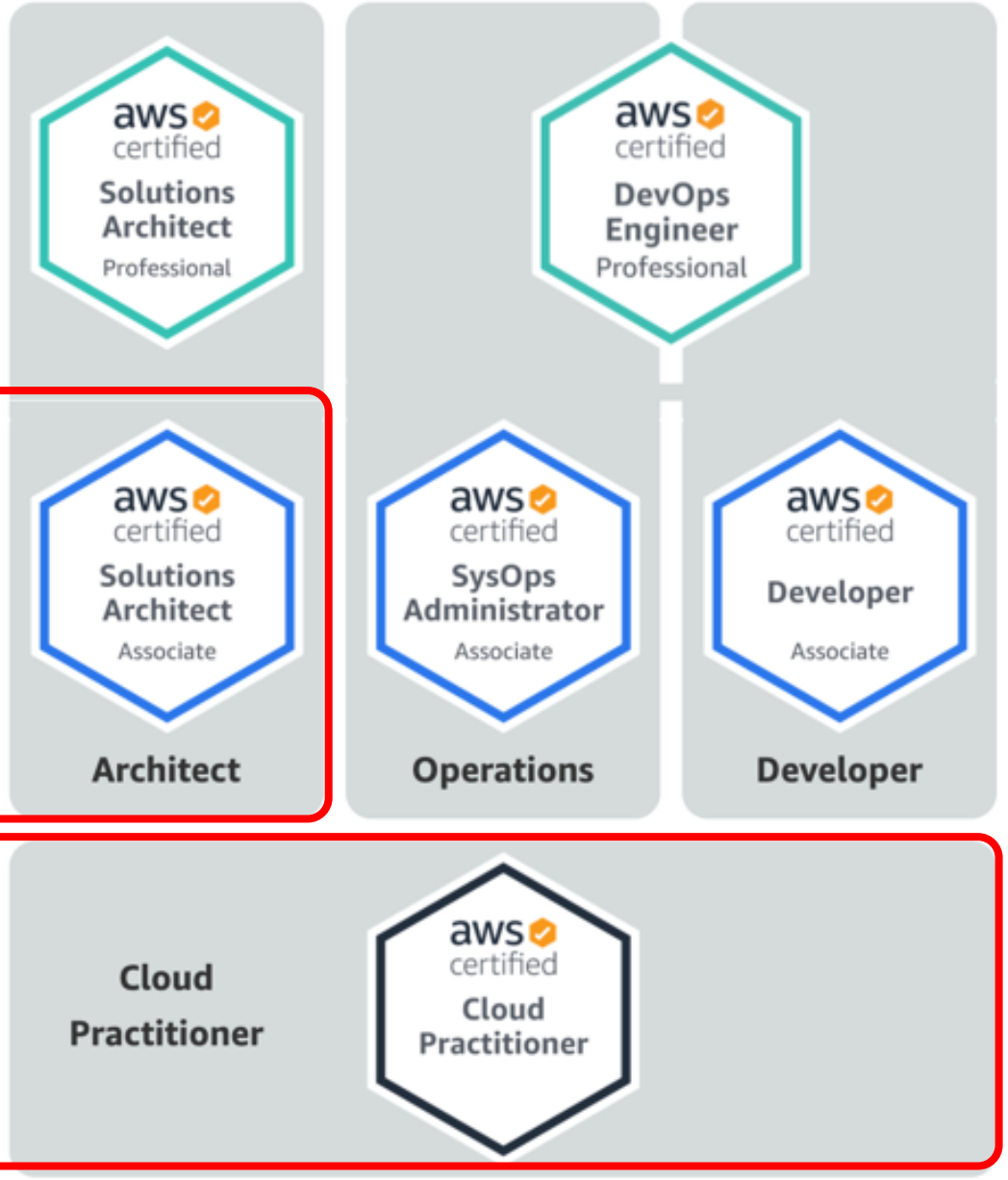
SAA

Foundational

Six months of fundamental AWS Cloud and industry knowledge

1

CLF



Specialty

Technical AWS Cloud experience in the Specialty domain as specified in the **exam guide**

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

AWS Certified Cloud Practitioner

- This certification provides individuals in a larger variety of cloud and technology roles with a way to validate their AWS Cloud knowledge and enhance their professional credibility.
- This exam covers four domains, including cloud concepts, security, technology, and billing and pricing.

https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Solutions Architect – Associate

- This certification validates your ability to effectively demonstrate knowledge of how to architect and deploy secure and robust applications on AWS technologies.
- This exam is for anyone with at least one year of hands-on experience designing available, cost-efficient, fault-tolerant, and scalable and distributed systems on AWS.

https://aws.amazon.com/certification/certified-solutions-architect-associate/

AWS Academy and Certifications

- **AWS Academy Cloud Foundations (ACF)**
  - **AWS Certified Cloud Practitioner (CLF-C01)** (2022/06)
  - https://aws.amazon.com/certification/certified-cloud-practitioner/

1

- **AWS Academy Cloud Architecting (ACA)**
  - **AWS Certified Solutions Architect – Associate (SAA-C02)**
  - https://aws.amazon.com/certification/certified-solutions-architect-associate/

2

https://aws.amazon.com/training/awsacademy/

AWS Academy and Certifications

- **AWS Academy Cloud Foundations (ACF)**
  - **AWS Certified Cloud Practitioner (CLF-C01)** (2022/06)
  - https://aws.amazon.com/certification/certified-cloud-practitioner/
  - **AWS Cloud Practitioner Essentials (Second Edition)**
    - https://aws.amazon.com/training/course-descriptions/cloud-practitioner-essentials/
  - **AWS Technical Essentials**
    - https://aws.amazon.com/training/course-descriptions/essentials/

1

- **AWS Academy Cloud Architecting (ACA)**
  - **AWS Certified Solutions Architect – Associate (SAA-C02)**
  - https://aws.amazon.com/certification/certified-solutions-architect-associate/
  - **Architecting on AWS**
    - https://aws.amazon.com/training/course-descriptions/architect/

2

https://aws.amazon.com/training/awsacademy/

AWS Certified Cloud Practitioner (CLF-C01)

Domain	% of Examination
Domain 1: Cloud Concepts	26%
Domain 2: Security and Compliance	25%
Domain 3: Technology	33%
Domain 4: Billing and Pricing	16%
TOTAL	100%

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Solutions Architect – Associate (SAA-C02)

Domain	% of Examination
Domain 1: Design Resilient Architectures	30%
Domain 2: Design High-Performing Architectures	28%
Domain 3: Specify Secure Applications and Architectures	24%
Domain 4: Design Cost-Optimized Architectures	18%
TOTAL	100%

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate

AWS Certified Cloud Practitioner (CLF-C01)

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Cloud Practitioner (CLF-C01)

- **Domain 1: Cloud Concepts**
  - 1.1 Define the AWS Cloud and its value proposition
  - 1.2 Identify aspects of AWS Cloud economics
  - 1.3 List the different cloud architecture design principles

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Cloud Practitioner (CLF-C01)

- **Domain 2: Security and Compliance**
  - 2.1 Define the AWS shared responsibility model
  - 2.2 Define AWS Cloud security and compliance concepts
  - 2.3 Identify AWS access management capabilities
  - 2.4 Identify resources for security support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Cloud Practitioner (CLF-C01)

- **Domain 3: Technology**
  - 3.1 Define methods of deploying and operating in the AWS Cloud
  - 3.2 Define the AWS global infrastructure
  - 3.3 Identify the core AWS services
  - 3.4 Identify resources for technology support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Cloud Practitioner (CLF-C01)

- **Domain 4: Billing and Pricing**
  - 4.1 Compare and contrast the various pricing models for AWS
  - 4.2 Recognize the various account structures in relation to AWS billing and pricing
  - 4.3 Identify resources available for billing support

Source: https://aws.amazon.com/certification/certified-cloud-practitioner/

AWS Certified Solutions Architect – Associate (SAA-C02)

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate

AWS Certified Solutions Architect – Associate (SAA-C02)

- **Domain 1: Design Resilient Architectures**
  - 1.1 Design a multi-tier architecture solution
  - 1.2 Design highly available and/or fault-tolerant architectures
  - 1.3 Design decoupling mechanisms using AWS services
  - 1.4 Choose appropriate resilient storage

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate

AWS Certified Solutions Architect – Associate (SAA-C02)

- **Domain 2: Design High-Performing Architectures**
  - 2.1 Identify elastic and scalable compute solutions for a workload
  - 2.2 Select high-performing and scalable storage solutions for a workload
  - 2.3 Select high-performing networking solutions for a workload
  - 2.4 Choose high-performing database solutions for a workload

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate

AWS Certified Solutions Architect – Associate (SAA-C02)

- **Domain 3: Design Secure Applications and Architectures**
  - 3.1 Design secure access to AWS resources
  - 3.2 Design secure application tiers
  - 3.3 Select appropriate data security options

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate

AWS Certified Solutions Architect – Associate (SAA-C02)

- **Domain 4: Design Cost-Optimized Architectures**
  - 4.1 Identify cost-effective storage solutions
  - 4.2 Identify cost-effective compute and database services
  - 4.3 Design cost-optimized network architectures

Source: https://aws.amazon.com/certification/certified-solutions-architect-associate

AWS Products and Services

- Analytics
- Application Integration
- AR & VR
- AWS Cost Management
- Blockchain
- Business Applications
- Compute
- Customer Engagement
- Database
- Developer Tools
- End User Computing
- Game Tech
- Internet of Things
- Machine Learning
- Management & Governance
- Media Services
- Migration & Transfer
- Mobile
- Networking & Content Delivery
- Quantum Technologies
- Robotics
- Satellite
- Security, Identity & Compliance
- Storage

Source: https://aws.amazon.com/

AWS Compute

Amazon EC2
Virtual servers in the cloud

Amazon EC2 Auto Scaling
Scale compute capacity to meet demand

Amazon Elastic Container Registry
Store and retrieve docker images

Amazon Elastic Container Service
Run and manage docker containers

Amazon Elastic Kubernetes Service
Run managed Kubernetes on AWS

Amazon Lightsail
Launch and manage virtual private servers

AWS Batch
Run batch jobs at any scale

AWS Elastic Beanstalk
Run and manage web apps

AWS Fargate
Run containers without managing servers or clusters

AWS Lambda
Run code without thinking about servers

AWS Outposts
Run AWS infrastructure on-premises

AWS Serverless Application Repository
Discover, deploy, and publish serverless applications

AWS Wavelength
Deliver ultra-low latency applications for 5G devices

VMware Cloud on AWS
Build a hybrid cloud without custom hardware

Source: https://aws.amazon.com/

AWS Database

Amazon Aurora
High Performance Managed Relational Database

Amazon DynamoDB
Managed NoSQL Database

Amazon DocumentDB (with MongoDB compatibility)
Fully managed document database

Amazon ElastiCache
In-memory Caching System

Amazon Managed Apache Cassandra Service
Managed Cassandra-compatible database

Amazon Neptune
Fully Managed Graph Database Service

Amazon Quantum Ledger Database (QLDB)
Fully managed ledger database

Amazon RDS
Managed Relational Database Service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB

Amazon RDS on VMware
Automate on-premises database management

Amazon Redshift
Fast, Simple, Cost-effective Data Warehousing

Amazon Timestream
Fully managed time series database

AWS Database Migration Service
Migrate Databases with Minimal Downtime

Source: https://aws.amazon.com/

AWS Storage

Amazon Simple Storage Service (S3)
Scalable Storage in the Cloud

Amazon Elastic Block Store (EBS)
EC2 block storage volumes

Amazon Elastic File System (EFS)
Fully managed file system for EC2

Amazon FSx for Lustre
High-performance file system integrated with S3

Amazon FSx for Windows File Server
Fully managed Windows native file system

Amazon S3 Glacier
Low-cost Archive Storage in the Cloud

AWS Backup
Centralized backup across AWS services

AWS Snow Family
Physical devices to migrate data into and out of AWS

AWS Storage Gateway
Hybrid Storage Integration

CloudEndure Disaster Recovery
Highly automated disaster recovery

Source: https://aws.amazon.com/

AWS Networking & Content Dilivery

Amazon VPC
Isolated Cloud Resources

Amazon API Gateway
Build, Deploy, and Manage APIs

Amazon CloudFront
Global Content Delivery Network

Amazon Route 53
Scalable Domain Name System

AWS PrivateLink
Securely Access Services Hosted on AWS

AWS App Mesh
Monitor and control microservices

AWS Cloud Map
Application resource registry for microservices

AWS Direct Connect
Dedicated Network Connection to AWS

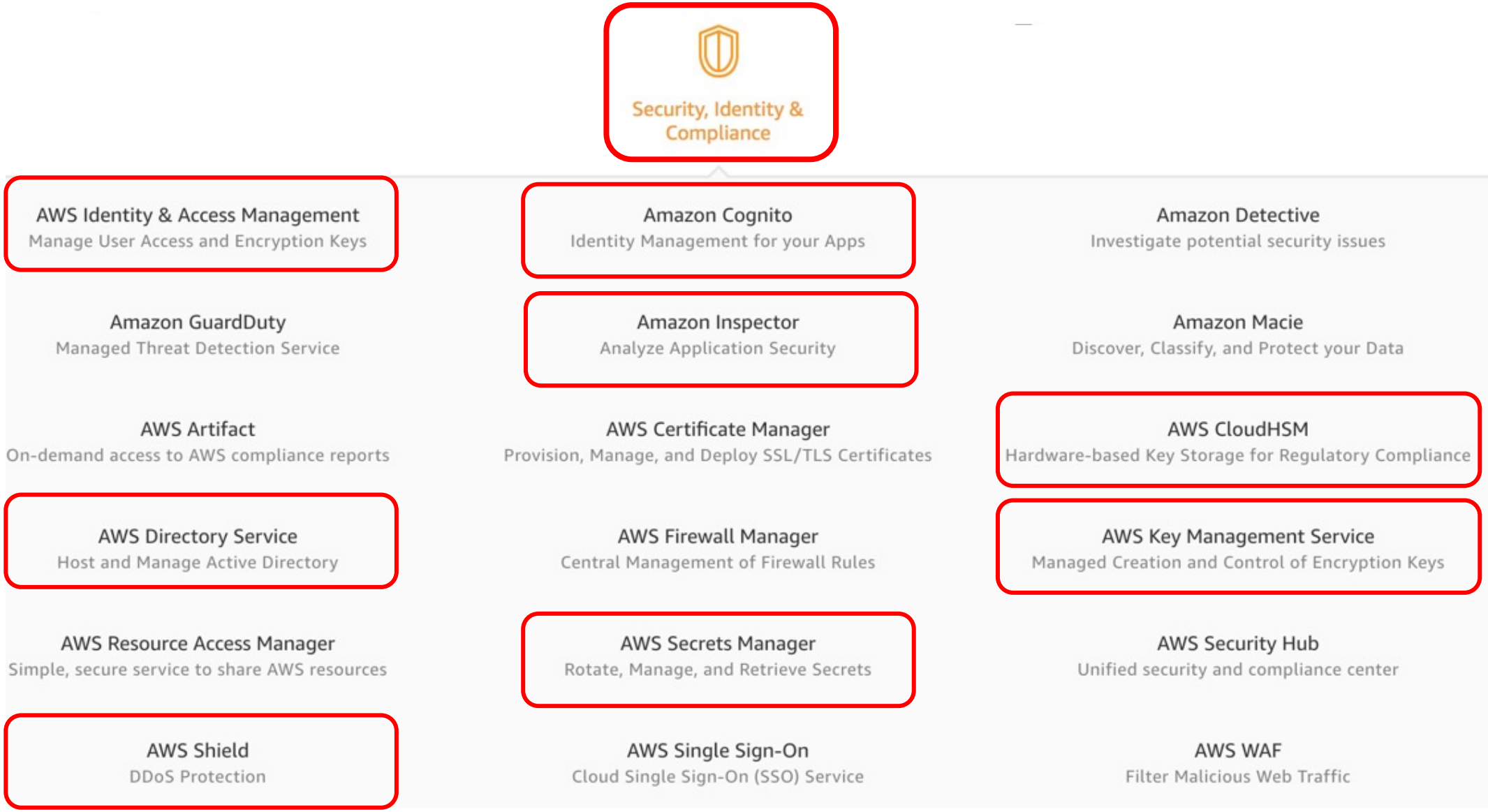
AWS Global Accelerator
Improve application availability and performance

AWS Transit Gateway
Easily scale VPC and account connections

Elastic Load Balancing
Distribute incoming traffic across multiple targets

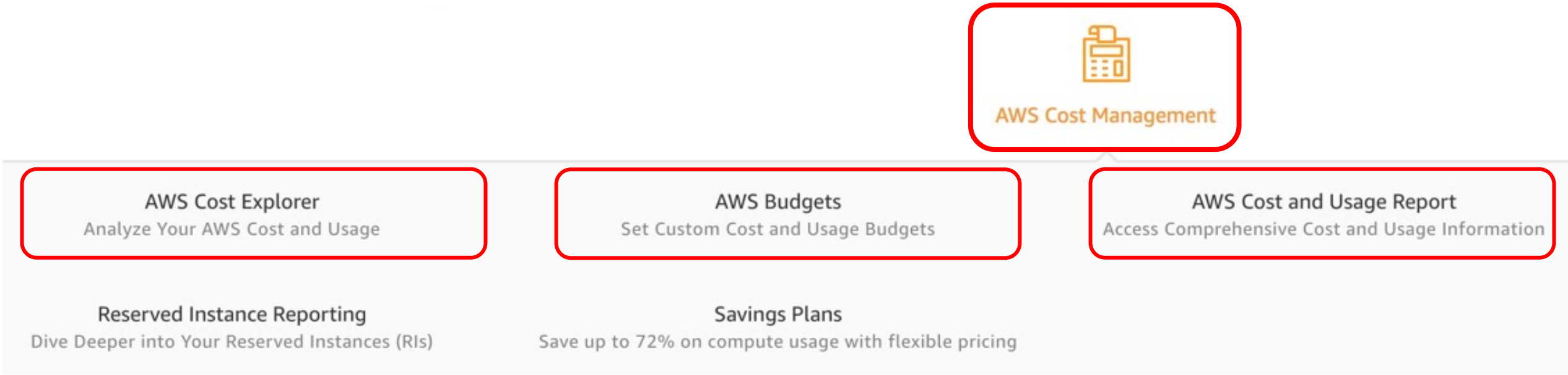
Source: https://aws.amazon.com/

AWS Security, Identity & Compliance



Source: https://aws.amazon.com/

AWS Cost Management



Source: https://aws.amazon.com/

AWS Services

- Amazon **EC2**
  - Virtual servers in the cloud
- Amazon **Simple Storage Service (S3)**
  - Scalable storage in the cloud
- Amazon **Aurora**
  - High performance managed relational database
- Amazon **DynamoDB**
  - Managed NoSQL database
- Amazon **RDS**
  - Managed relational database service for MySQL, PostgreSQL, Oracle, SQL Server, and MariaDB

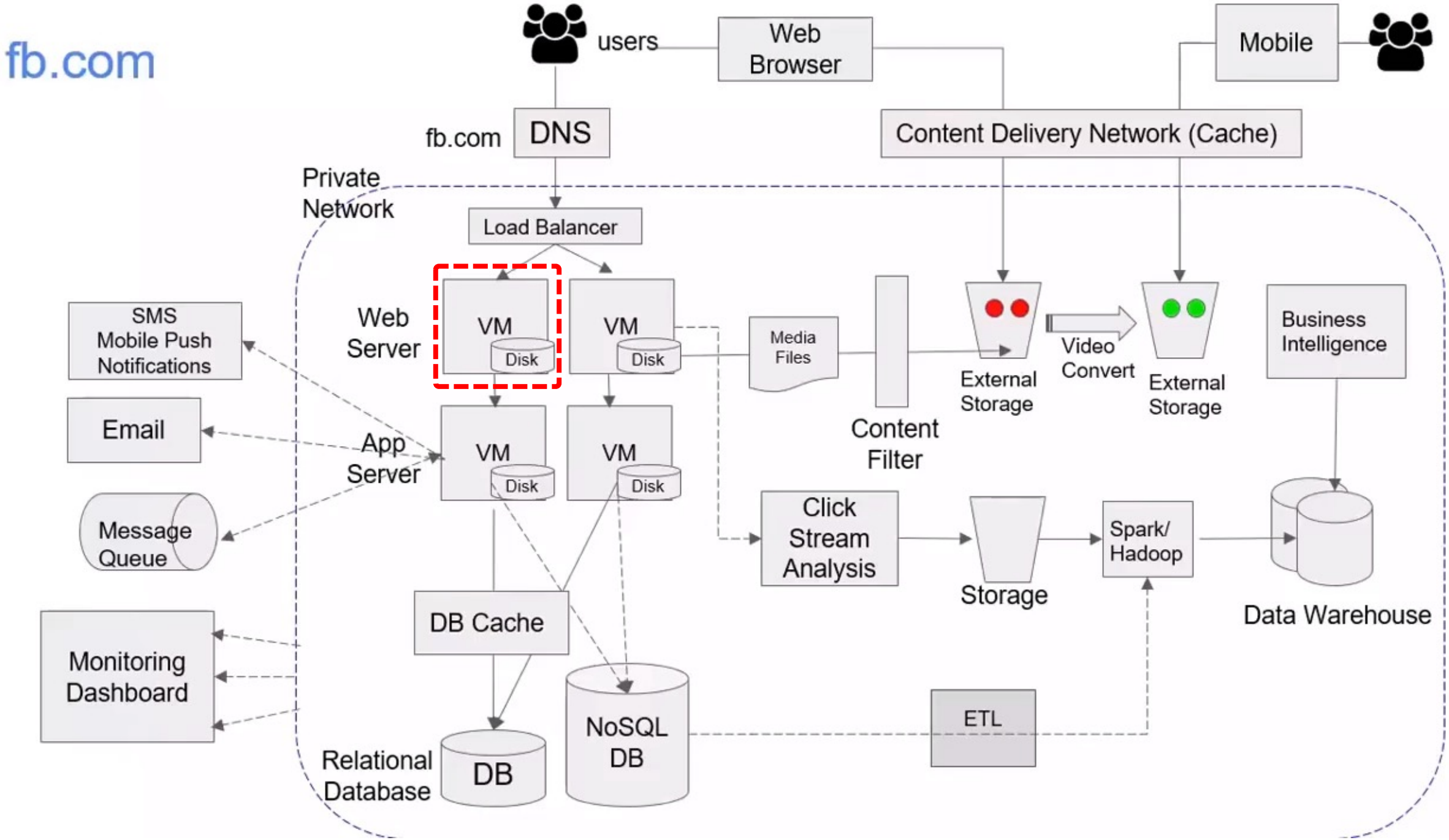
Source: https://aws.amazon.com/

AWS Services

- AWS **Lambda**
  - Run code without thinking about servers
- AWS **Elastic Beanstalk**
  - Run and manage web apps
- Amazon **VPC**
  - Isolated cloud resources
- Amazon **Lightsail**
  - Launch and manage virtual private servers
- Amazon **SageMaker**
  - Build, train, and deploy machine learning models at scale

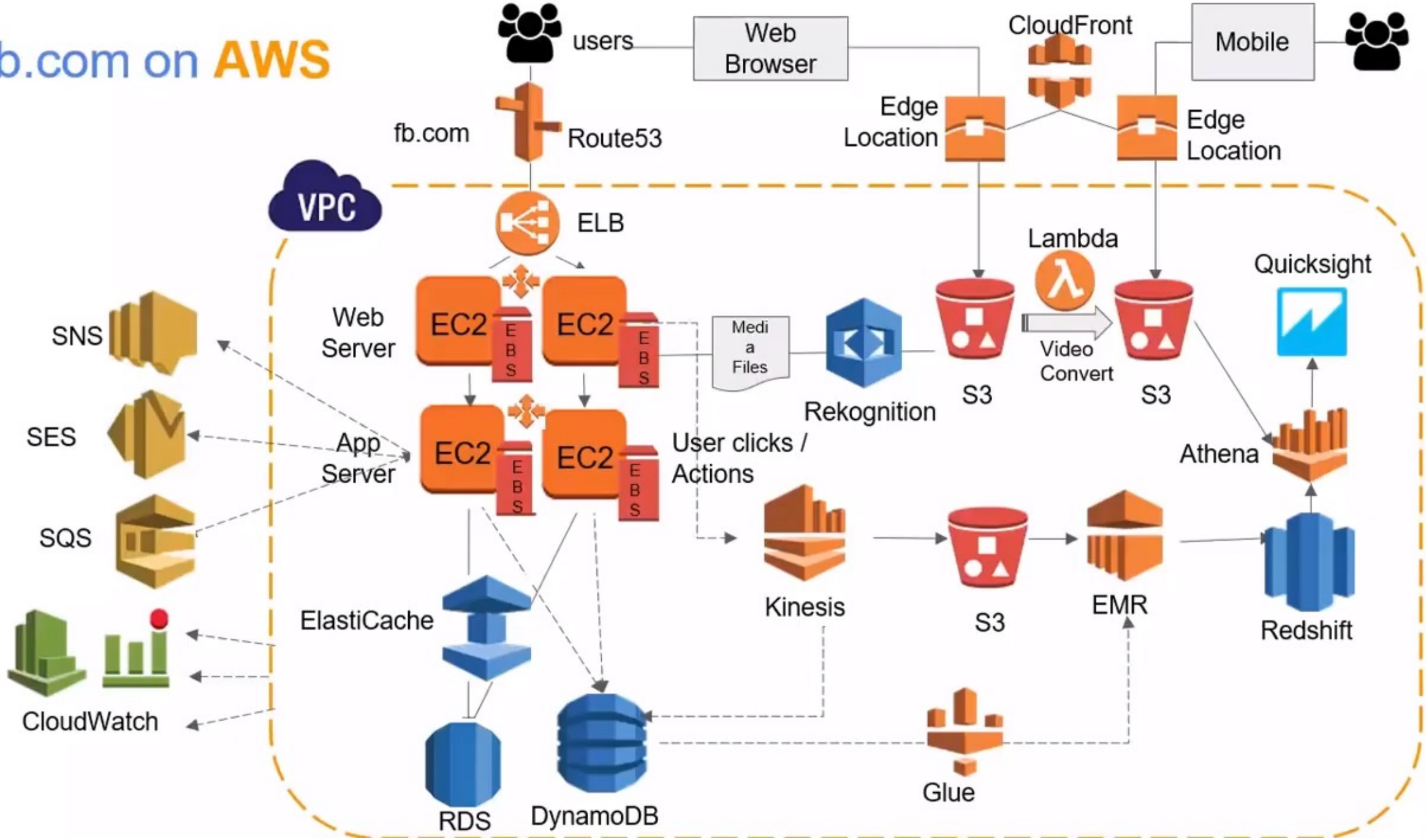
Source: https://aws.amazon.com/

Web Application with AWS Core Services



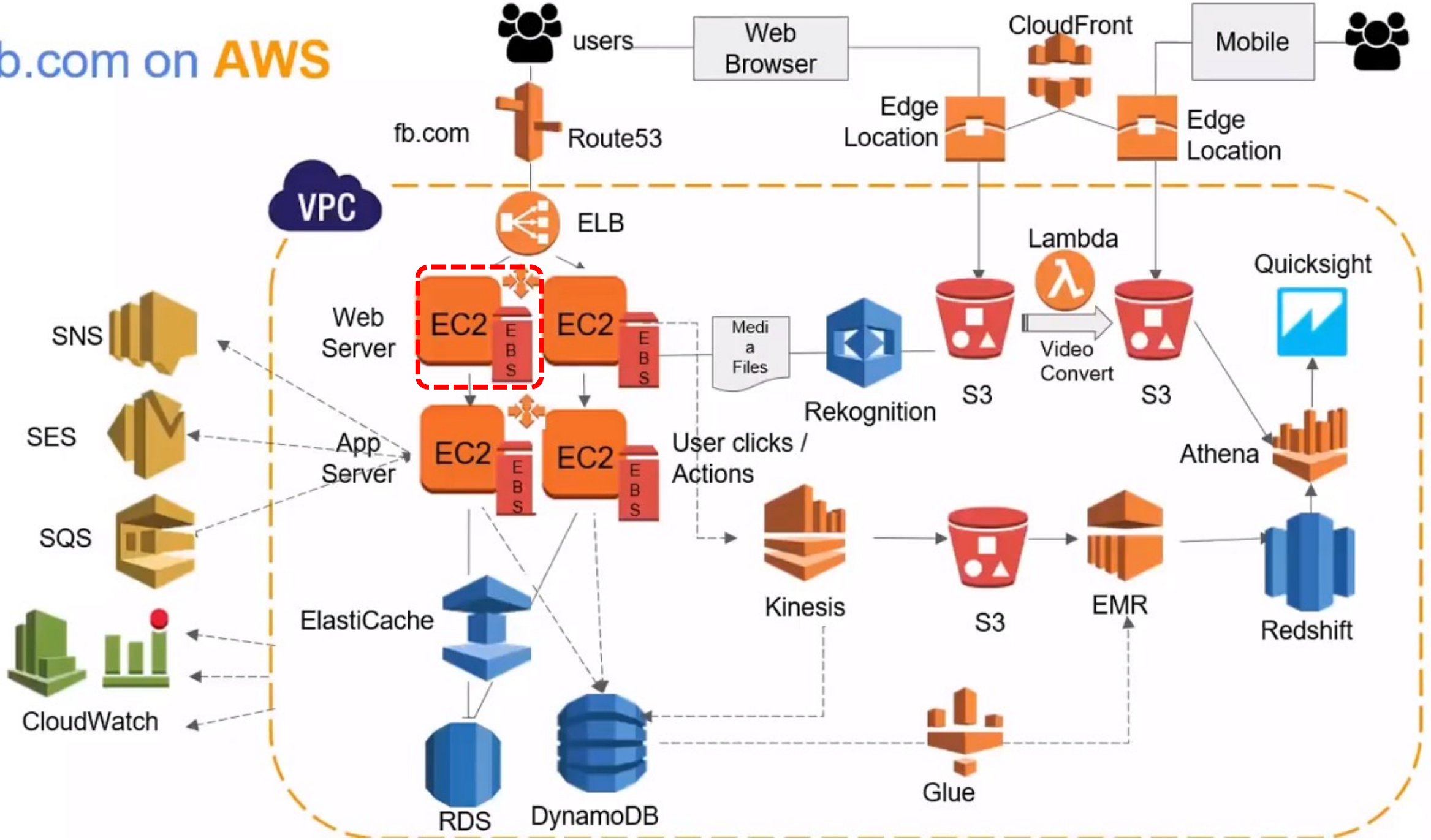
Source: AWS Training Center (2019), Introduction to AWS Services, https://youtu.be/Z3SYDTMP3ME

fb.com on AWS



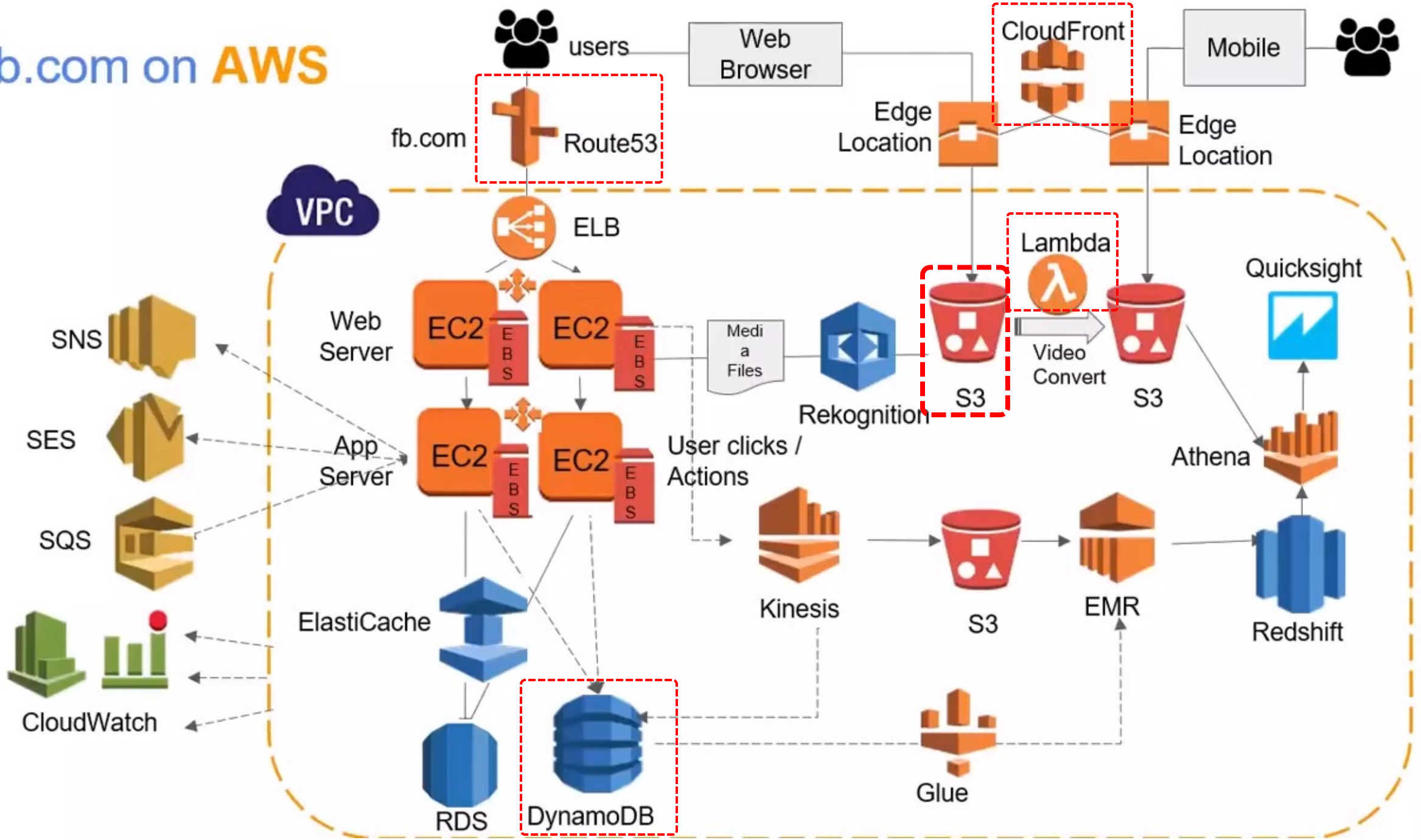
Source: AWS Training Center (2019), Introduction to AWS Services, https://youtu.be/Z3SYDTMP3ME

fb.com on AWS

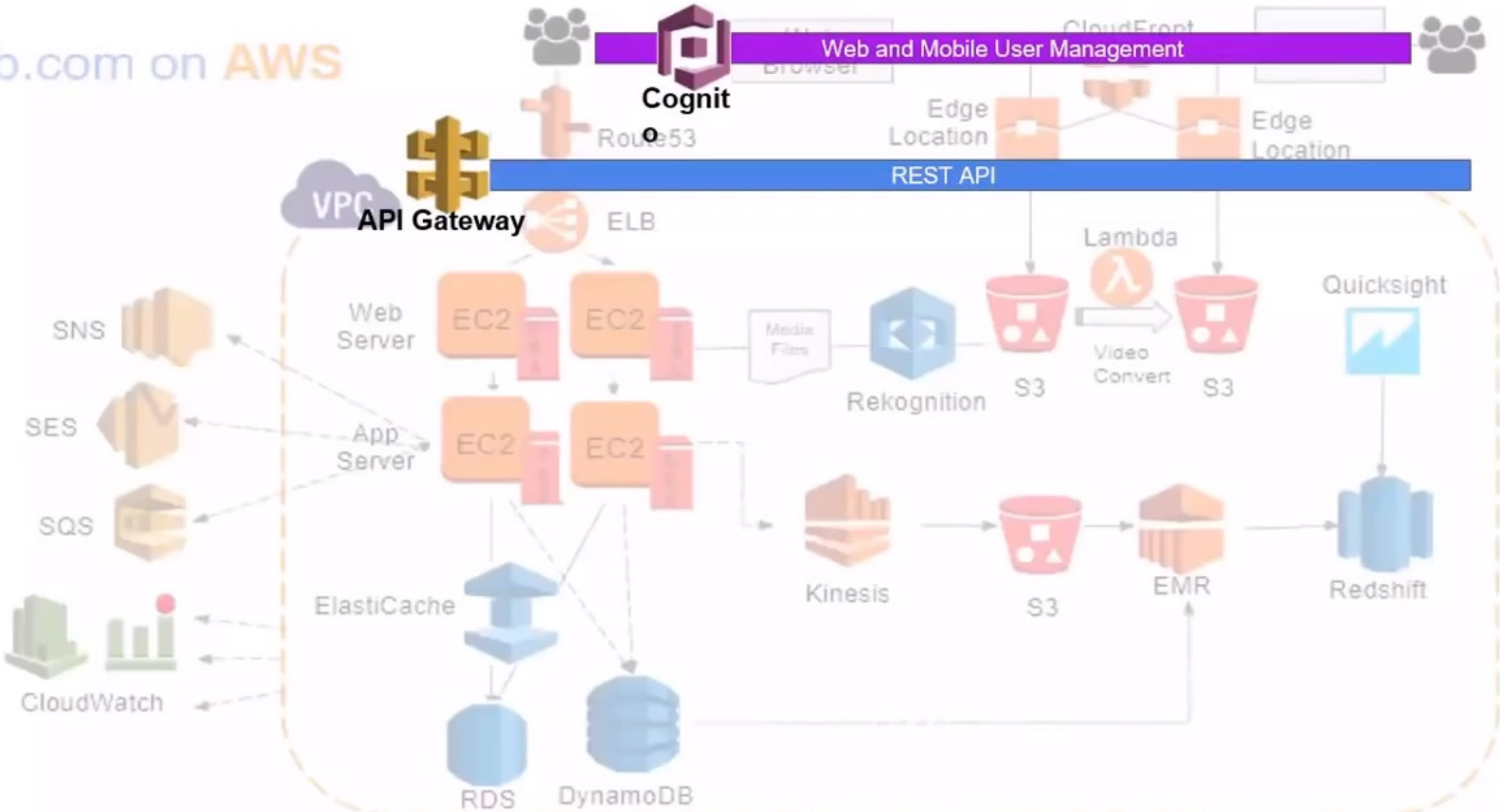


Source: AWS Training Center (2019), Introduction to AWS Services, https://youtu.be/Z3SYDTMP3ME

fb.com on AWS

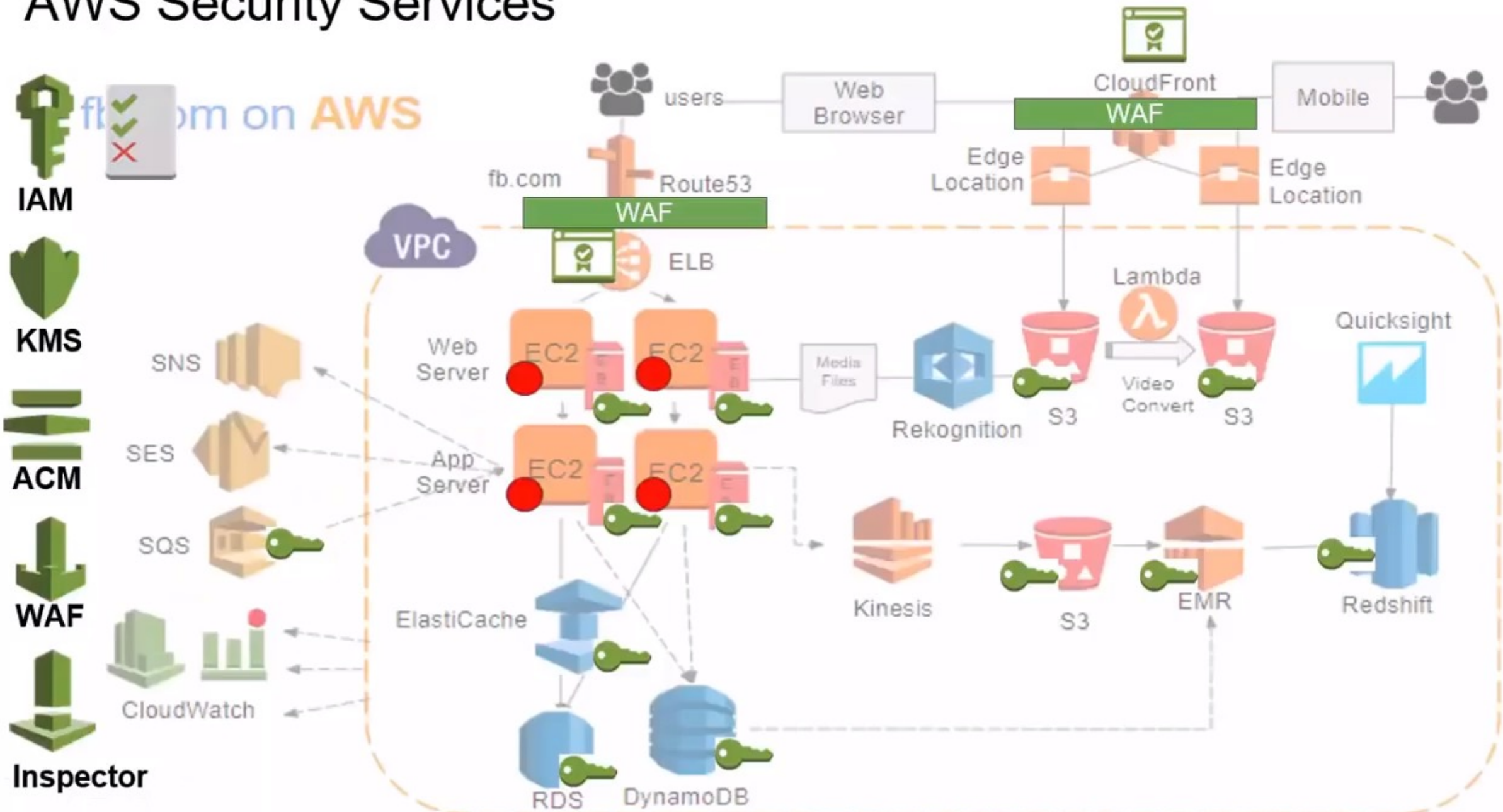

users
Web Browser
CloudFront
Mobile
fb.com
Route53
Edge Location
Edge Location
VPC
ELB
Lambda
Quicksight
Web Server
EC2
EC2
EBS
EBS
Media Files
Rekognition
S3
Video Convert
S3
SNS
SES
SQS
App Server
EC2
EC2
EBS
EBS
User clicks / Actions
Athena
Kinesis
S3
EMR
Redshift
ElastiCache
CloudWatch
RDS
DynamoDB
Glue

AWS Application Services



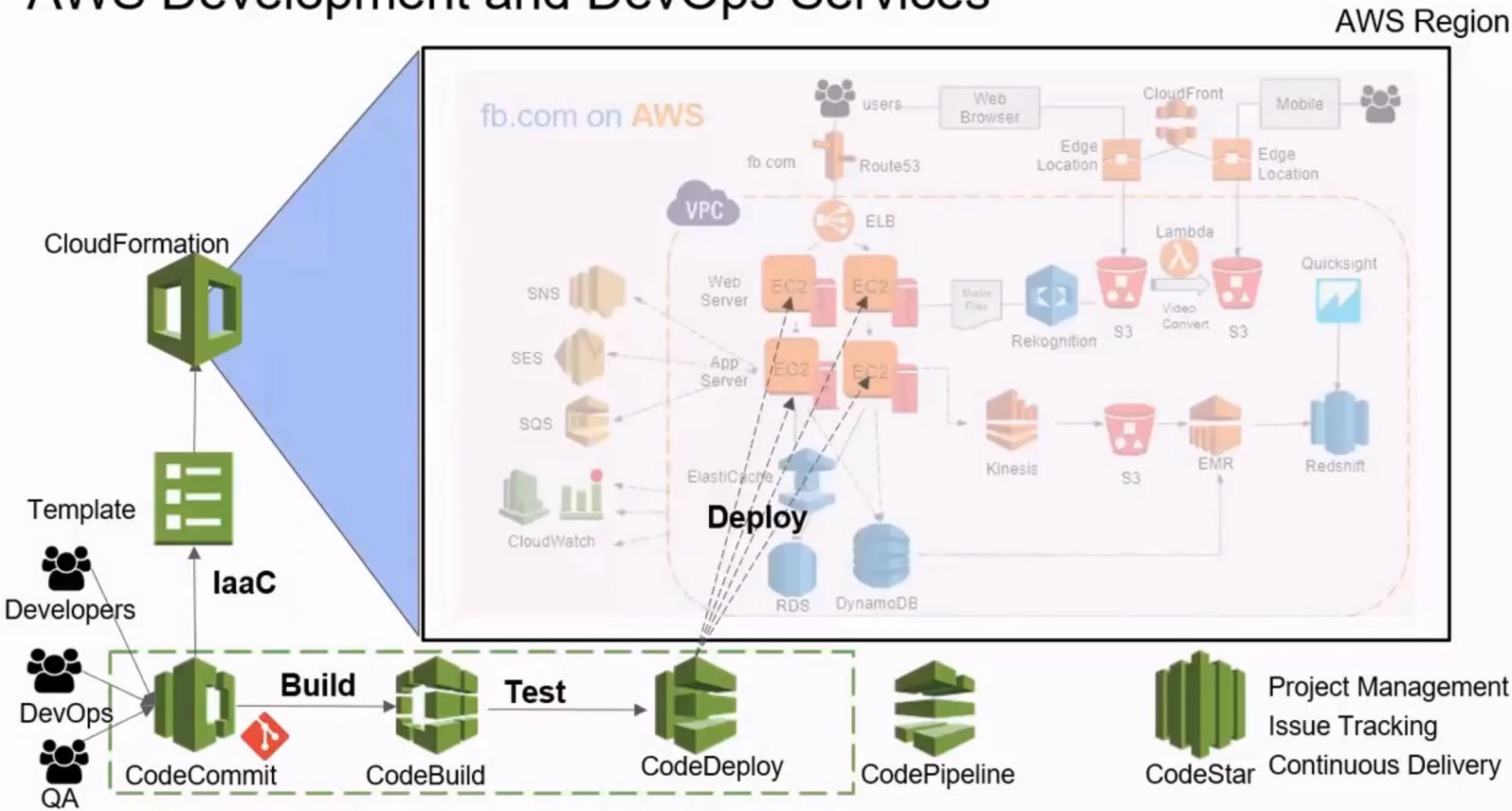
Source: AWS Training Center (2019), Introduction to AWS Services, https://youtu.be/Z3SYDTMP3ME

AWS Security Services



Source: AWS Training Center (2019), Introduction to AWS Services, https://youtu.be/Z3SYDTMP3ME

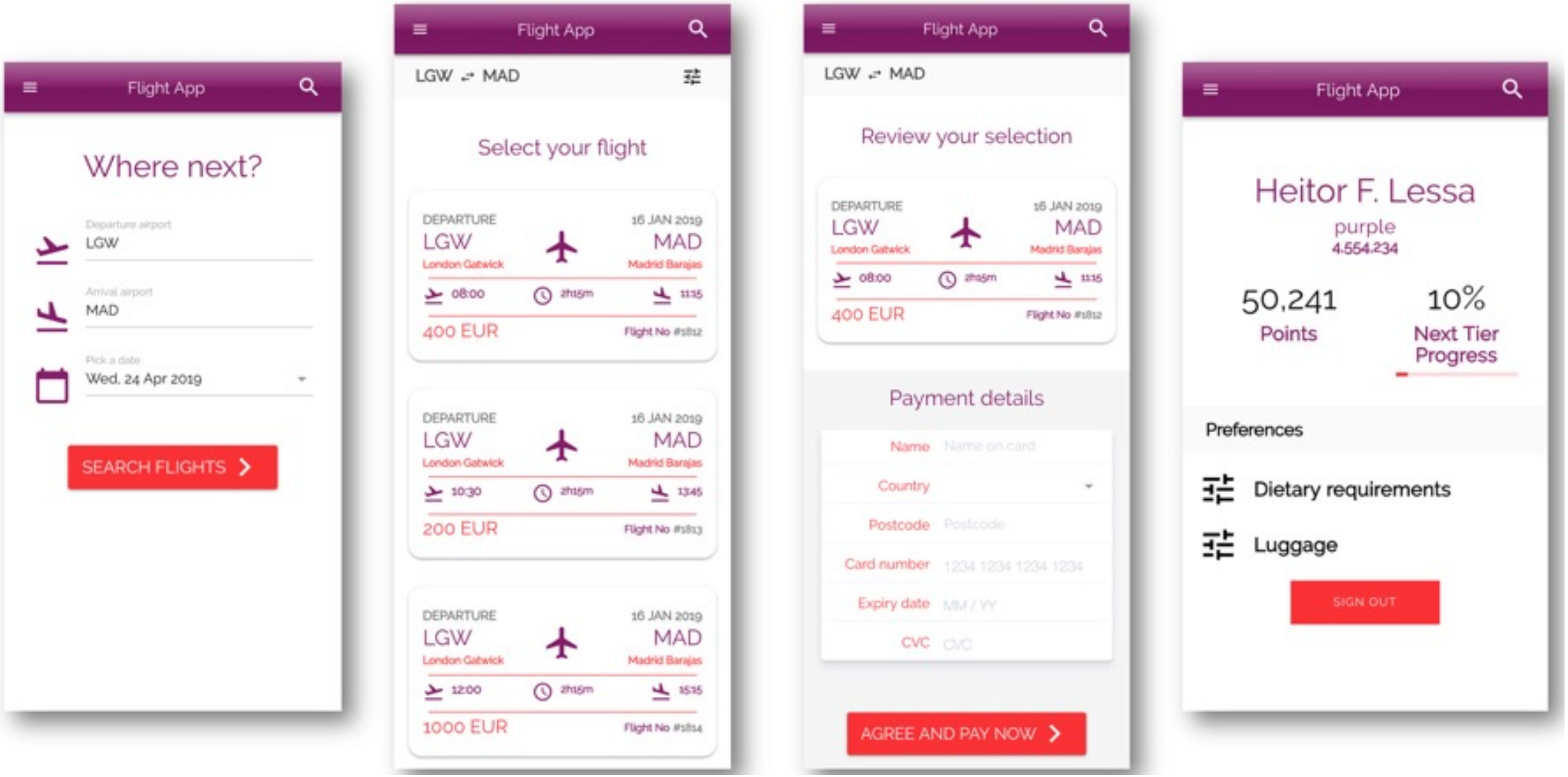
AWS Development and DevOps Services



Source: AWS Training Center (2019), Introduction to AWS Services, https://youtu.be/Z3SYDTMP3ME

AWS Serverless Architecture

AWS Serverless Airline Booking



Source: https://github.com/aws-samples/aws-serverless-airline-booking

AWS Serverless Airline Booking Stack

UI/UX


Quasar framework


Vue.js


AWS Amplify


Stripe Elements

Data/Lang


Amazon DynamoDB


Python


Typescript


JavaScript

API/Auth


AWS AppSync


Amazon API Gateway


Amazon Cognito

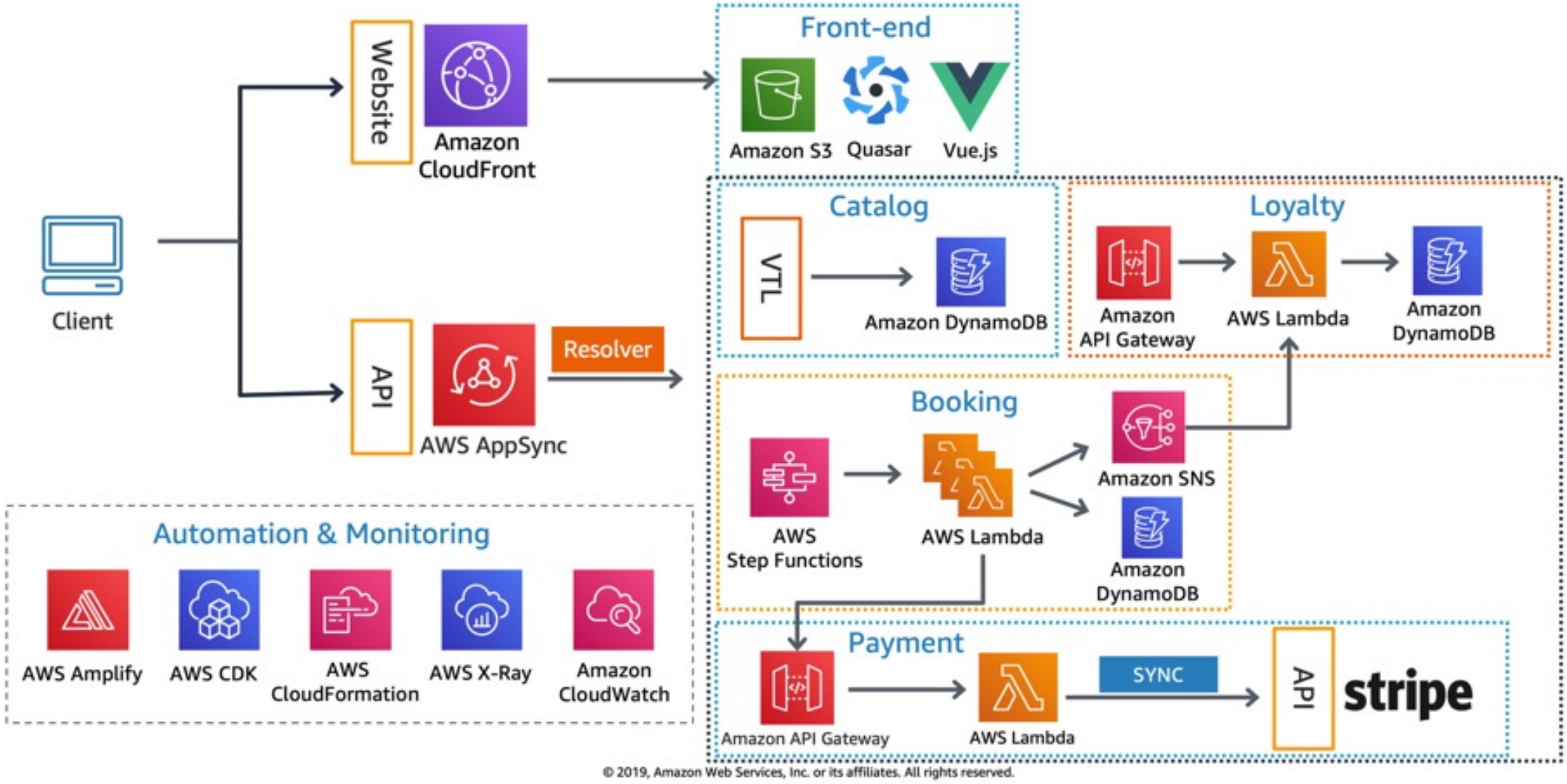
Messaging


Amazon SNS


AWS Step Functions

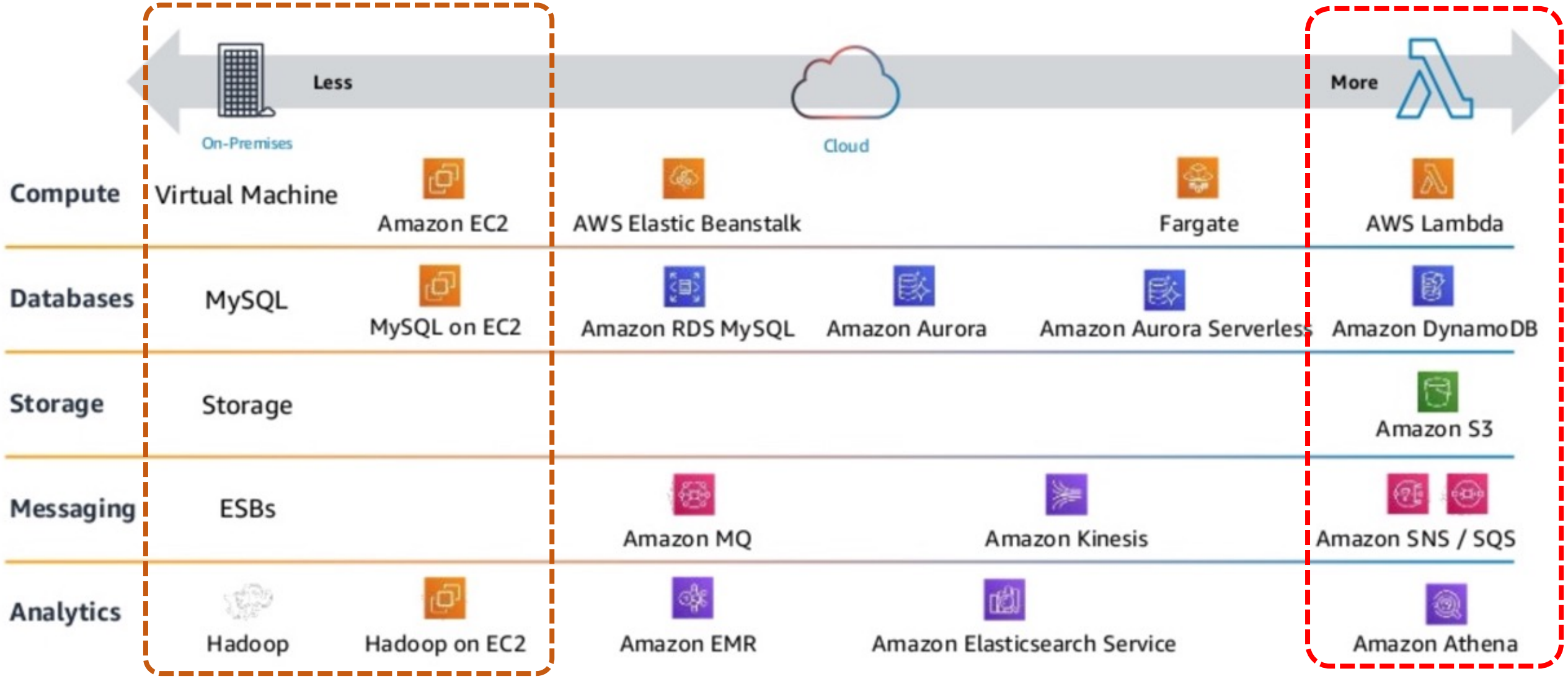
Source: https://github.com/aws-samples/aws-serverless-airline-booking

AWS Serverless Airline Booking
High level infrastructure architecture



Source: https://github.com/aws-samples/aws-serverless-airline-booking

AWS Serverless Architecture
AWS Operational Responsibility Models



Source: Heitor Lessa (2019), How to build a full stack serverless airline ticketing web app, https://www.youtube.com/watch?v=MyoOeHTp2pg

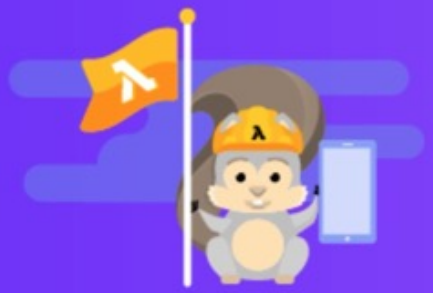
Build a Serverless Web Application

Build a Serverless Web Application

Projects on AWS:

Build a Serverless Web Application

with AWS Lambda, Amazon API Gateway, Amazon S3, Amazon DynamoDB, and Amazon Cognito



Introduction | 1 Host a static website | 2 Manage users | 3 Build a serverless backend | 4 Deploy a RESTful API | 5 Terminate resources

Overview

In this tutorial, you'll create a simple serverless web application that enables users to request unicorn rides from the Wild Rydes fleet. The application will present users with an HTML based user interface for indicating the location where they would like to be picked up and will interface on the backend with a RESTful web service to submit the request and dispatch a nearby unicorn. The application will also provide facilities for users to register with the service and log in before requesting rides.

AWS Experience: Beginner

Time to complete: 2 hours

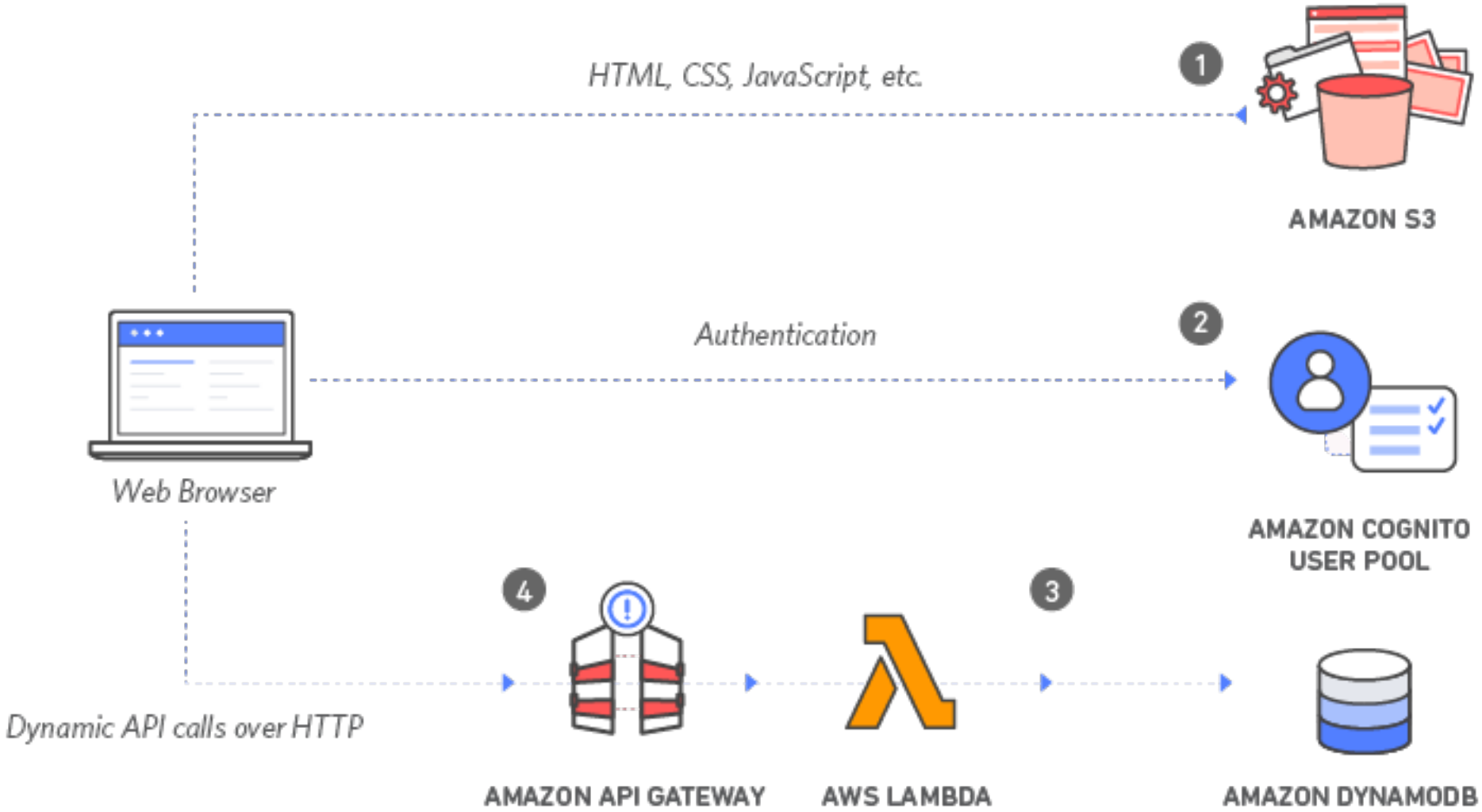
Cost to complete: Each service used in this architecture is eligible for the AWS Free Tier. If you are outside the usage limits of the Free Tier, completing this tutorial will cost you less than $0.25*.

Application Architecture

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

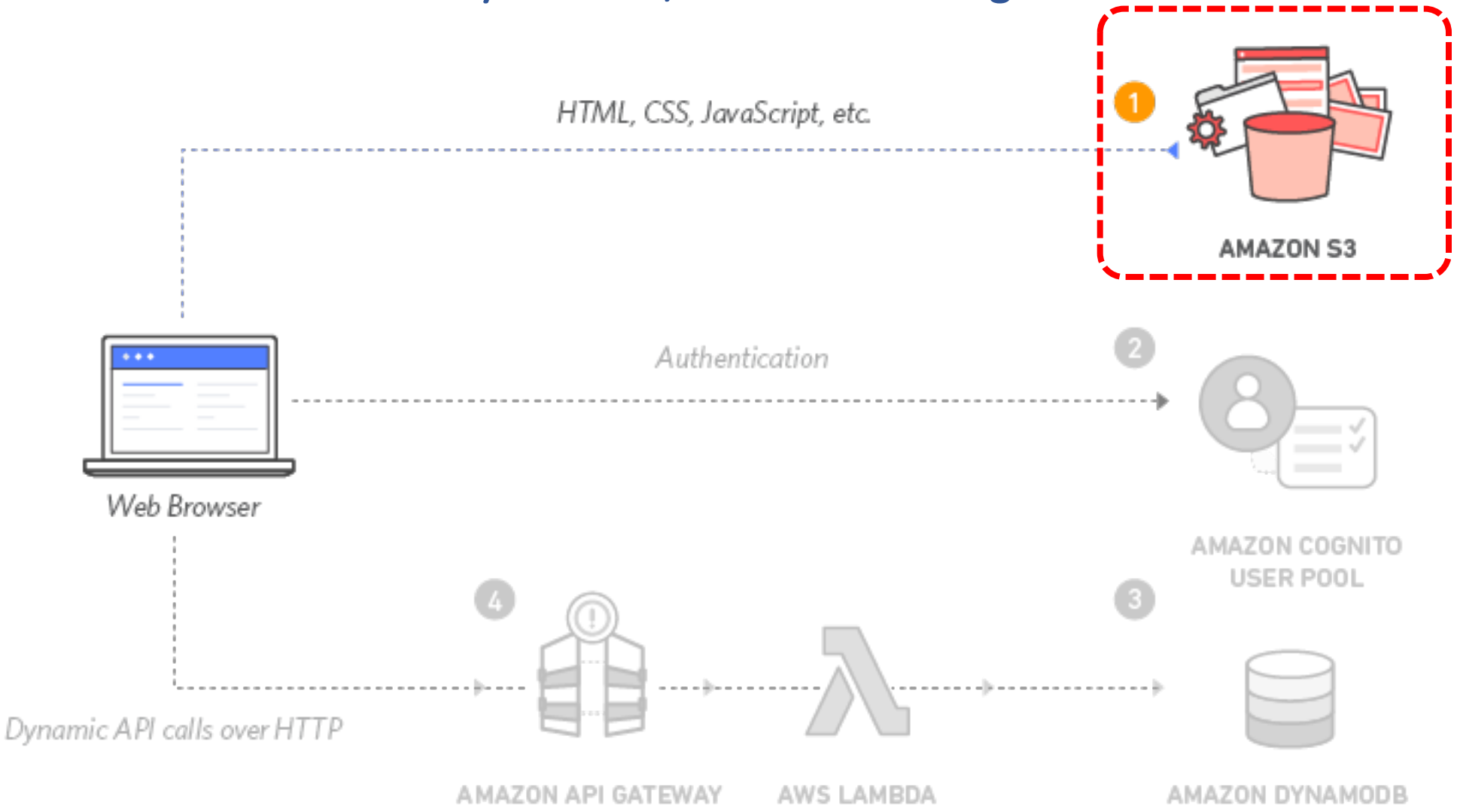


Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

1



Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

1

HTML, CSS, JavaScript, etc.

Static Web Hosting

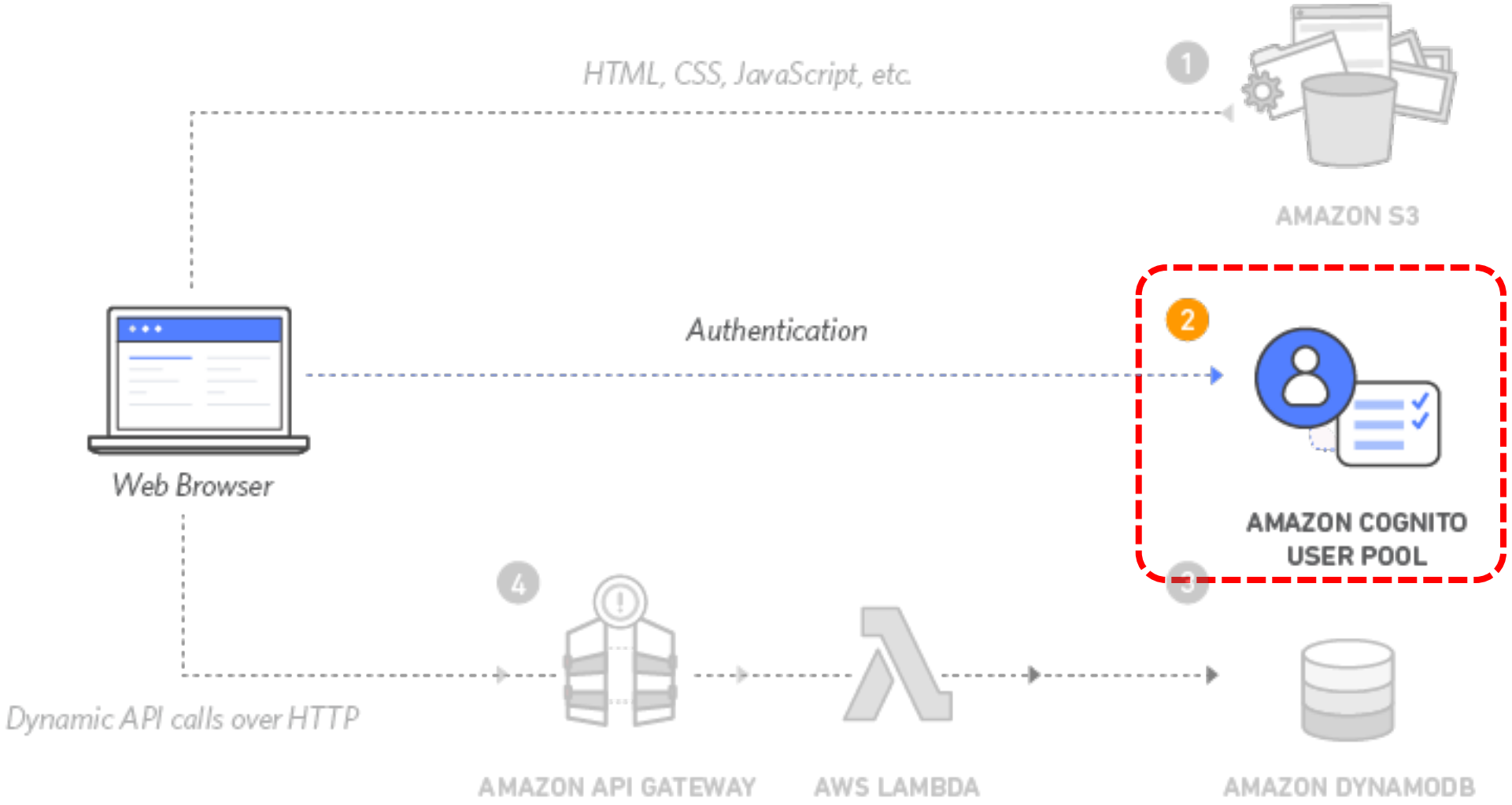
Amazon S3 hosts static web resources including HTML, CSS, JavaScript, and image files which are loaded in the user's browser.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

2



Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

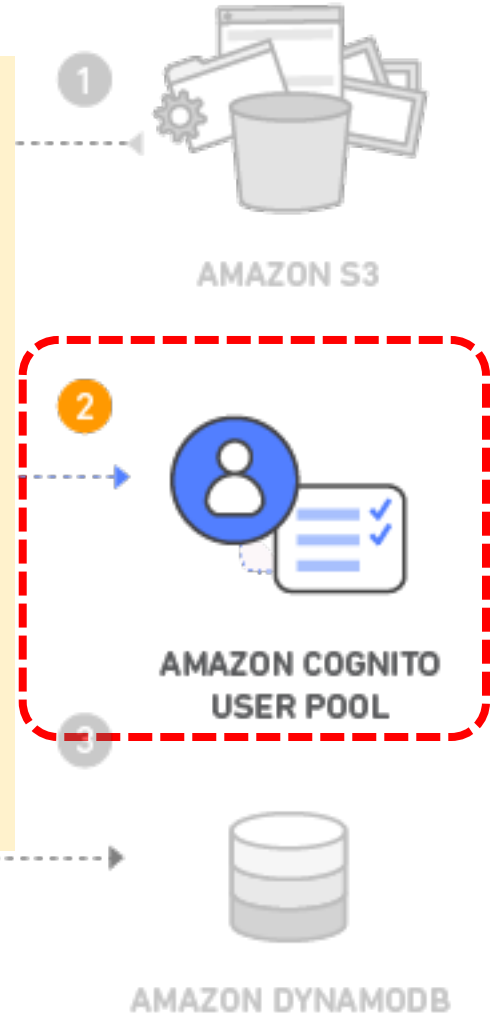
Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

2

User Management

Amazon Cognito provides user management and authentication functions to secure the backend API.

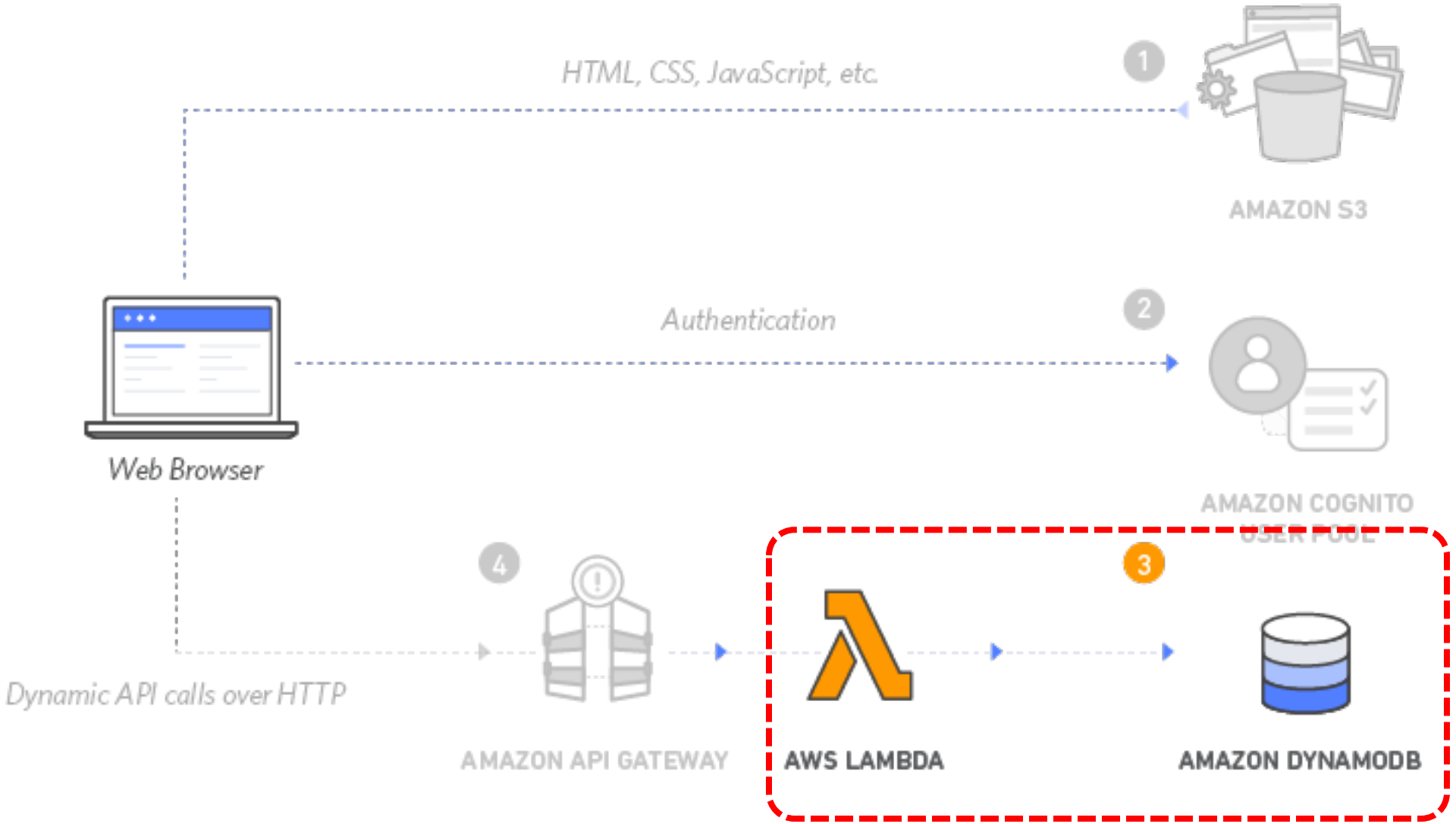


Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

3



Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

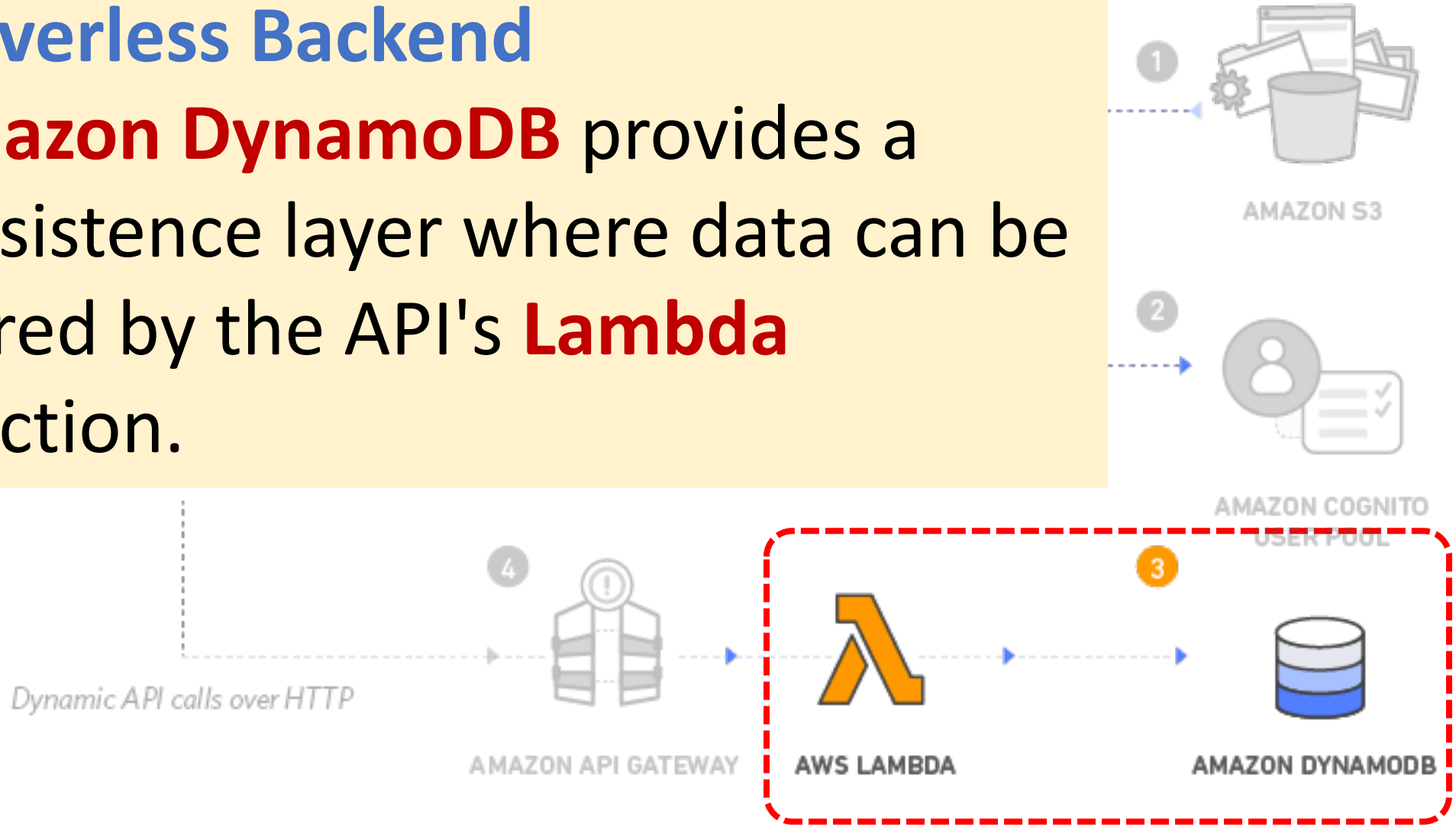
Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

3

Serverless Backend

Amazon DynamoDB provides a persistence layer where data can be stored by the API's **Lambda** function.

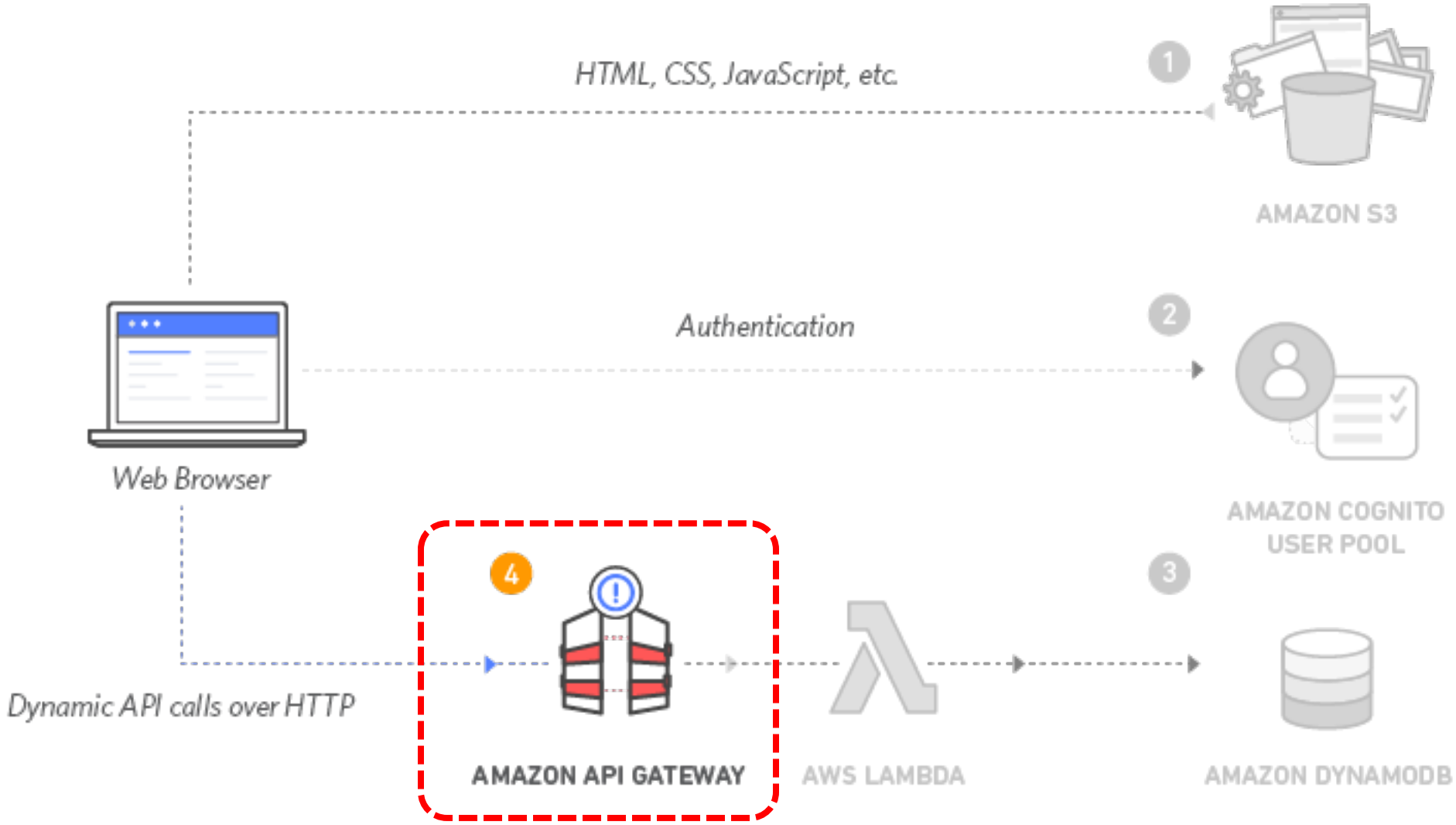


Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

4



Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

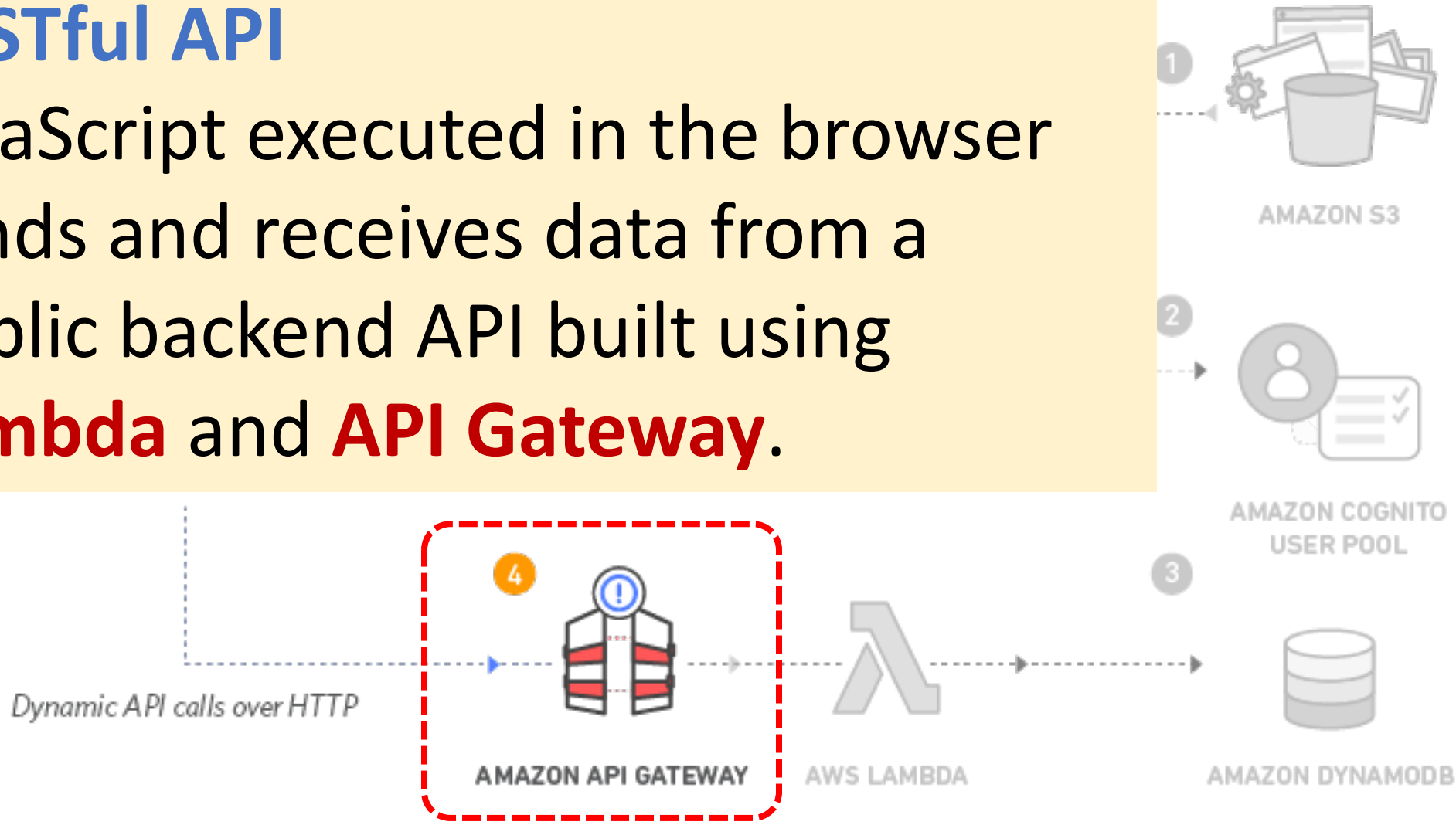
Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

4

RESTful API

JavaScript executed in the browser sends and receives data from a public backend API built using **Lambda** and **API Gateway**.



Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Build a Serverless Web Application

with Amazon S3, AWS Lambda, Amazon API Gateway, Amazon DynamoDB, and Amazon Cognito

5

Terminate resources

Resource Cleanup

You will terminate an **Amazon S3** bucket, an **Amazon Cognito** User Pool, an **AWS Lambda** function, an **IAM** role, a **DynamoDB** table, a **REST API**, and a **CloudWatch** Log.

It is a best practice to delete resources you are no longer using to avoid unwanted charges.

Source: https://aws.amazon.com/getting-started/projects/build-serverless-web-app-lambda-apigateway-s3-dynamodb-cognito/

Summary

1. Cloud Concepts Overview
2. Cloud Economics and Billing
3. AWS Global Infrastructure Overview
4. AWS Cloud Security
5. Networking and Content Delivery
6. Cloud Compute
7. Cloud Storage
8. Cloud Databases
9. Cloud Architecture
10. Cloud Automatic Scaling and Monitoring

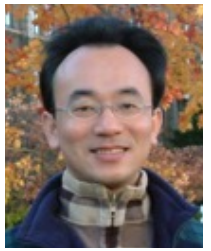
企業雲端運算入門
(Foundation of Business Cloud Computing)
雲端概念概述
(Cloud Concepts Overview)

企業雲端運算入門 (Foundation of Business Cloud Computing) (BA4, NTPU) (Spring 2023)
(AWS Academy Cloud Foundations; ACF) (AWS Certified Cloud Practitioner)
(BA4, NTPU) (3 Credits, Elective) (U4010) (自主學習課程)(商業智慧與大數據分析學士學分學程)
(1112) (國立台北大學企管系4A, 4B) (選修3學分) (授課教師：謝榮桂，戴敏育) (2023.02 - 2023.06)
(週三 Wed, 6, 7, 8, 14:10-17:00) (台北大學三峽校區 商3F10)

謝榮桂 (Jung-Kuei Hsieh), 戴敏育 (Min-Yuh Day)

National Taipei University

國立臺北大學



2023-02-22