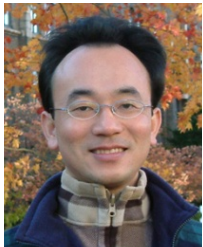


雲端服務架構實務

(Cloud Services Architecting Practices)

Course orientation on Cloud Services Architecting Practices

雲端服務架構實務 (Cloud Services Architecting Practices) (MI4, TKU) (Spring 2021)
(AWS Academy Cloud Architecting, ACA)(AWS Solutions Architect, SAA)
(MI4, TKU) (2 Credits, Elective) (M2436) (2779)
(1092) (淡江大學資管四 MI4, TKU) (選修2學分) (2021.02 - 2021.06)
(週四 Thu, 9, 10, 16:10-18:00) (淡江大學淡水校園 B216)



Min-Yuh Day, Ph.D, Associate Professor

戴敏育 副教授

Institute of Information Management, National Taipei University

國立臺北大學 資訊管理研究所

<https://web.ntpu.edu.tw/~myday>

2021-02-25

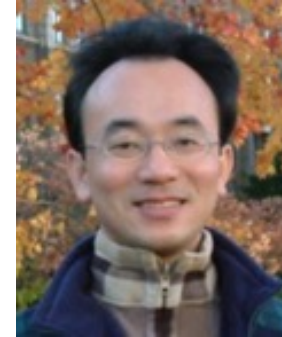


雲端服務架構實務 (Cloud Services Architecting Practices)

Contact Information



戴敏育 博士 (Min-Yuh Day, Ph.D.)
副教授 (Associate Professor)
國立臺北大學 資訊管理研究所



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**Tamkang
University**

淡江大學



academy





淡江大學109學年度第2學期 課程教學計畫表

Spring 2021 (2021.02 - 2021.06)

- 課程名稱：**雲端服務架構實務
(Cloud Services Architecting Practices)**
- 授課教師：戴敏育 (Min-Yuh Day)
- 開課系級：資管四P (TLMXB4P) (M2436) (2779)
- 開課資料：選修 單學期 2 學分
(2 Credits, Elective)
- 上課時間：週四 Thu 9, 10 (16:10-18:00)
- 上課地點：B216 (淡江大學淡水校園)

遠距非同步課程



課程簡介



- 雲端服務架構實務課程主要介紹：
AWS 技術基礎和在 **AWS 上建立架構**。
- **AWS 技術基礎**介紹 AWS 產品、服務和常見解決方案。
- 在 **AWS 上建立架構**內容涵蓋在 AWS 上建置 IT 基礎架構的基礎。
- **解決方案架構師**如何透過了解 AWS 服務來優化對 AWS 雲端的使用，及如何讓這些服務符合雲端解決方案。
- AWS 雲端最佳實務與建議的設計模式，協助學員思考在 AWS 上架構最佳 IT 解決方案的程序。



Course Introduction

- This course, **Cloud Services Architecting Practices**, introduces **AWS Technical Essentials** and **Architecting on AWS**.
- In **AWS Technical Essentials**, students will learn about AWS products, services, and common solutions.
- **Architecting on AWS** covers fundamentals of building IT infrastructure on the AWS platform.
- Students will learn how to optimize the AWS Cloud by understanding how AWS services fit into cloud-based solutions.
- In addition, students explore AWS Cloud best practices and design patterns for architecting optimal IT solutions on AWS.



課程目標



1. 根據 AWS 推薦的架構原則和最佳實踐做出架構決策。
2. 了解利用 AWS 服務讓您的基礎設施具備可擴展性、可靠性和高可用性。
3. 利用 AWS 託管服務提高基礎設施的靈活性和彈性。
4. 提高基於 AWS 的基礎設施的效率，以提升性能並降低成本。
5. 使用架構完善的框架改進採用解決方案的架構。



Course Objective

1. Make architectural decisions based on the AWS recommended architectural principles and best practices.
2. Explore leveraging AWS services to make your infrastructure scalable, reliable, and highly available.
3. Leverage AWS managed services to enable greater flexibility and resiliency in an infrastructure.
4. Make an AWS-based infrastructure more efficient in order to increase performance and reduce costs.
5. Use the Well-Architected Framework to improve AWS architectures with AWS solutions.

課程大綱 (Syllabus)



週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2021/02/25	Course orientation on Cloud Services Architecting Practices: AWS Solutions Architect Overview
2	2021/03/04	Automating Your Infrastructure
3	2021/03/11	Decoupling Your Infrastructure
4	2021/03/18	Designing Web-Scale Media
5	2021/03/25	Well-Architected Framework
6	2021/04/01	Off-campus study (教學行政觀摩日)
7	2021/04/08	Well-Architected Pillar 1 - Operational Excellence
8	2021/04/15	Well-Architected Pillar 2 - Security

課程大綱 (Syllabus)



週次 (Week) 日期 (Date) 內容 (Subject/Topics)

9 2021/04/22 期中上機測驗

10 2021/04/29 期中考試週

11 2021/05/06 Well-Architected Pillar 3 - Reliability

12 2021/05/13 Well-Architected Pillar 4 - Performance Efficiency,
Well-Architected Pillar 5 - Cost-Optimization

13 2021/05/20 Troubleshooting,
Design Patterns and Sample Architectures

14 2021/05/27 期末上機測驗

15 2021/06/03 畢業考試週



教學目標之教學方法與評量方法

- 教學方法

- 講述、討論、發表、實作、體驗、模擬

- 評量方法

- 測驗、討論、實作、報告



學期成績計算方式

- 期中評量：30.0 %
- 期末評量：30.0 %
- 平時評量：40.0 % (課堂參與及報告討論表現)



教材課本與參考書籍

- **教材課本 (Textbook)**
 - **Slides**
 - **AWS Academy Cloud Foundations (AWS ACF)**, AWS Academy
 - **AWS Academy Cloud Architecting (AWS ACA)**, AWS Academy



教材課本與參考書籍

• 參考書籍 (References)

- Ben Piper and David Clinton (2019),
AWS Certified Solutions Architect Study Guide: Associate SAA-C01 Exam, 2 edition, Sybex, 2019
- **AWS Technical Essentials**
 - <https://aws.amazon.com/training/course-descriptions/essentials/>
- **Architecting on AWS**
 - <https://aws.amazon.com/training/course-descriptions/architect/>
- **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/>
- **AWS Certified Solutions Architect – Associate**
 - <https://aws.amazon.com/certification/certified-solutions-architect-associate/>

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

SAA



Architect

Operations

Developer

Foundational

Six months of fundamental AWS Cloud and industry knowledge

CLF



Cloud Practitioner

Specialty

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





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.





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.



AWS Academy and Certifications

- **AWS Academy Cloud Foundations (ACF)**

- **AWS Certified Cloud Practitioner**
(CLF-C01) (2021/01)

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



- **AWS Academy Cloud Architecting (ACA)**

- **AWS Certified Solutions Architect – Associate**
(SAA-C02) (2021/05)

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



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

AWS Academy and Certifications

- **AWS Academy Cloud Foundations (ACF)**

- **AWS Certified Cloud Practitioner (CLF-C01)** (2021/01)

- <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/>

- **AWS Academy Cloud Architecting (ACA)**

- **AWS Certified Solutions Architect – Associate (SAA-C02)** (2021/05)

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

- **Architecting on AWS**

- <https://aws.amazon.com/training/course-descriptions/architect/>

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

1



2





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%



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%

AWS Certified Cloud Practitioner (CLF-C01)





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



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



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



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

AWS Certified Solutions Architect – Associate (SAA-C02)





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



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



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



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



AWS Academy

Cloud Architecting (ACA)



AWS Academy **Cloud Architecting** (ACA) Course Overview



- Module 0 (Optional): AWS Service Review
- Module 1: Course Welcome and Overview
- Module 2: Designing the Network
- Module 3: Designing for High Availability – Section 1
- Module 4: Designing for High Availability with Scaling – Section 2
- Module 5: Automating Your Infrastructure
- Module 6: Decoupling Your Infrastructure
- Module 7: Designing Web-Scale Media



AWS Academy **Cloud Architecting** (ACA) Course Overview



- Module 8: Well-Architected Framework
- Module 9: Well-Architected Pillar 1 - Operational Excellence
- Module 10: Well-Architected Pillar 2 - Security
- Module 11: Well-Architected Pillar 3 - Reliability
- Module 12: Well-Architected Pillar 4 - Performance Efficiency
- Module 13: Well-Architected Pillar 5 - Cost-Optimization
- Module 14: Troubleshooting
- Module 15: Design Patterns and Sample Architectures



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



AWS Compute



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



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



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



AWS Networking & Content Delivery



Networking & Content Delivery

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



AWS Security, Identity & Compliance



Security, Identity &
Compliance

AWS Identity & Access Management
Manage User Access and Encryption Keys

Amazon Cognito
Identity Management for your Apps

Amazon Detective
Investigate potential security issues

Amazon GuardDuty
Managed Threat Detection Service

Amazon Inspector
Analyze Application Security

Amazon Macie
Discover, Classify, and Protect your Data

AWS Artifact
On-demand access to AWS compliance reports

AWS Certificate Manager
Provision, Manage, and Deploy SSL/TLS Certificates

AWS CloudHSM
Hardware-based Key Storage for Regulatory Compliance

AWS Directory Service
Host and Manage Active Directory

AWS Firewall Manager
Central Management of Firewall Rules

AWS Key Management Service
Managed Creation and Control of Encryption Keys

AWS Resource Access Manager
Simple, secure service to share AWS resources

AWS Secrets Manager
Rotate, Manage, and Retrieve Secrets

AWS Security Hub
Unified security and compliance center

AWS Shield
DDoS Protection

AWS Single Sign-On
Cloud Single Sign-On (SSO) Service

AWS WAF
Filter Malicious Web Traffic



AWS Cost Management



AWS Cost Management

AWS Cost Explorer

Analyze Your AWS Cost and Usage

AWS Budgets

Set Custom Cost and Usage Budgets

AWS Cost and Usage Report

Access Comprehensive Cost and Usage Information

Reserved Instance Reporting

Dive Deeper into Your Reserved Instances (RIs)

Savings Plans

Save up to 72% on compute usage with flexible pricing



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

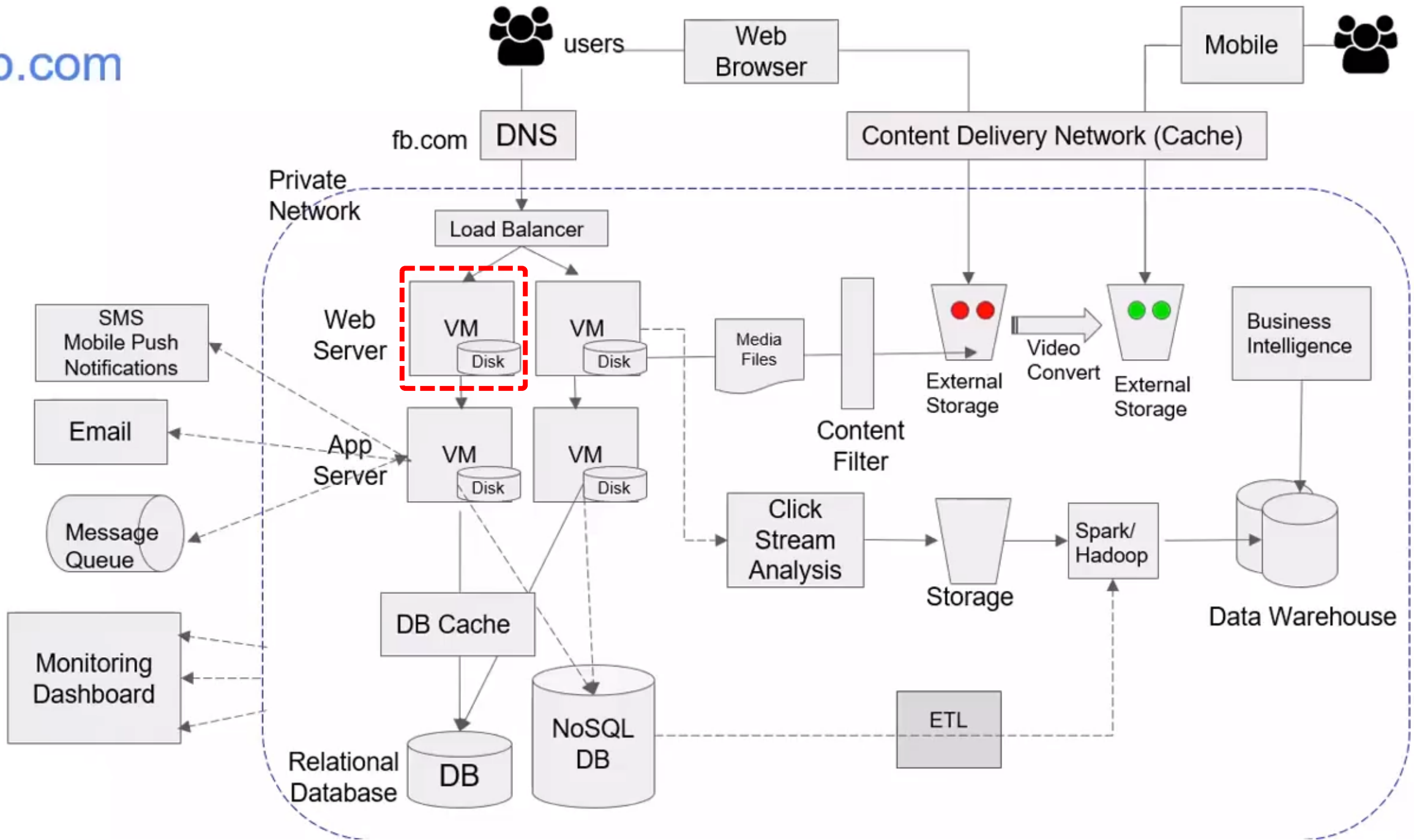


AWS Services

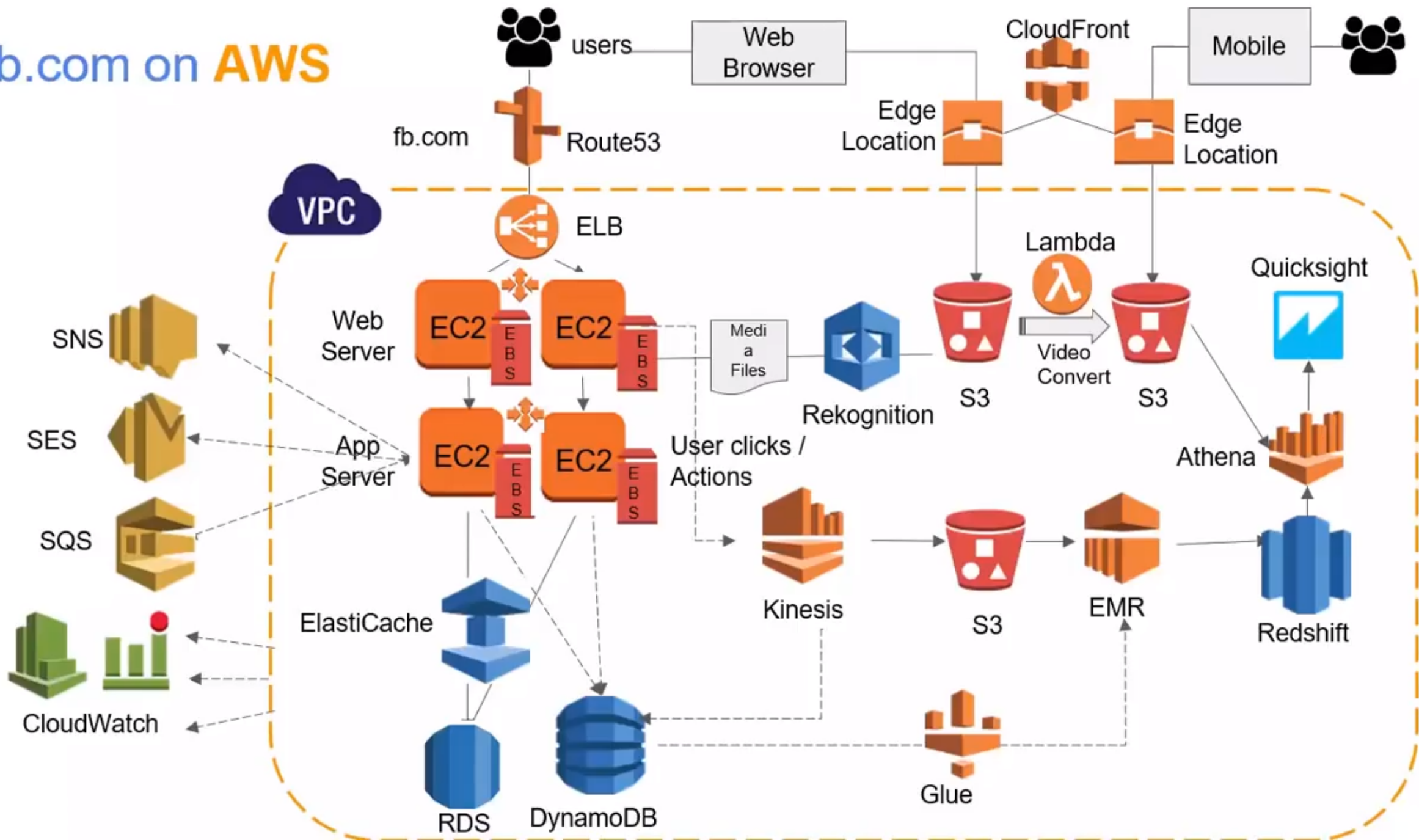
- **AWS Lambda**
 - Run code without thinking about servers
- **AWS Elastic Beanstalk**
 - Run and manage web apps
- **Amazon VPC**
 - Isolated cloud resources
- **Amazon Lightsail**
 - Launch and manage virtual private servers
- **Amazon SageMaker**
 - Build, train, and deploy machine learning models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



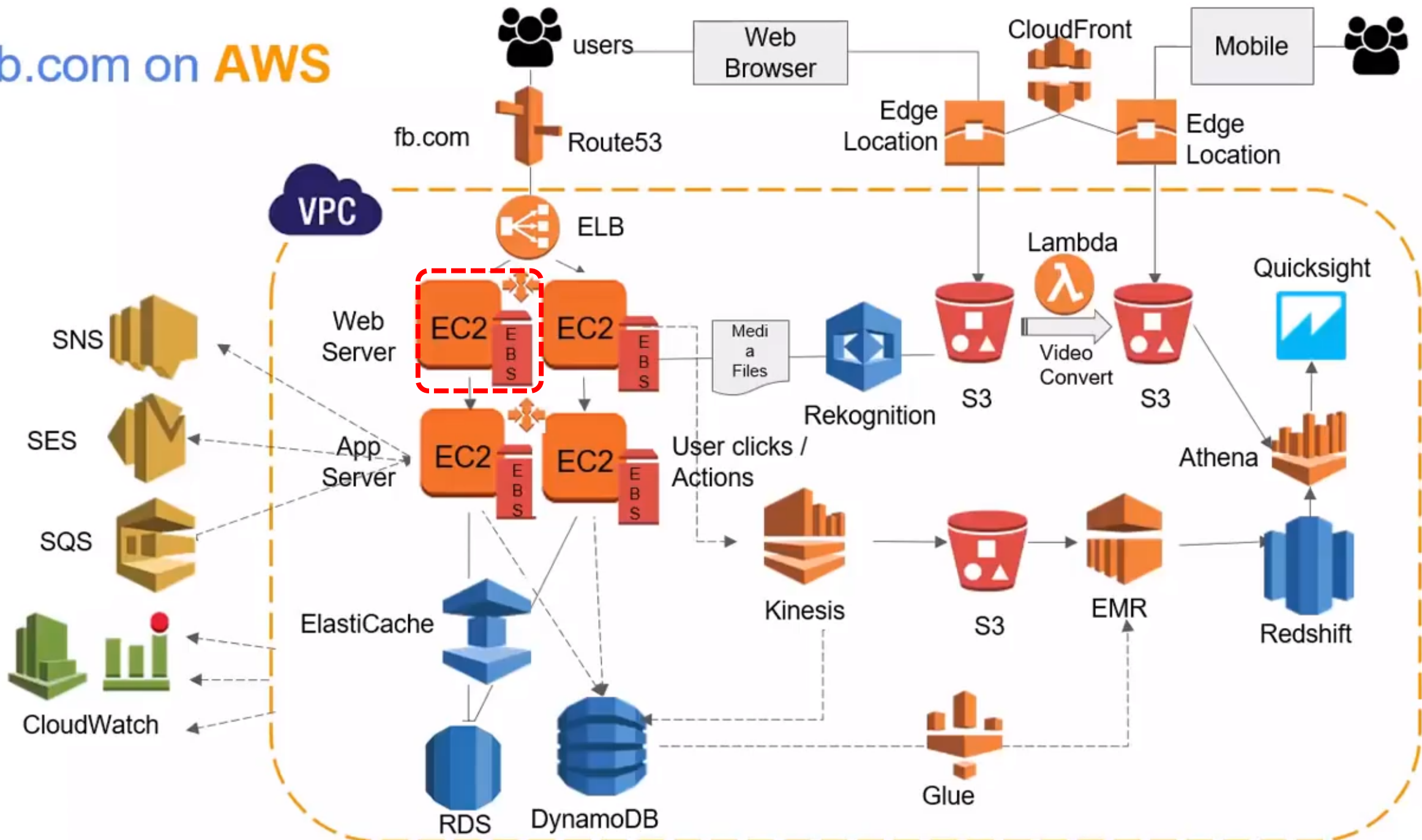
Web Application with AWS Core Services



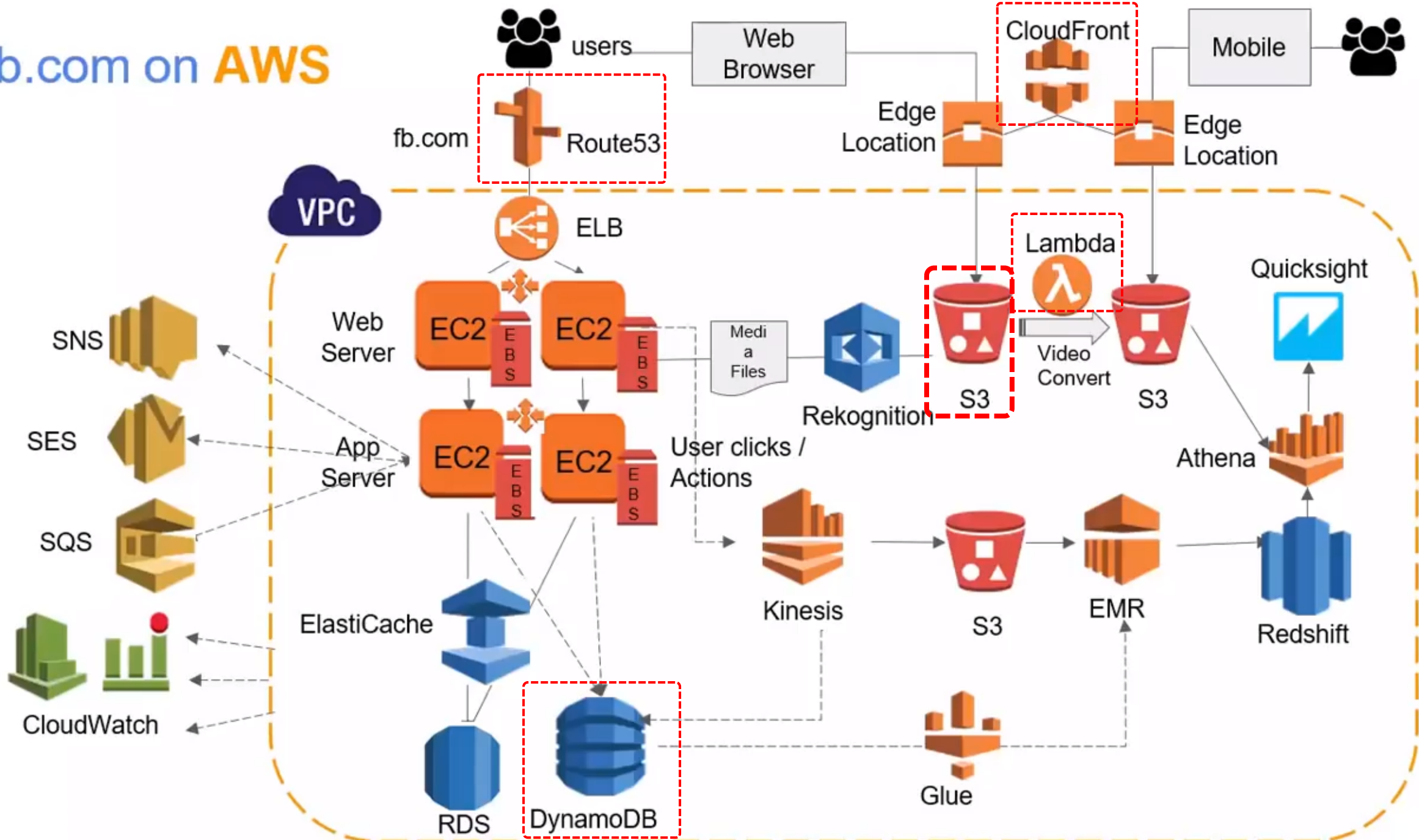
fb.com on AWS



fb.com on AWS

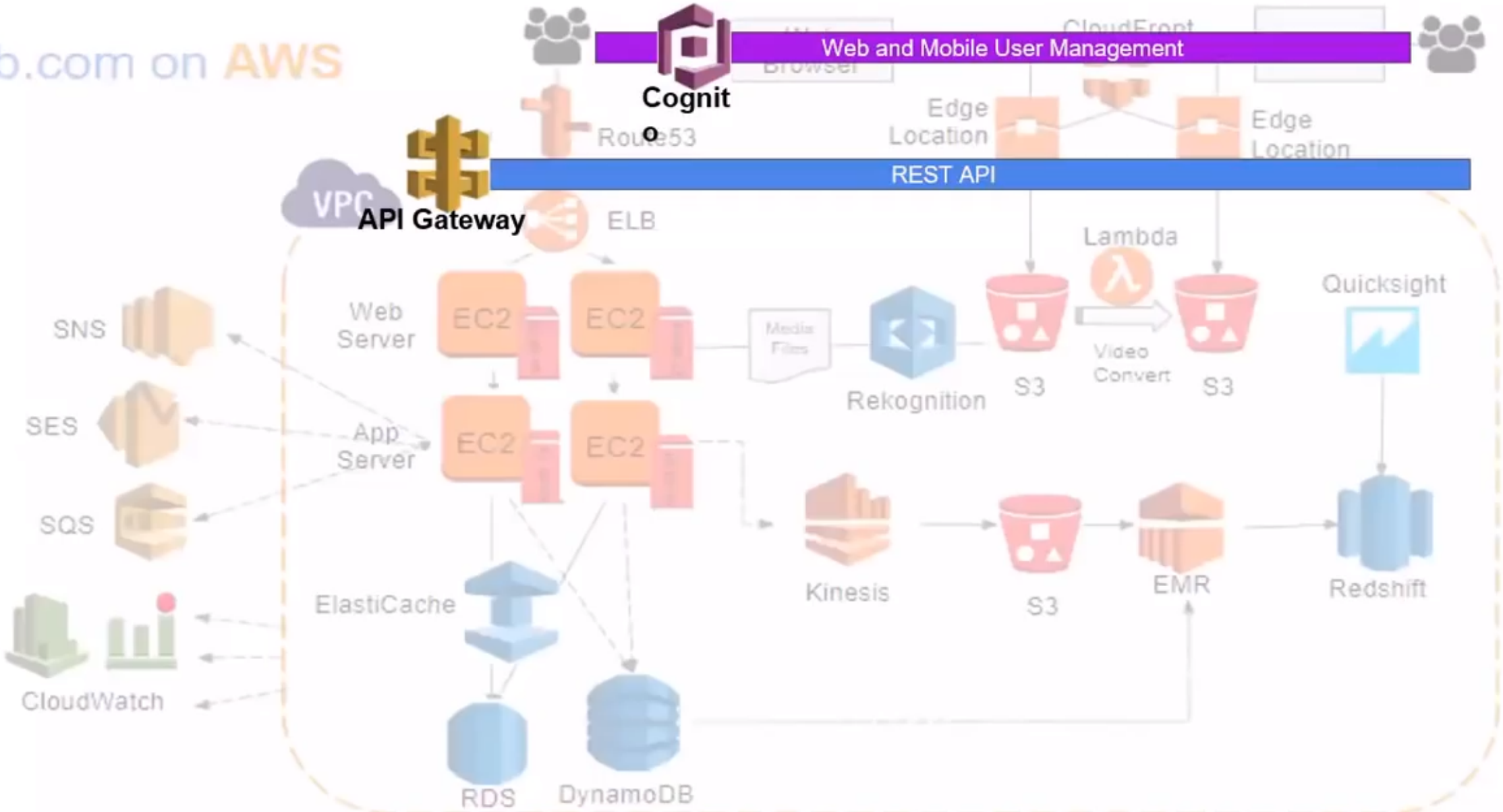


fb.com on AWS



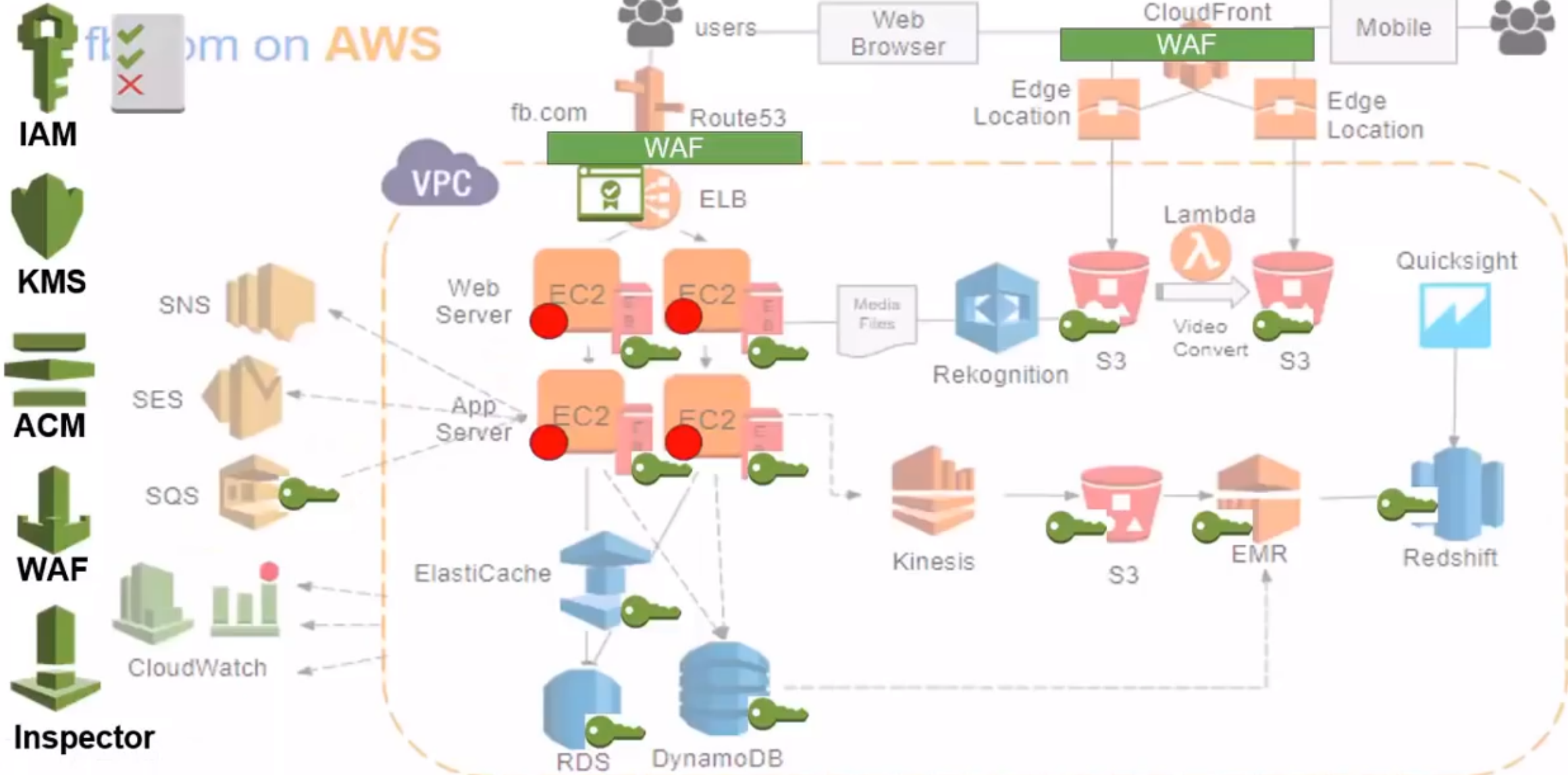
AWS Application Services

fb.com on AWS



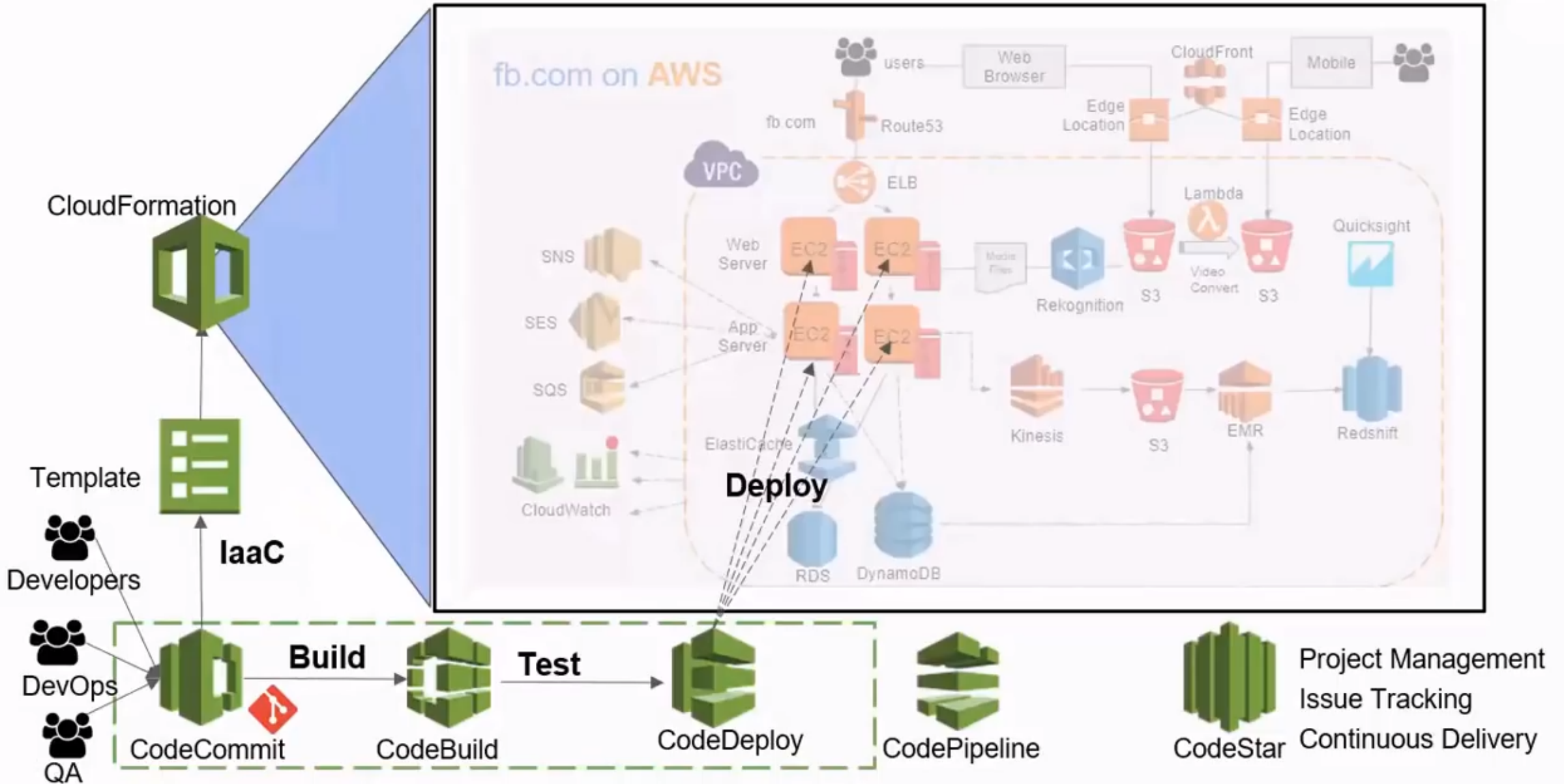
Source: AWS Training Center (2019), Introduction to AWS Services, <https://youtu.be/Z3SYDTMP3ME>

AWS Security Services



AWS Development and DevOps Services

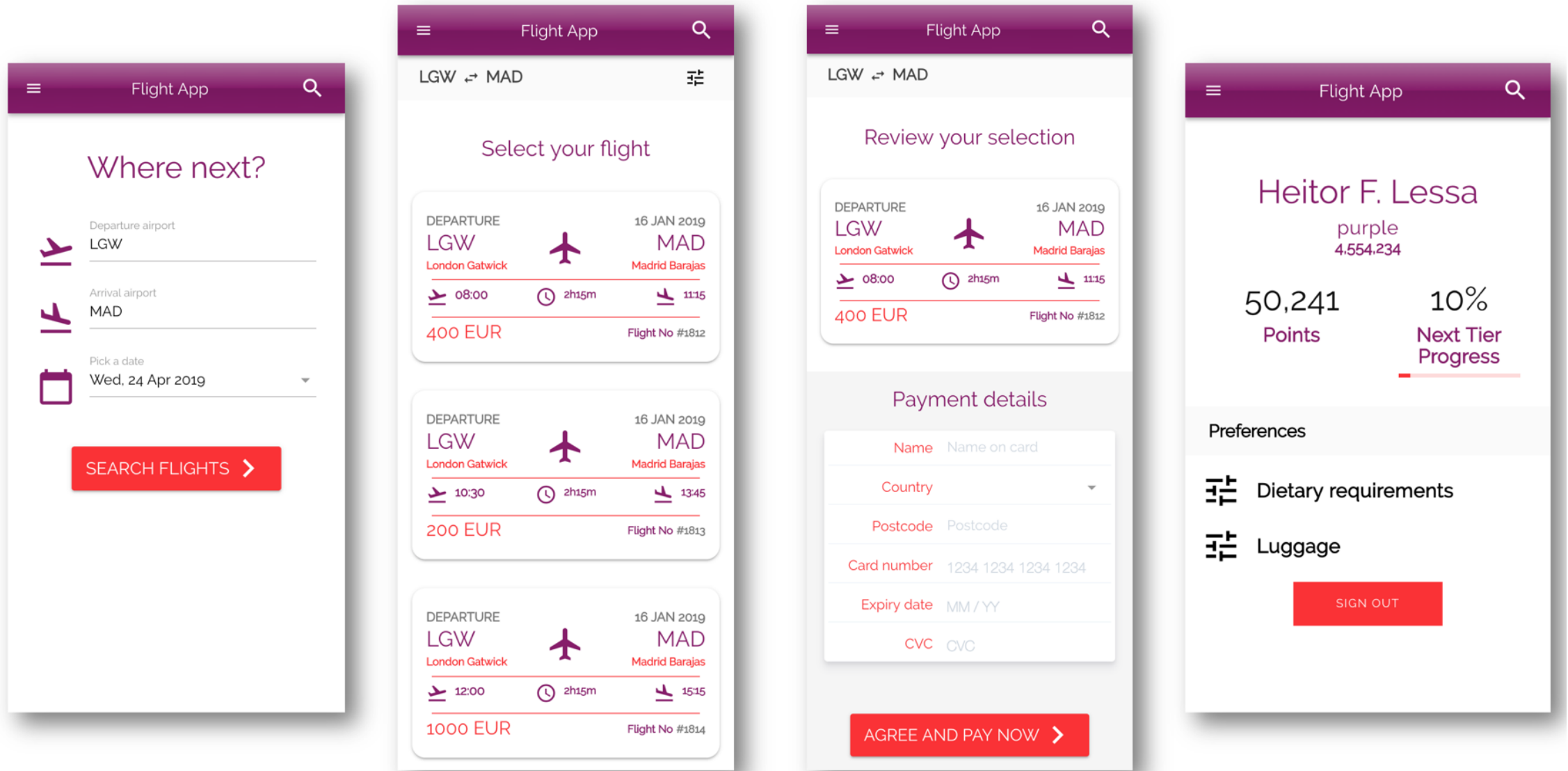
AWS Region





AWS Serverless Architecture

aws 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

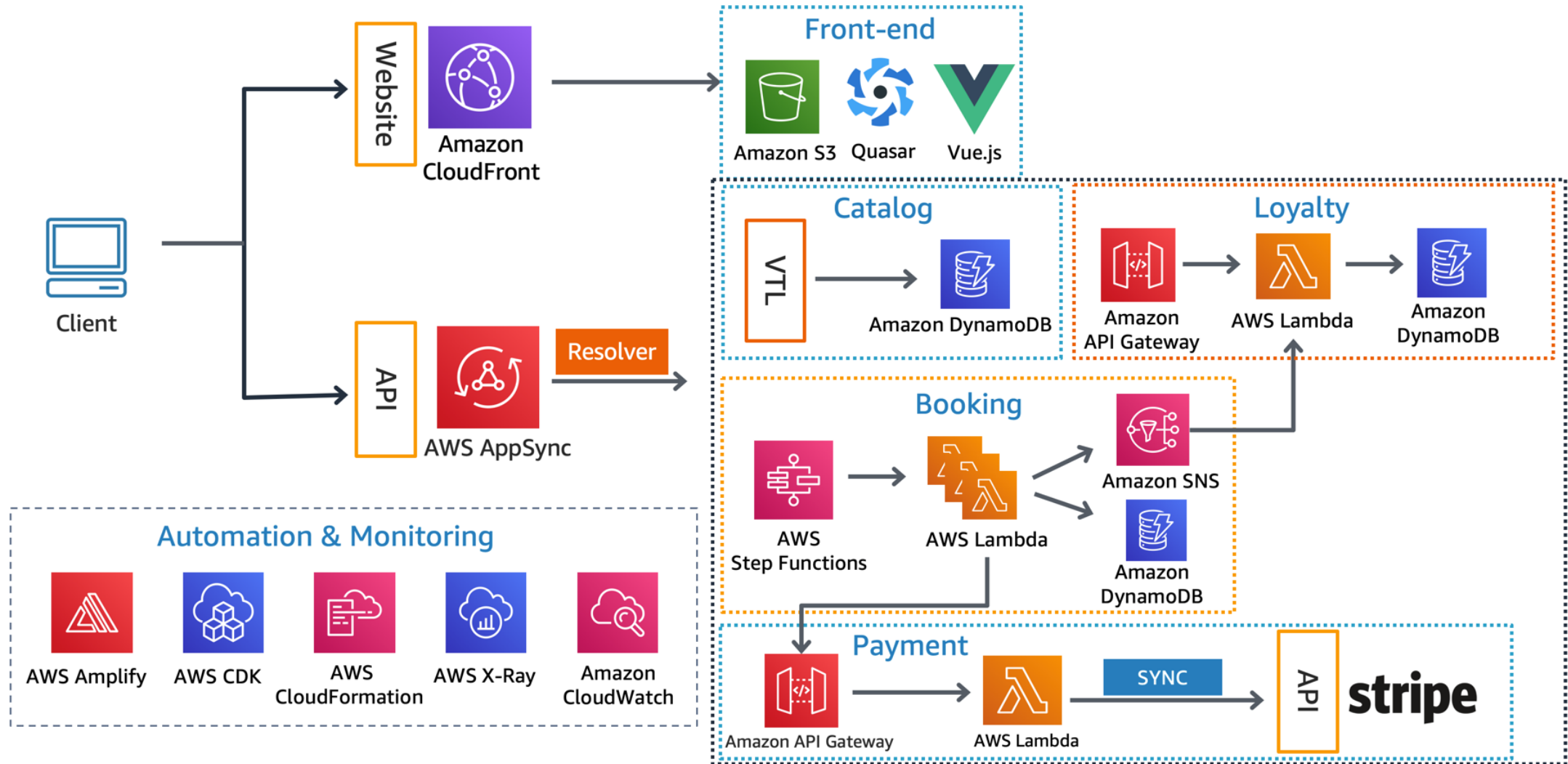


AWS Step Functions



AWS Serverless Airline Booking

High level infrastructure architecture

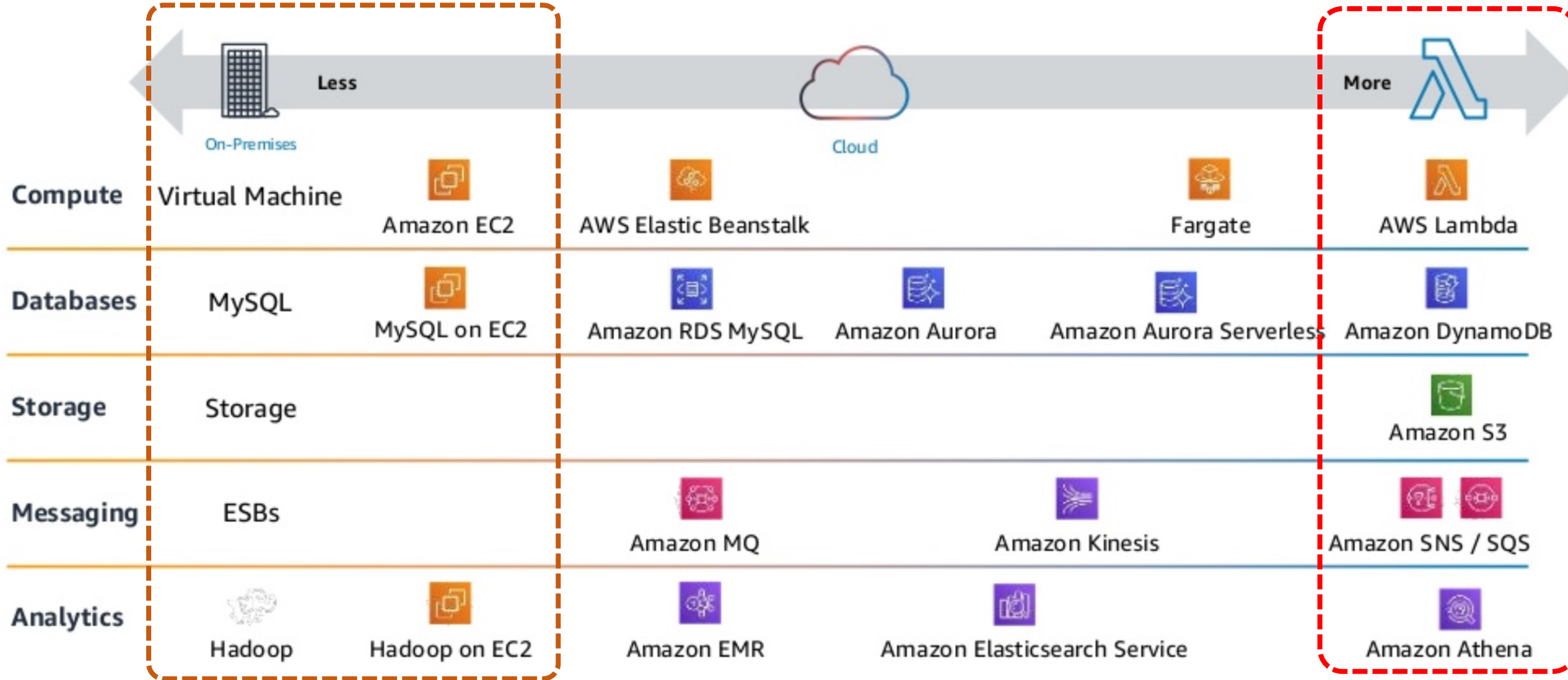


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AWS Serverless Architecture

AWS Operational Responsibility Models





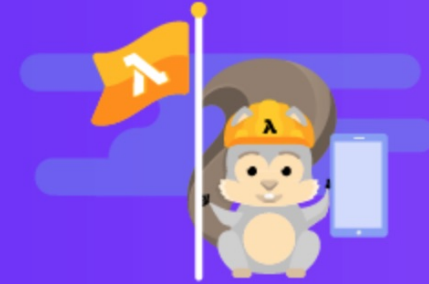
Build a Serverless Web Application

aws 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.

Application Architecture

AWS Experience: Beginner

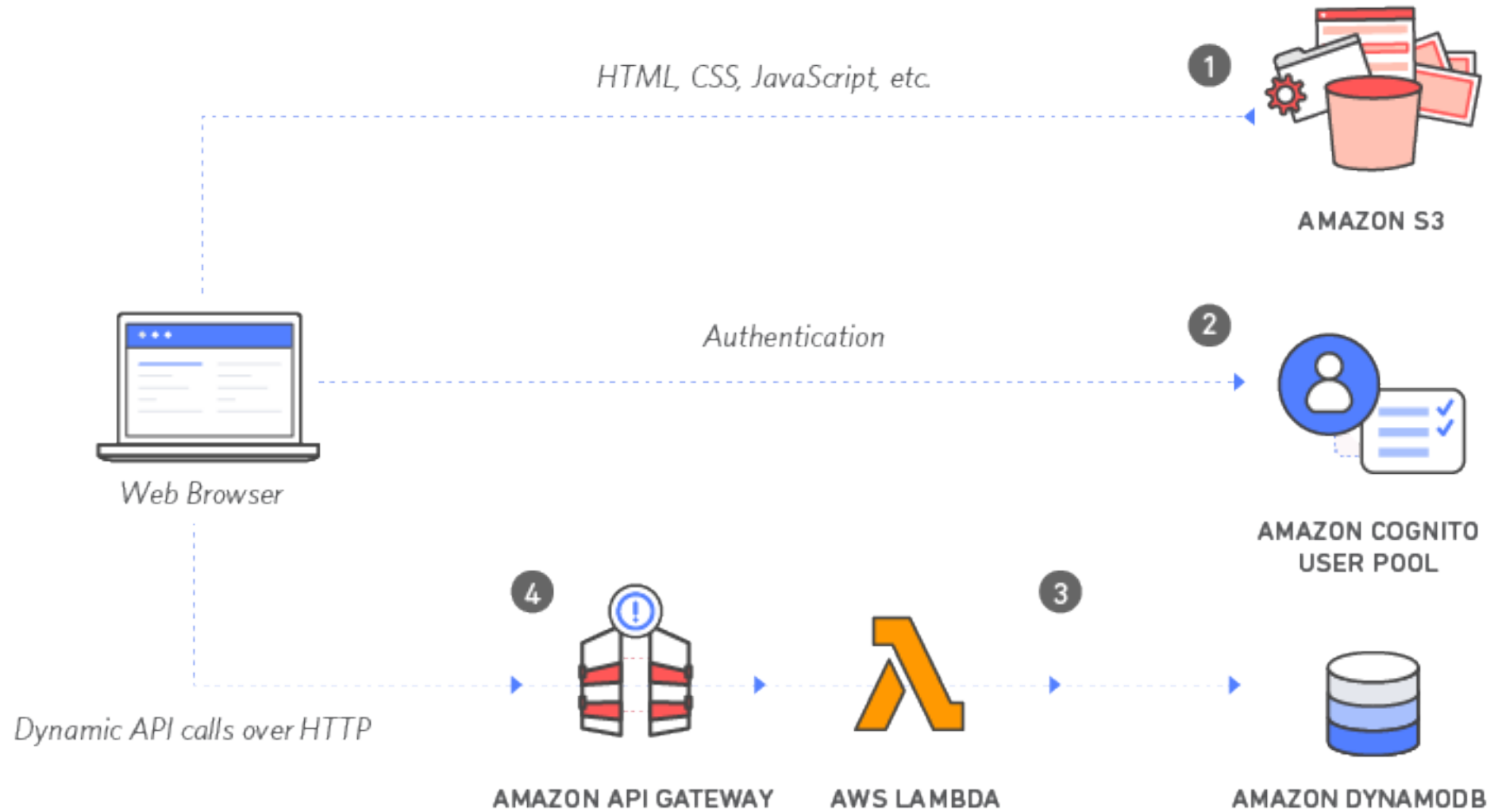
Time to complete: 2 hours

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*.



Build a Serverless Web Application

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

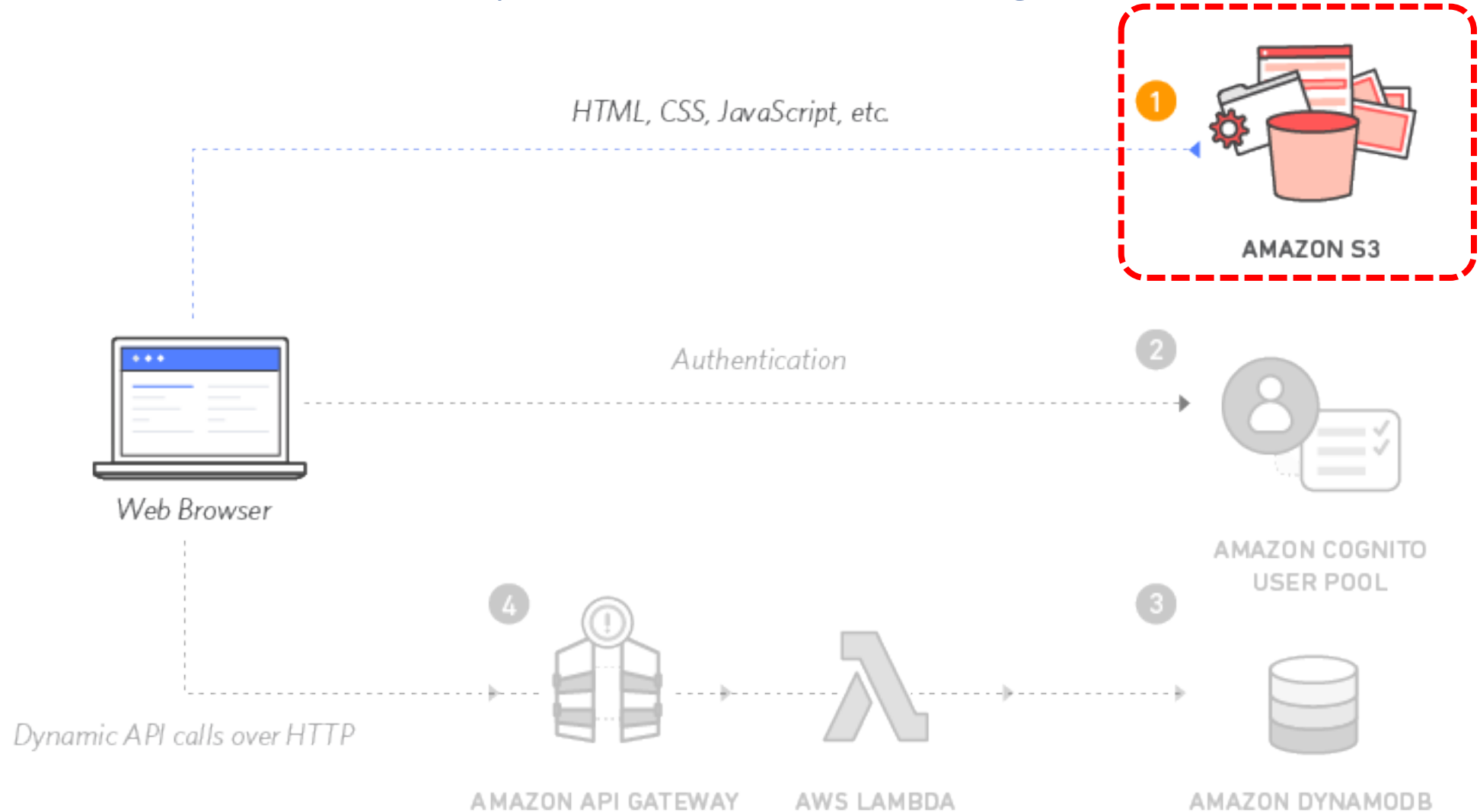




Build a Serverless Web Application

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

1





Build a Serverless Web Application

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

1

Static Web Hosting

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

HTML, CSS, JavaScript, etc.



AMAZON S3



AMAZON COGNITO
USER POOL



AMAZON DYNAMODB



Build a Serverless Web Application

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

2



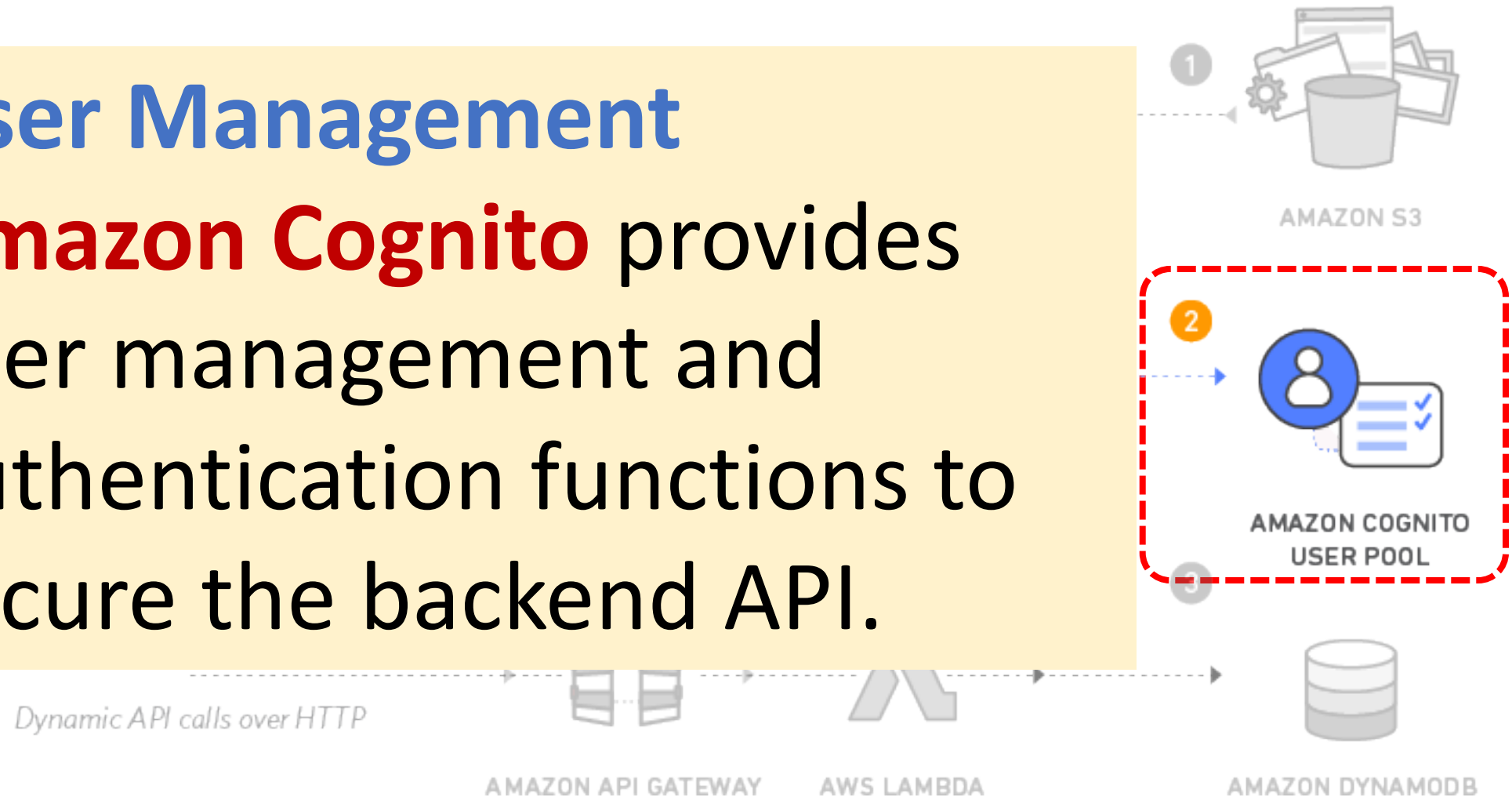


Build a Serverless Web Application

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.

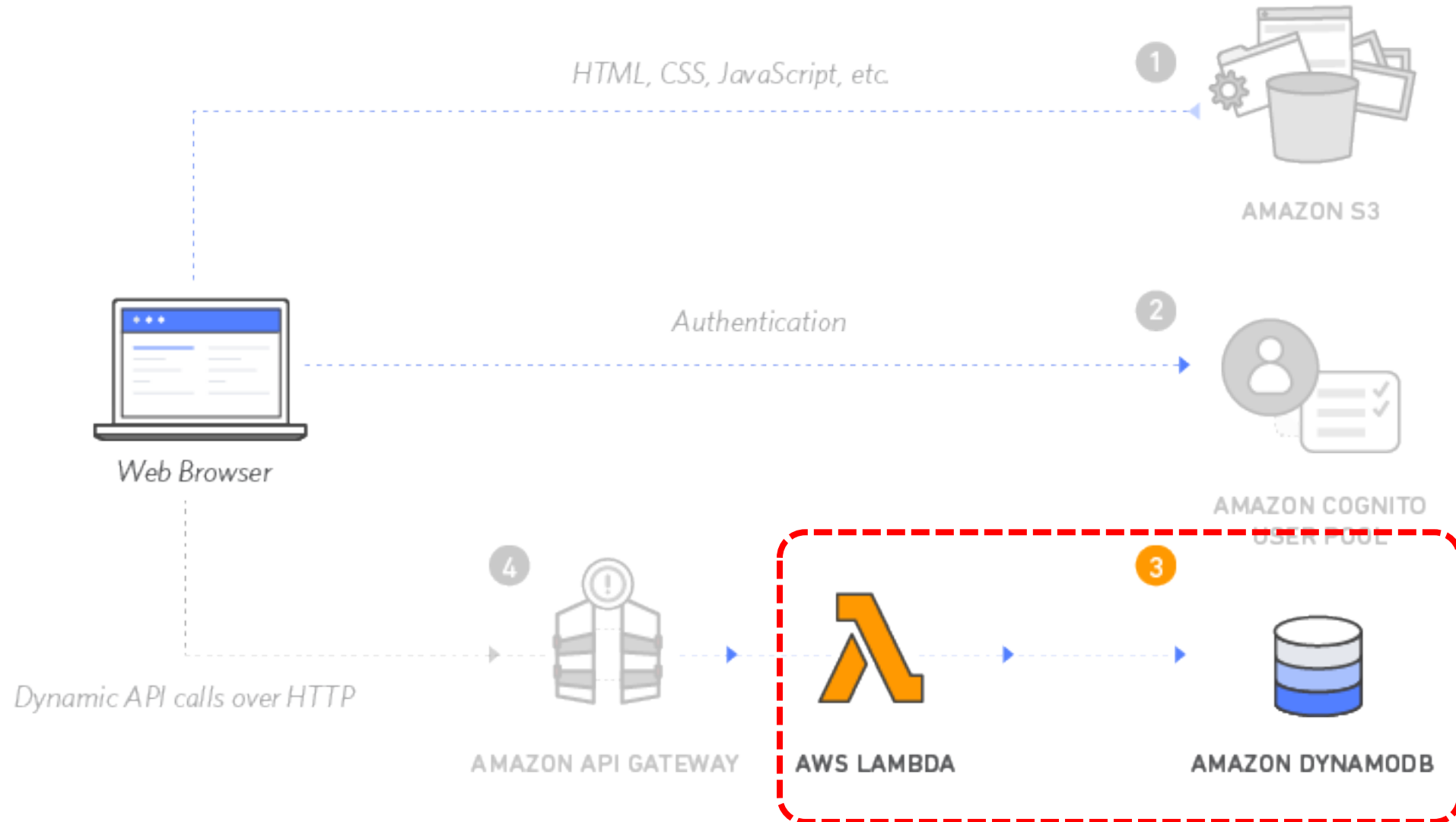




Build a Serverless Web Application

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

3





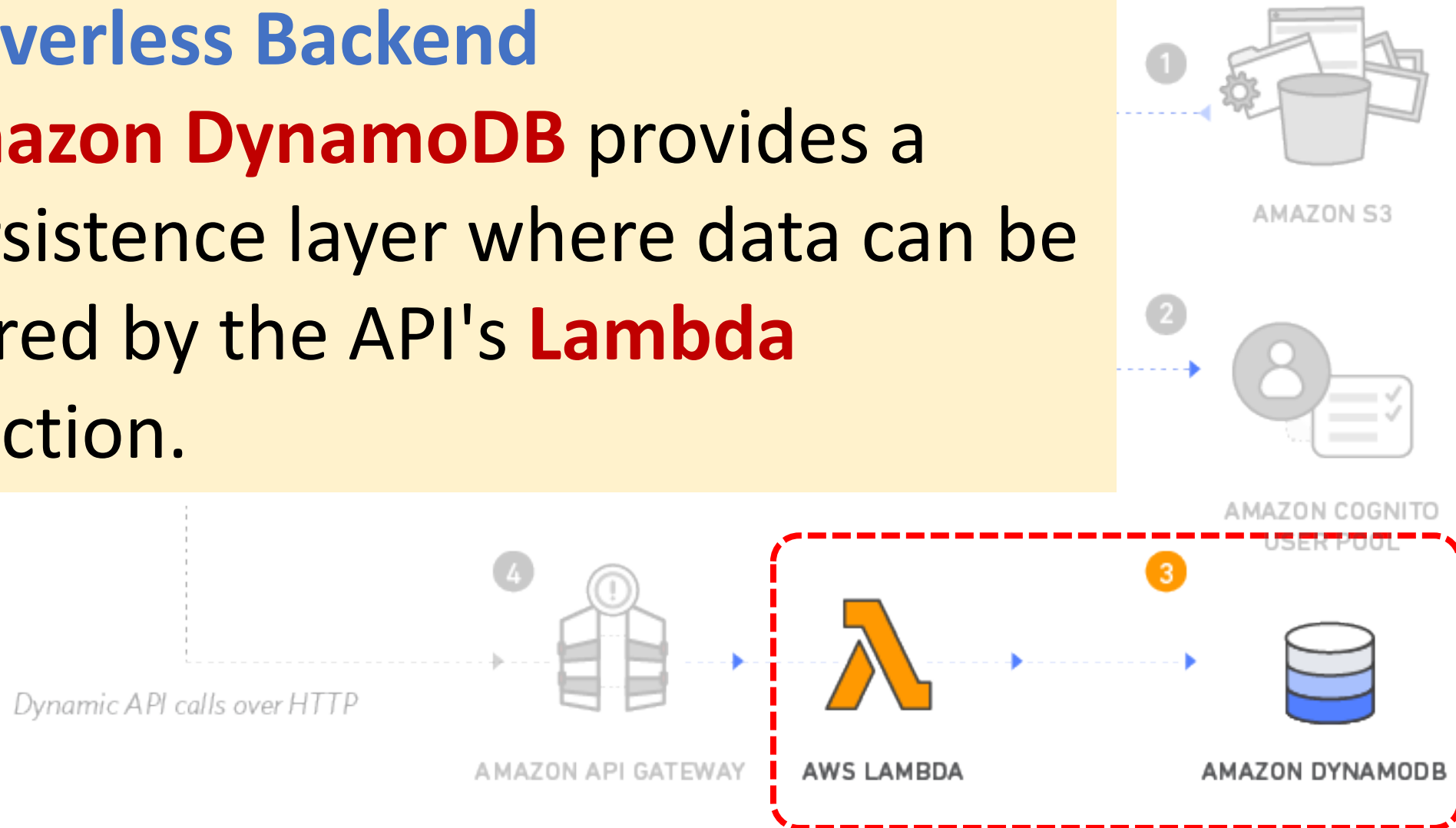
Build a Serverless Web Application

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.

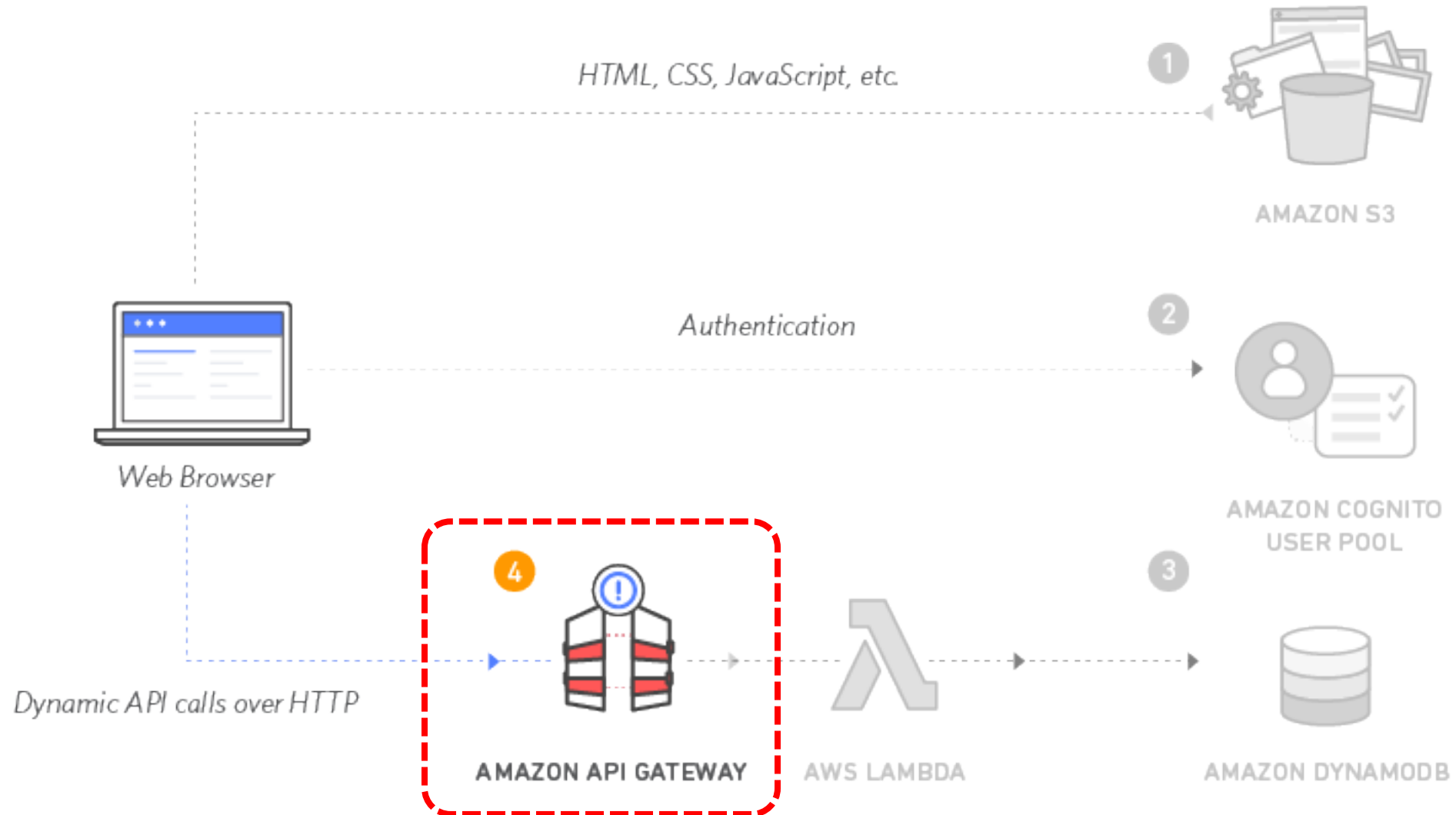




Build a Serverless Web Application

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

4





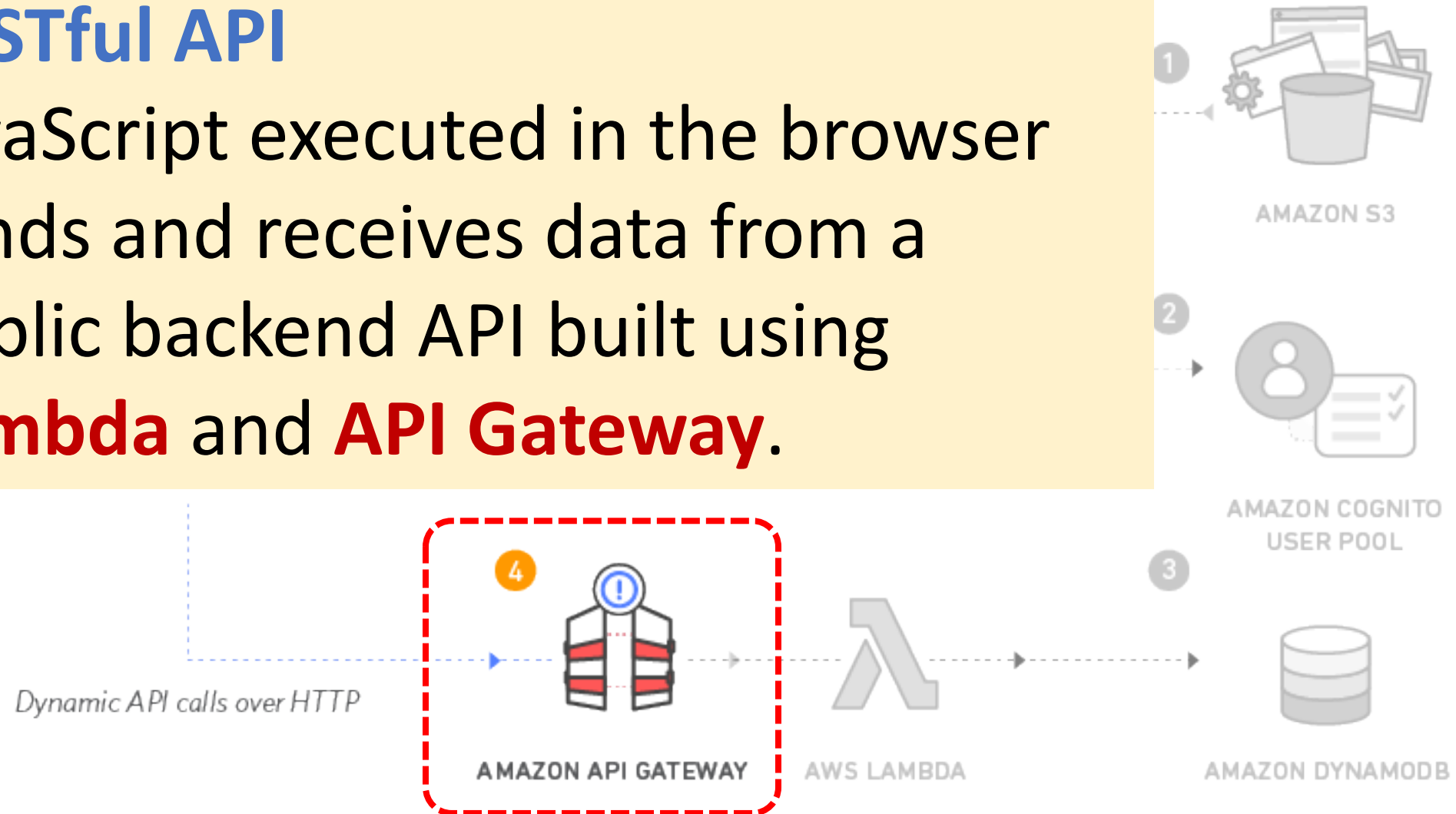
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RESTful API

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





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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.



Summary



- **雲端服務架構實務**課程主要介紹：
AWS 技術基礎和在 **AWS 上建立架構**。
- **AWS 技術基礎**介紹 AWS 產品、服務和常見解決方案。
- **在 AWS 上建立架構**內容涵蓋在 AWS 上建置 IT 基礎架構的基礎。
- **解決方案架構師**如何透過了解 AWS 服務來優化對 AWS 雲端的使用，及如何讓這些服務符合雲端解決方案。
- AWS 雲端最佳實務與建議的設計模式，協助學員思考在 AWS 上架構最佳 IT 解決方案的程序。

雲端服務架構實務 (Cloud Services Architecting Practices)

Contact Information



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