

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 2022)
(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)
(1102) (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) (2022.02 - 2022.06)
(週三 Wed, 6, 7, 8, 14:10-17:00) (台北大學三峽校區 文3F10_L)

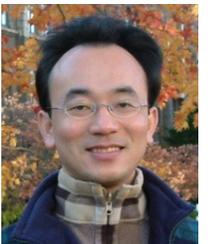


謝榮桂 (Jung-Kuei Hsieh), 戴敏育 (Min-Yuh Day)

National Taipei University

國立臺北大學

2022-02-23





國立臺北大學

110學年度第2學期 課程大綱

Spring 2022 (2022.02 - 2022.06)

- 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 文3F10_L)

(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	2022/02/23	雲端概念概述 (Cloud Concepts Overview)
2	2022/03/02	雲端經濟與計費 (Cloud Economics and Billing)
3	2022/03/09	AWS全球基礎設施概述 (AWS Global Infrastructure Overview)
4	2022/03/16	AWS雲端安全 (AWS Cloud Security)
5	2022/03/23	網路和內容交付 (Networking and Content Delivery)
6	2022/03/30	雲端計算 (Cloud Compute)

課程大綱 (Syllabus)



週次 (Week)	日期 (Date)	內容 (Subject/Topics)
7	2022/04/06	放假一天 (Make-up Holiday, No Classes)
8	2022/04/13	雲端儲存 (Cloud Storage)
9	2022/04/20	雲端數據庫 (Cloud Databases)
10	2022/04/27	雲端架構 (Cloud Architecture)
11	2022/05/04	雲端自動擴展和監控 (Cloud Automatic Scaling and Monitoring)
12	2022/05/11	學生自主學習 (Self-learning)

課程大綱 (Syllabus)



週次 (Week)	日期 (Date)	內容 (Subject/Topics)
13	2022/05/18	學生自主學習 (Self-learning)
14	2022/05/25	雲端專案成果報告與討論 (Cloud Project Presentation and Discussion)
15	2022/06/01	學生自主學習 (Self-learning)
16	2022/06/08	期末專案成果報告 (Final Project Presentation)
17	2022/06/15	學生自主學習 (Self-learning)
18	2022/06/22	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



Specialty

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

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

Security Specialty

<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.





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) (2021/05)

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



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

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

- <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)** (2021/05)

- <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)**

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

AWS Backup
Centralized backup across AWS services

CloudEndure Disaster Recovery
Highly automated disaster recovery

Amazon Elastic Block Store (EBS)
EC2 block storage volumes

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

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

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

Amazon S3 Glacier
Low-cost Archive Storage in the Cloud

AWS Storage Gateway
Hybrid Storage Integration



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

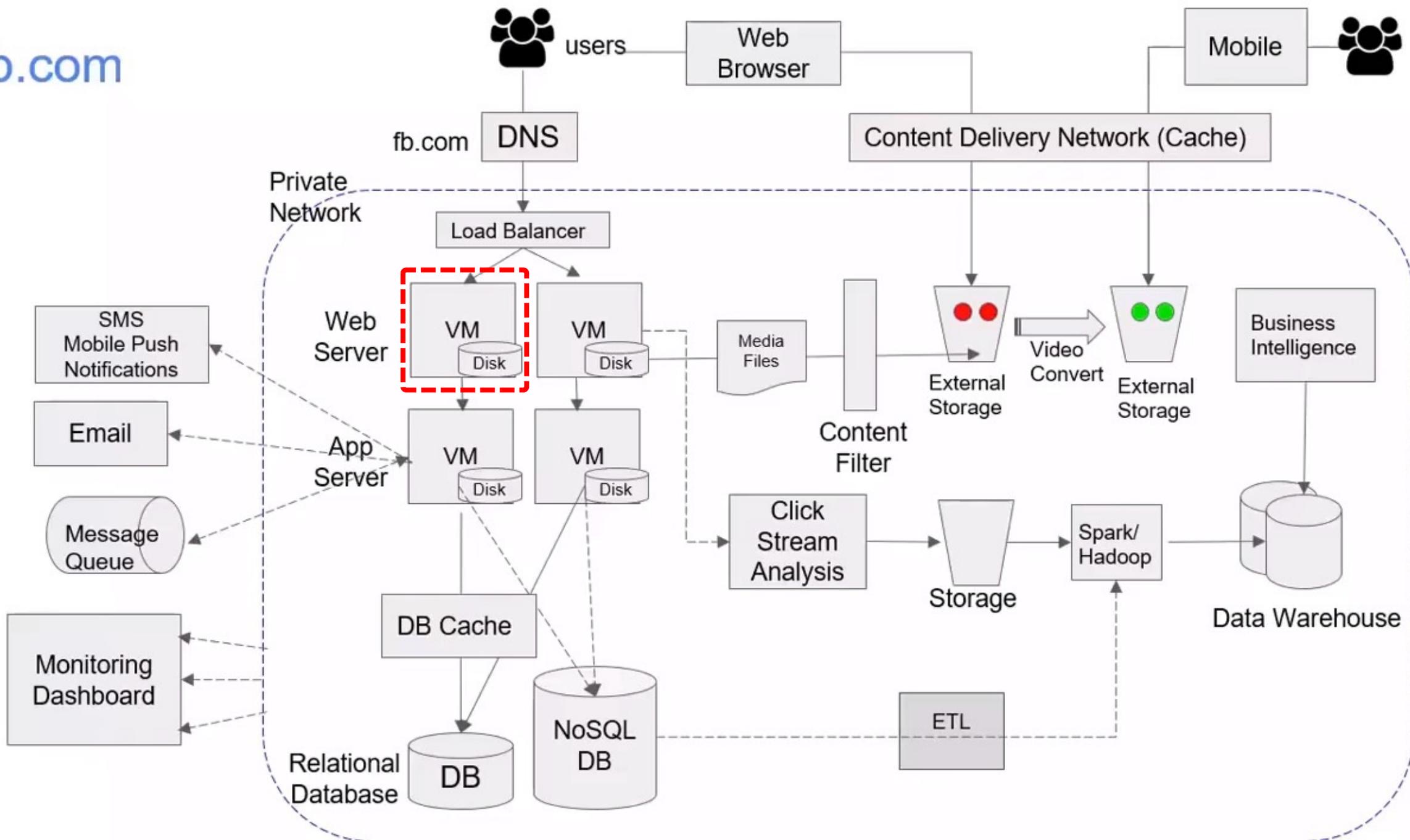


AWS Services

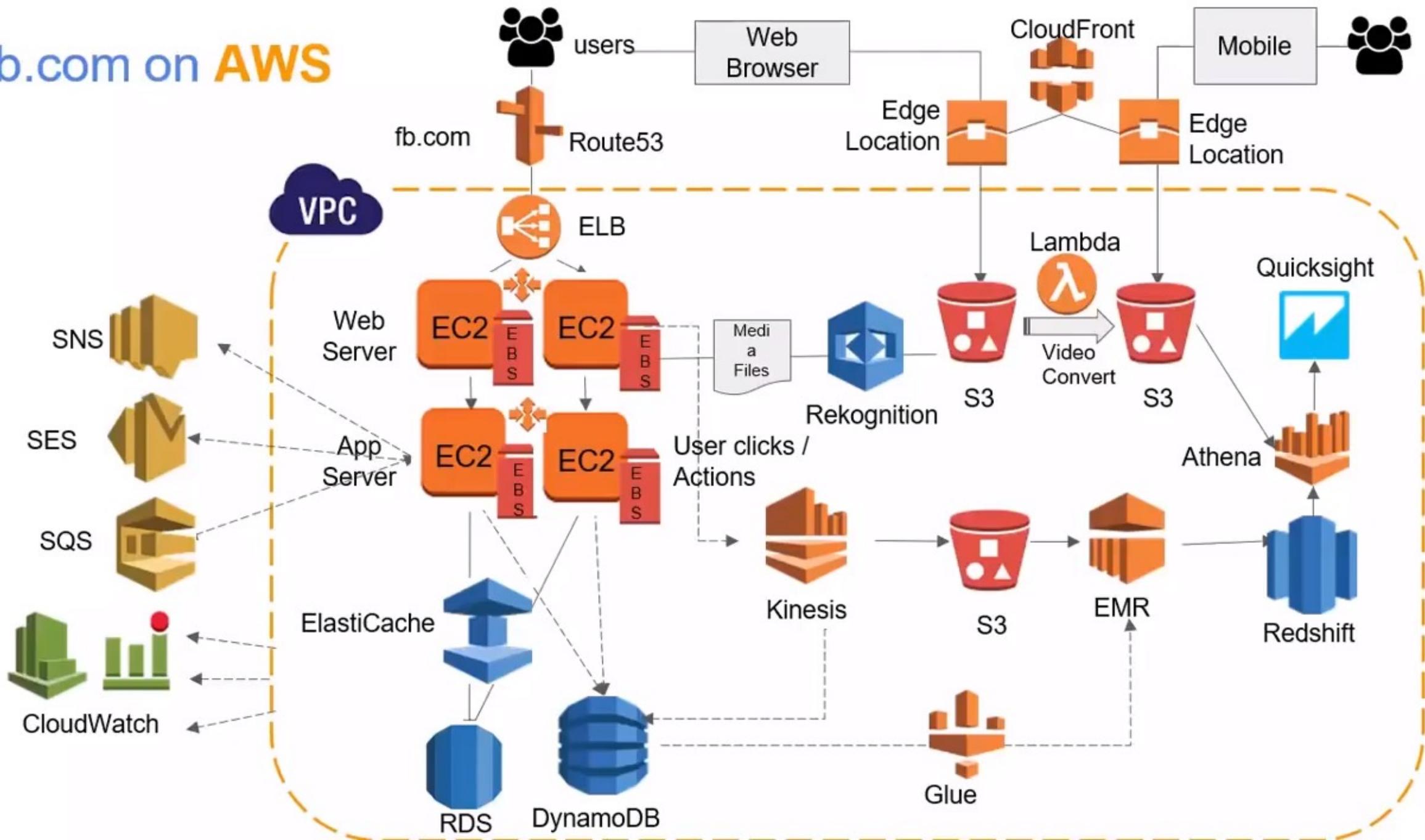
- **AWS Lambda**
 - Run code without thinking about servers
- **AWS Elastic Beanstalk**
 - Run and manage web apps
- **Amazon VPC**
 - Isolated cloud resources
- **Amazon Lightsail**
 - Launch and manage virtual private servers
- **Amazon SageMaker**
 - Build, train, and deploy machine learning models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



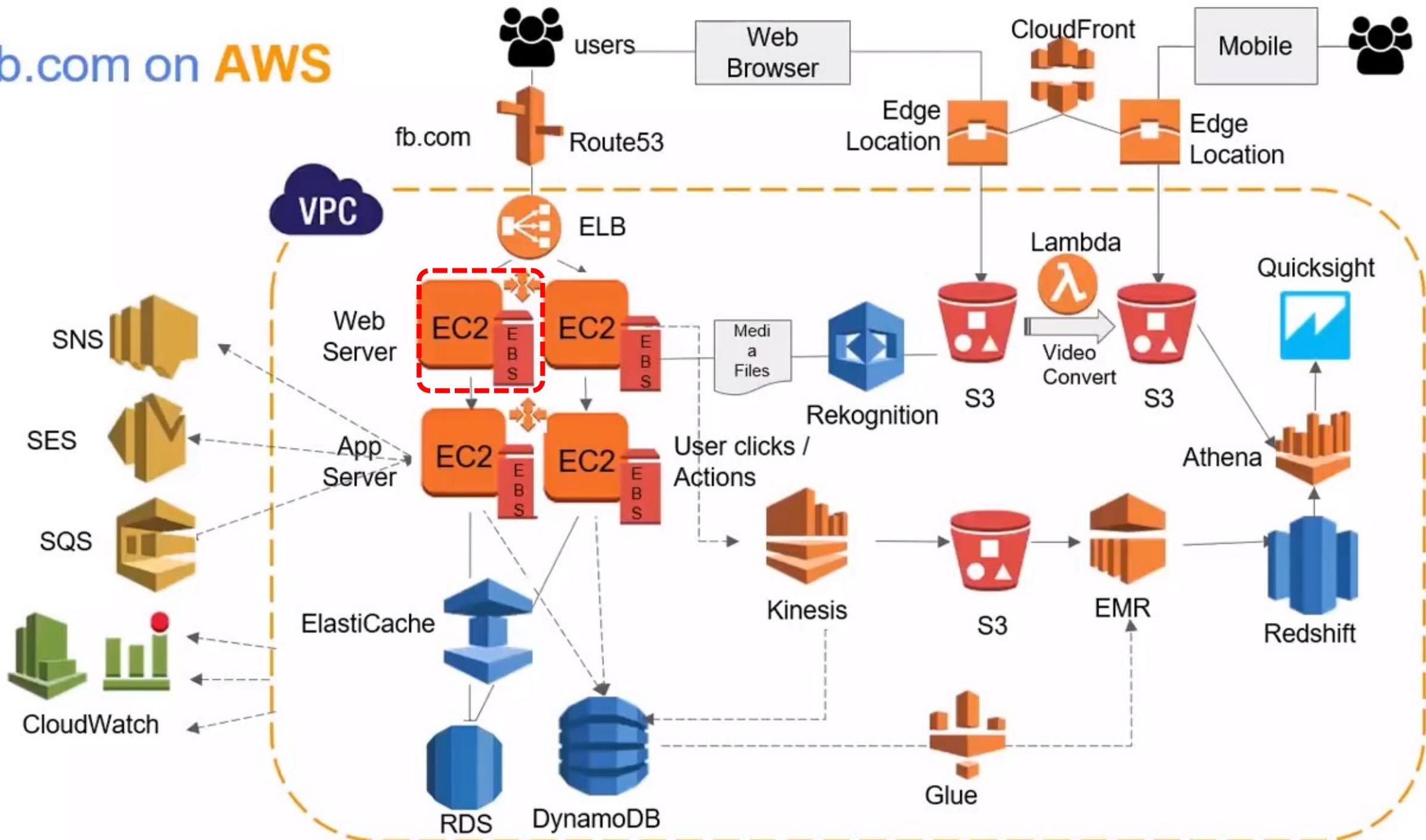
Web Application with AWS Core Services



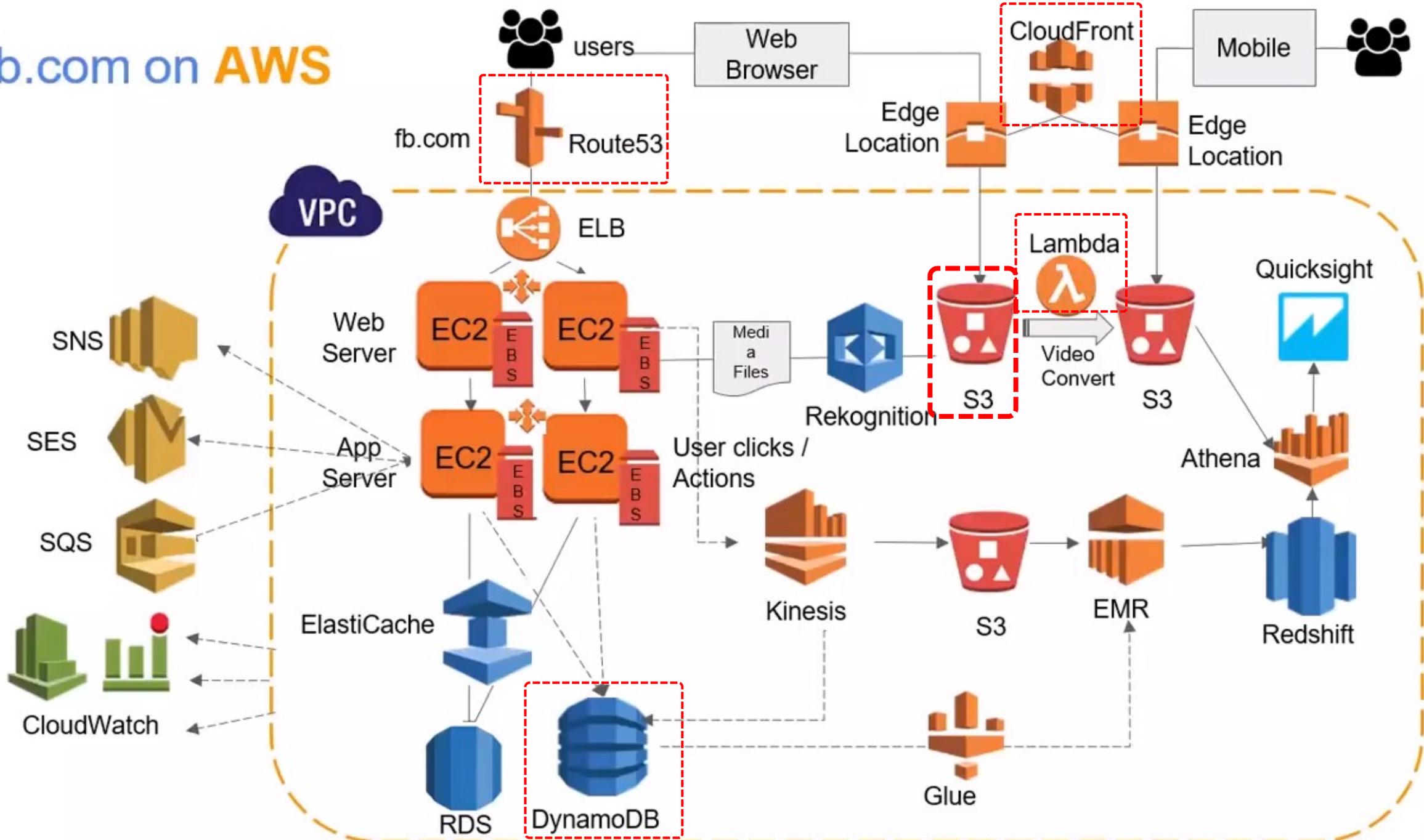
fb.com on AWS



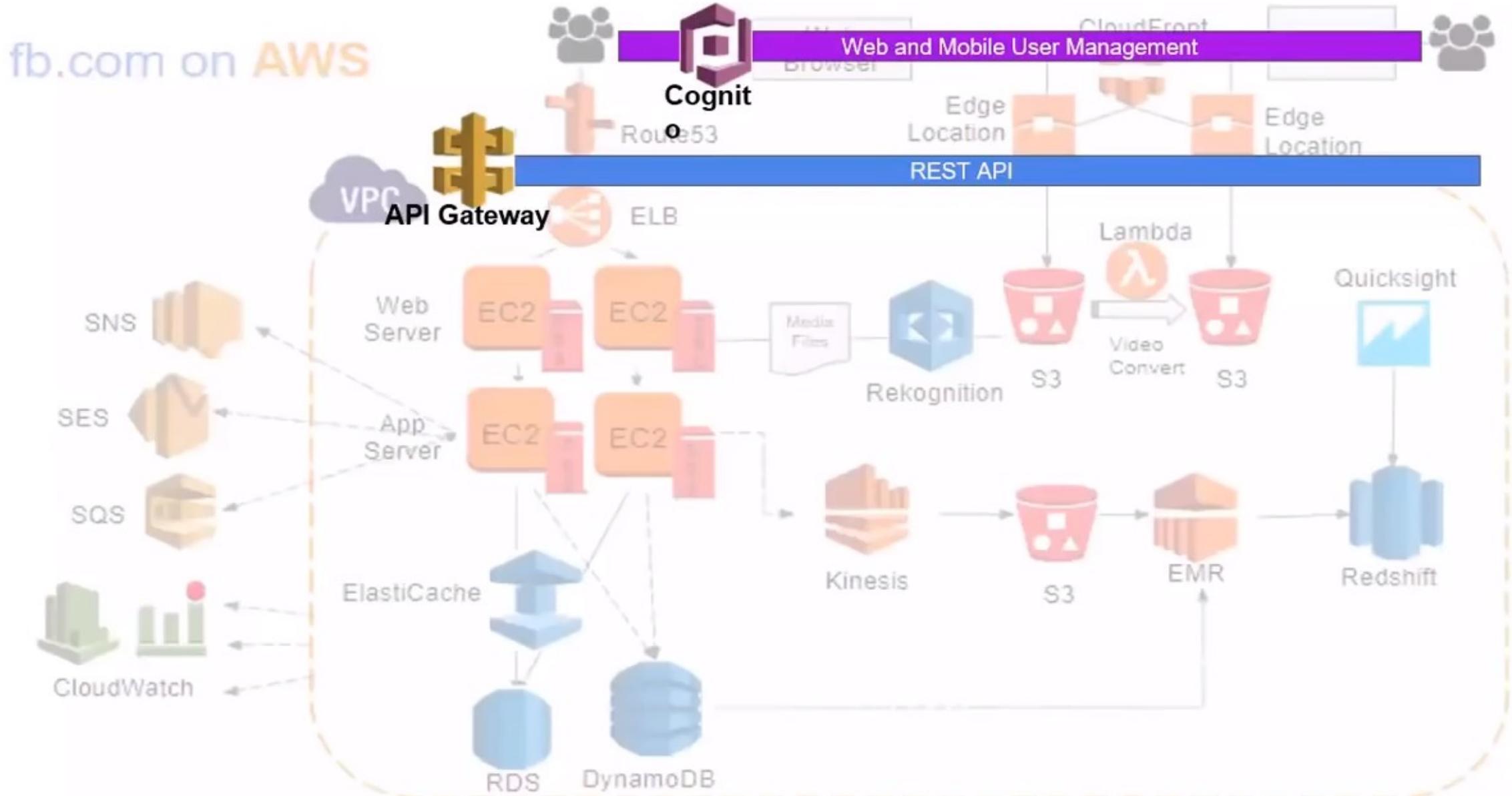
fb.com on AWS



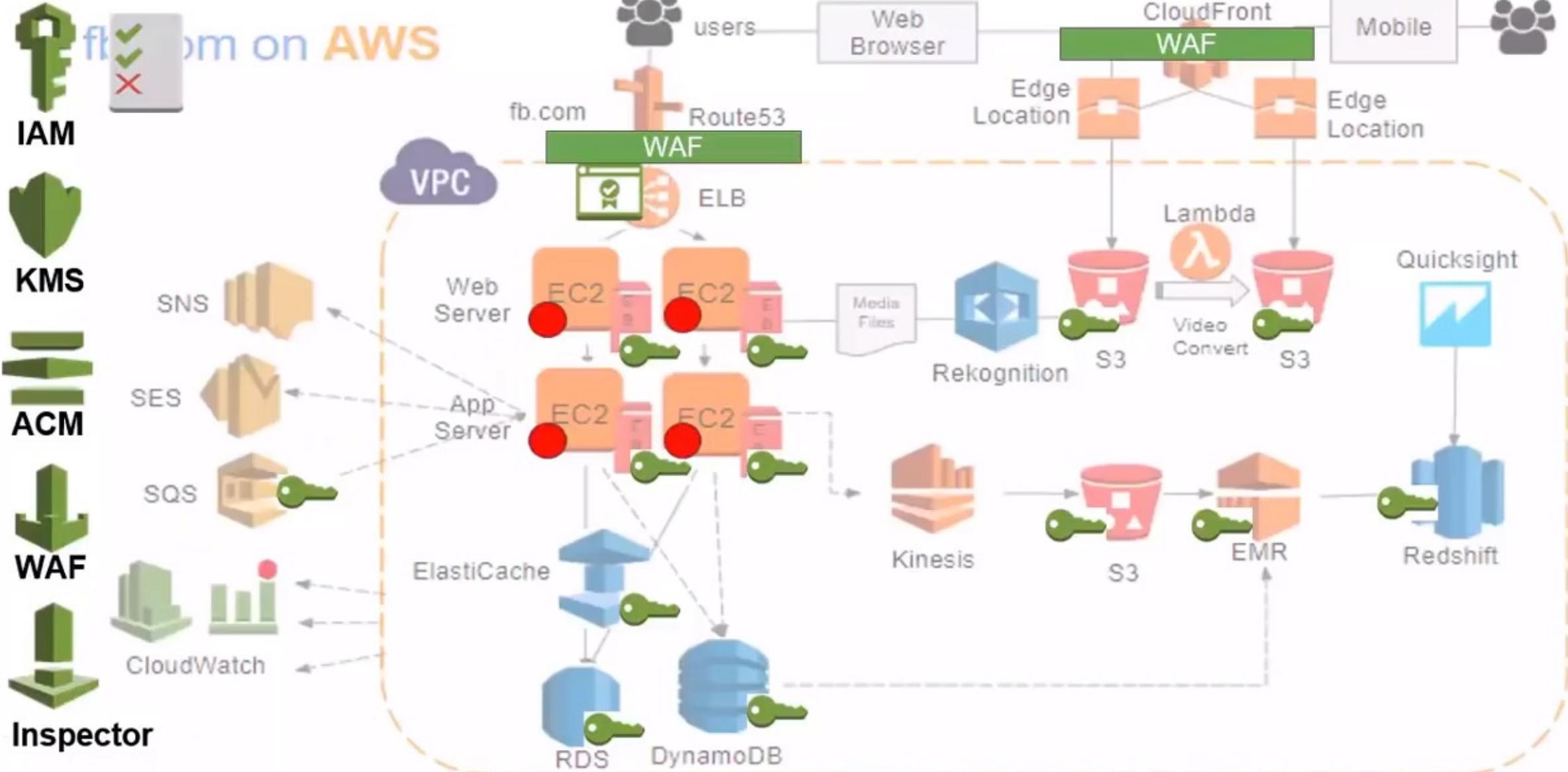
fb.com on AWS



AWS Application Services

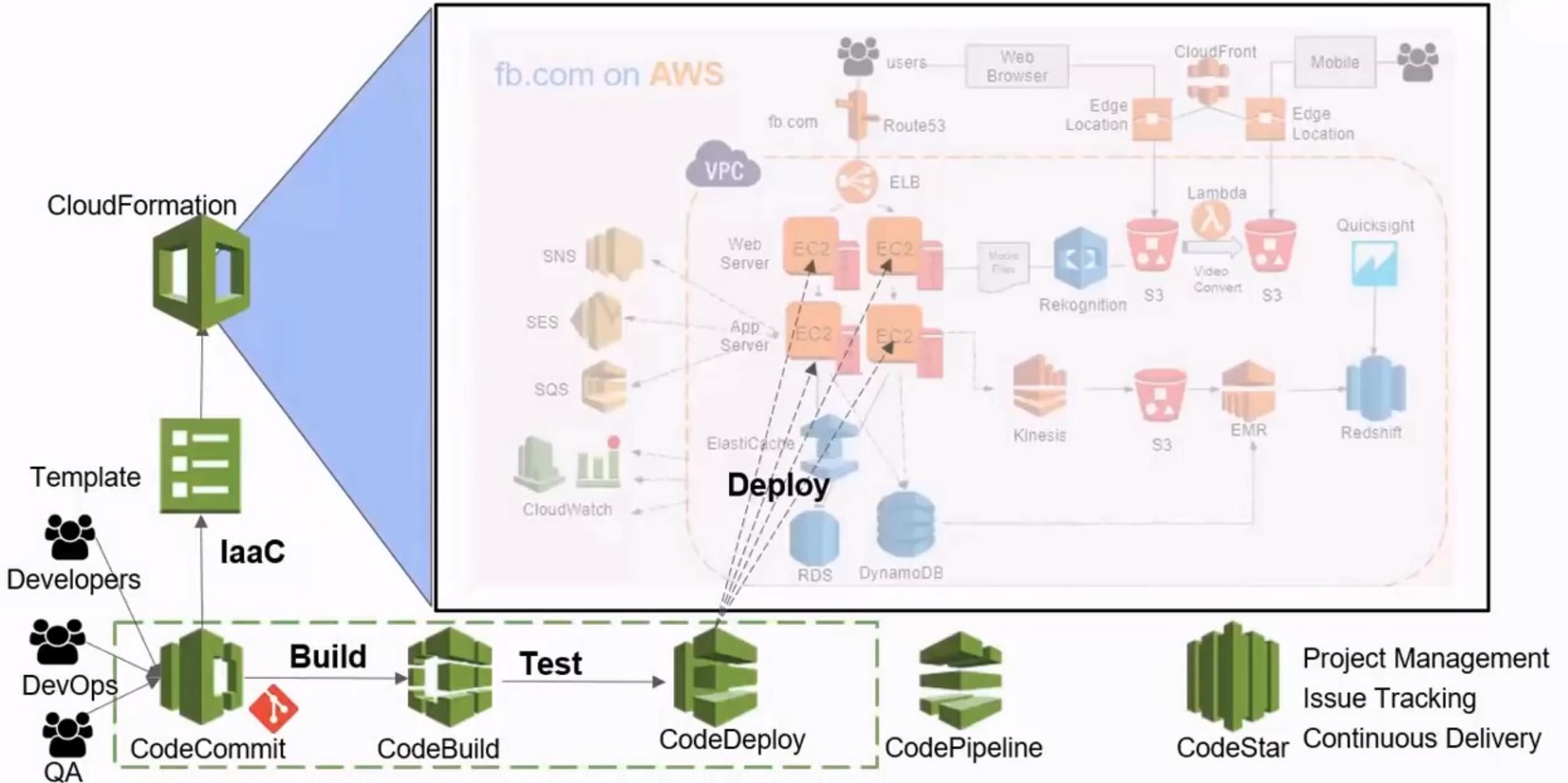


AWS Security Services



AWS Development and DevOps Services

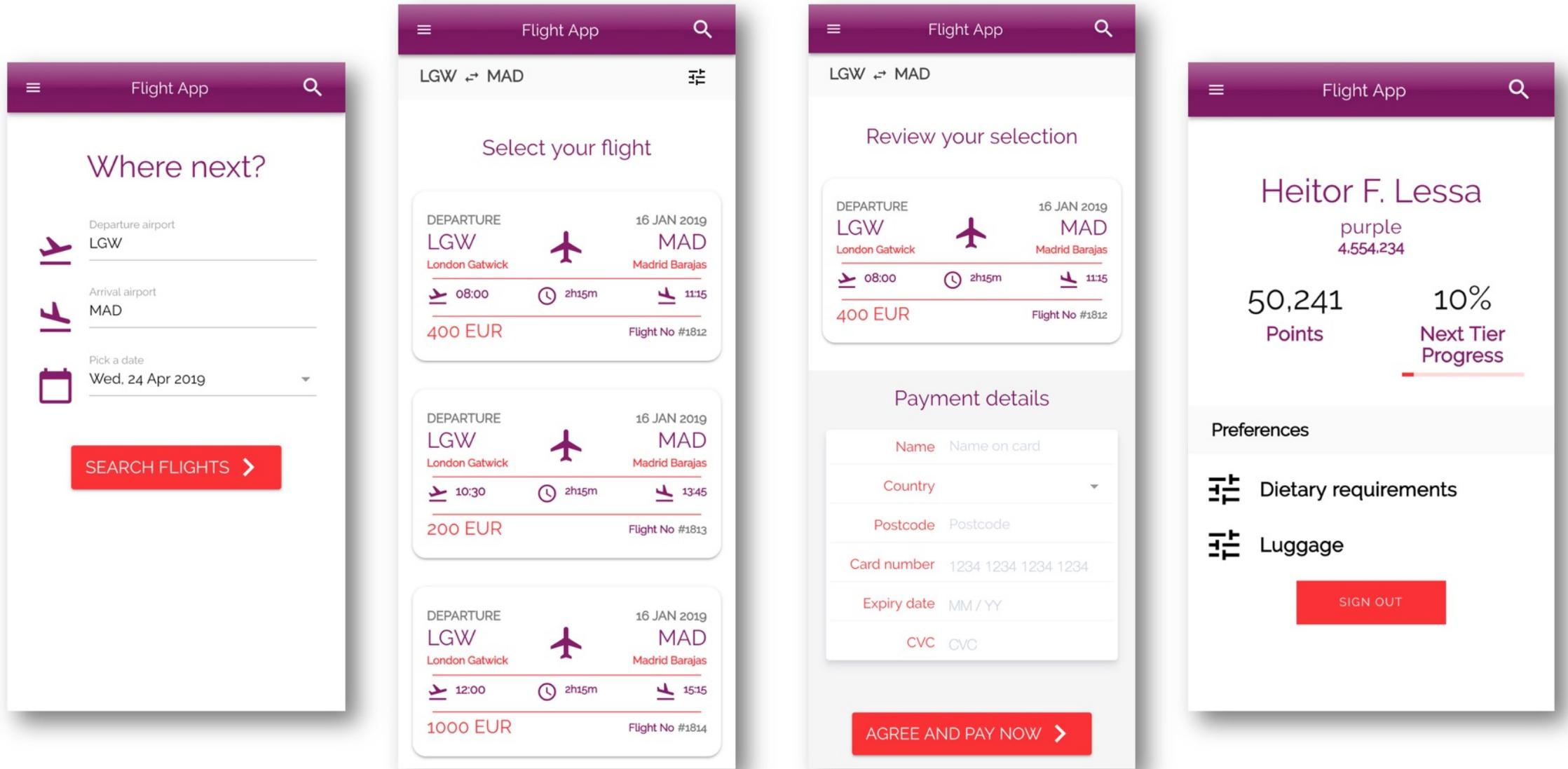
AWS Region





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



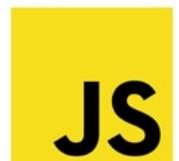
Amazon DynamoDB



Python



Typescript



JavaScript

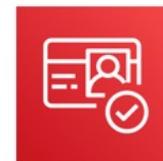
API/Auth



AWS AppSync



Amazon API Gateway



Amazon Cognito

Messaging



Amazon SNS

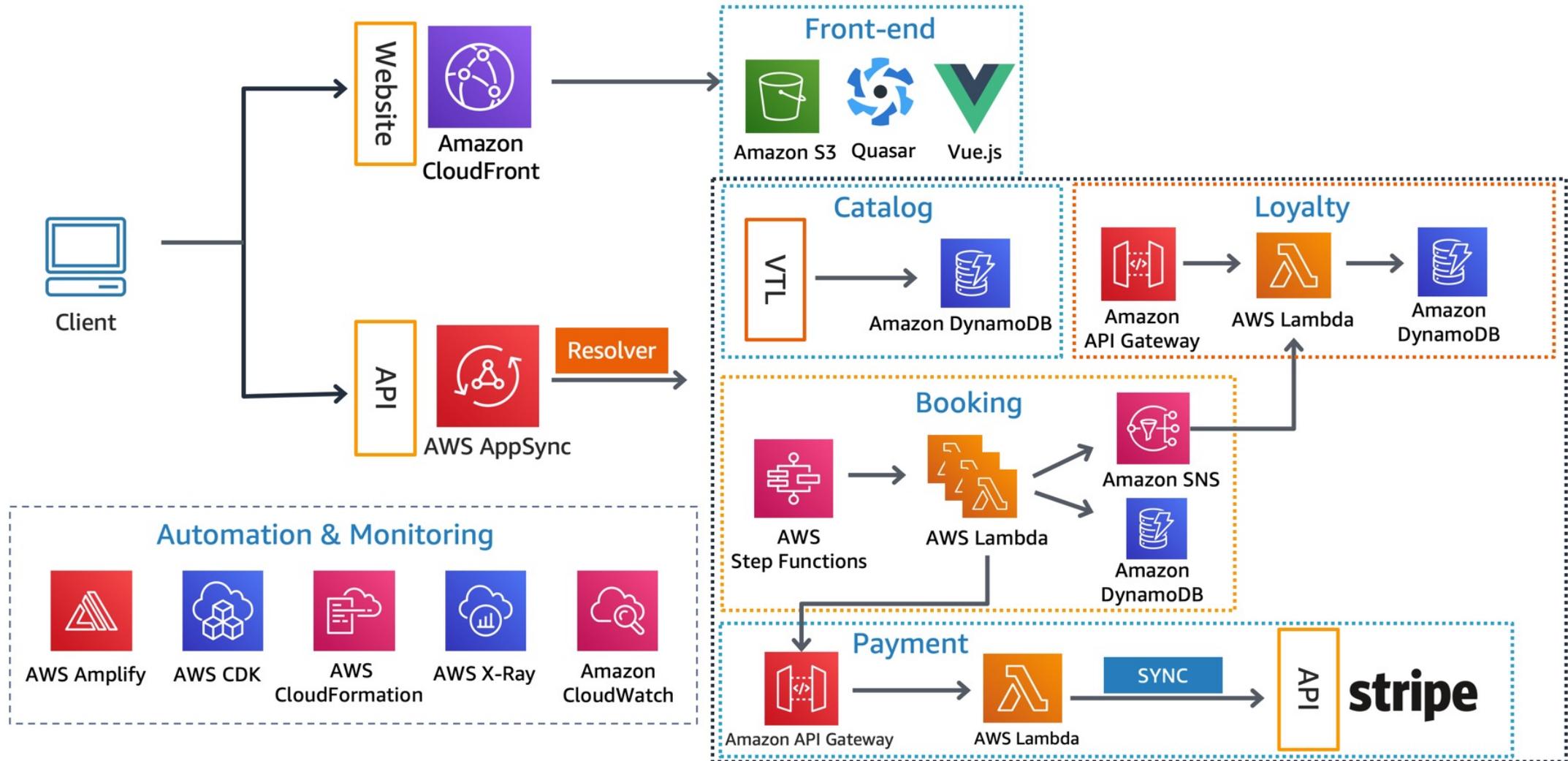


AWS Step Functions



AWS Serverless Airline Booking

High level infrastructure architecture



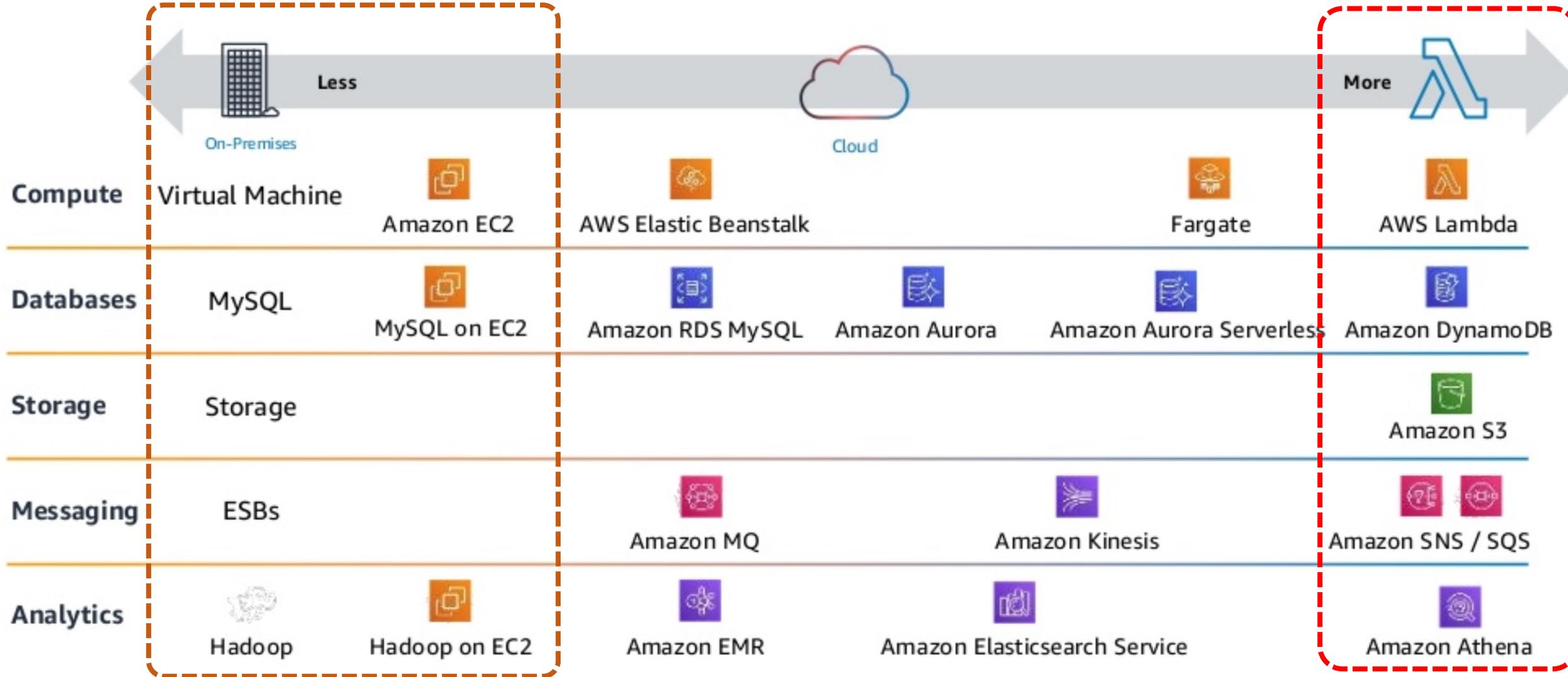
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Source: <https://github.com/aws-samples/aws-serverless-airline-booking>



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

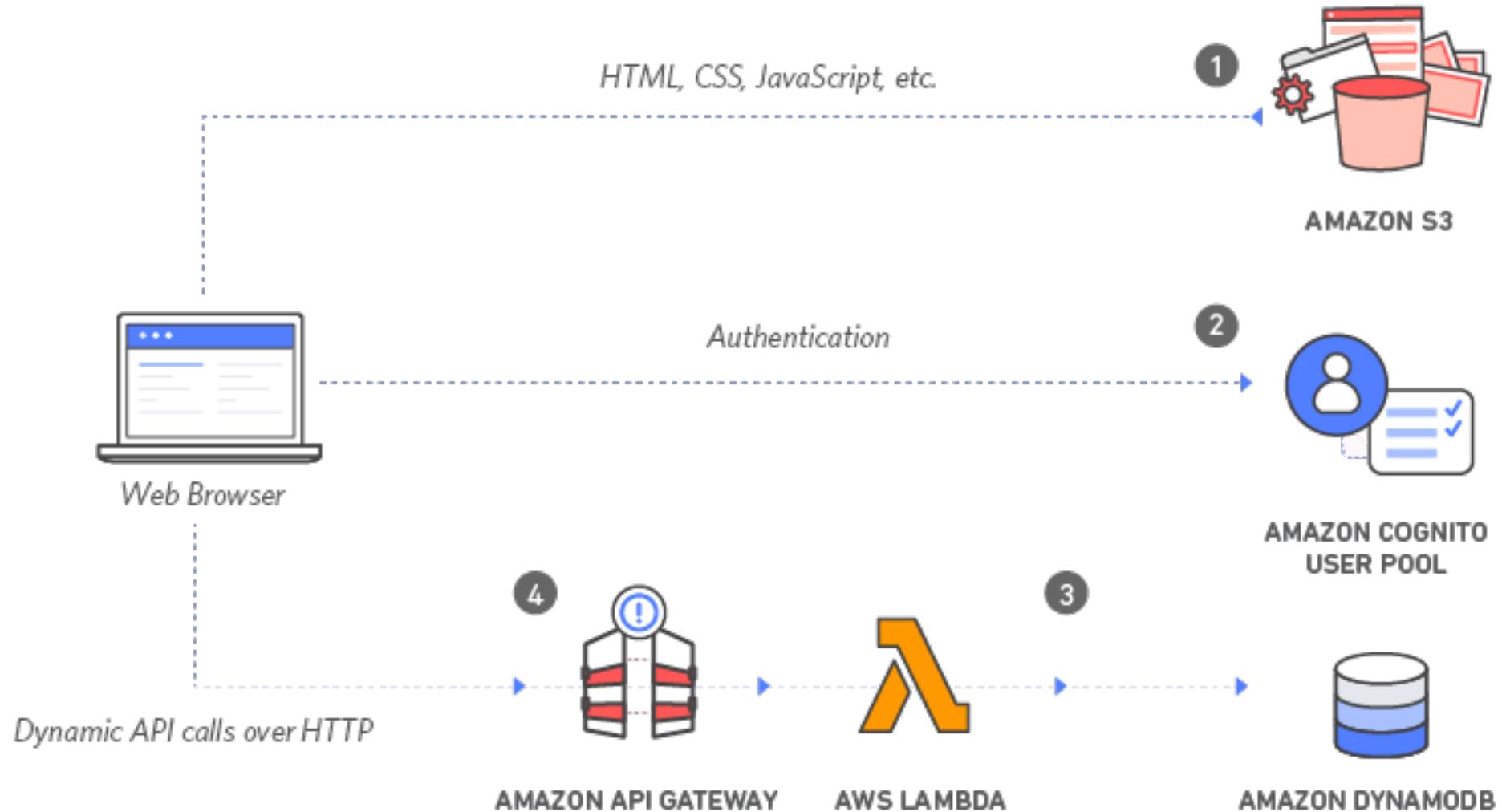
Time to complete: 2 hours

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.

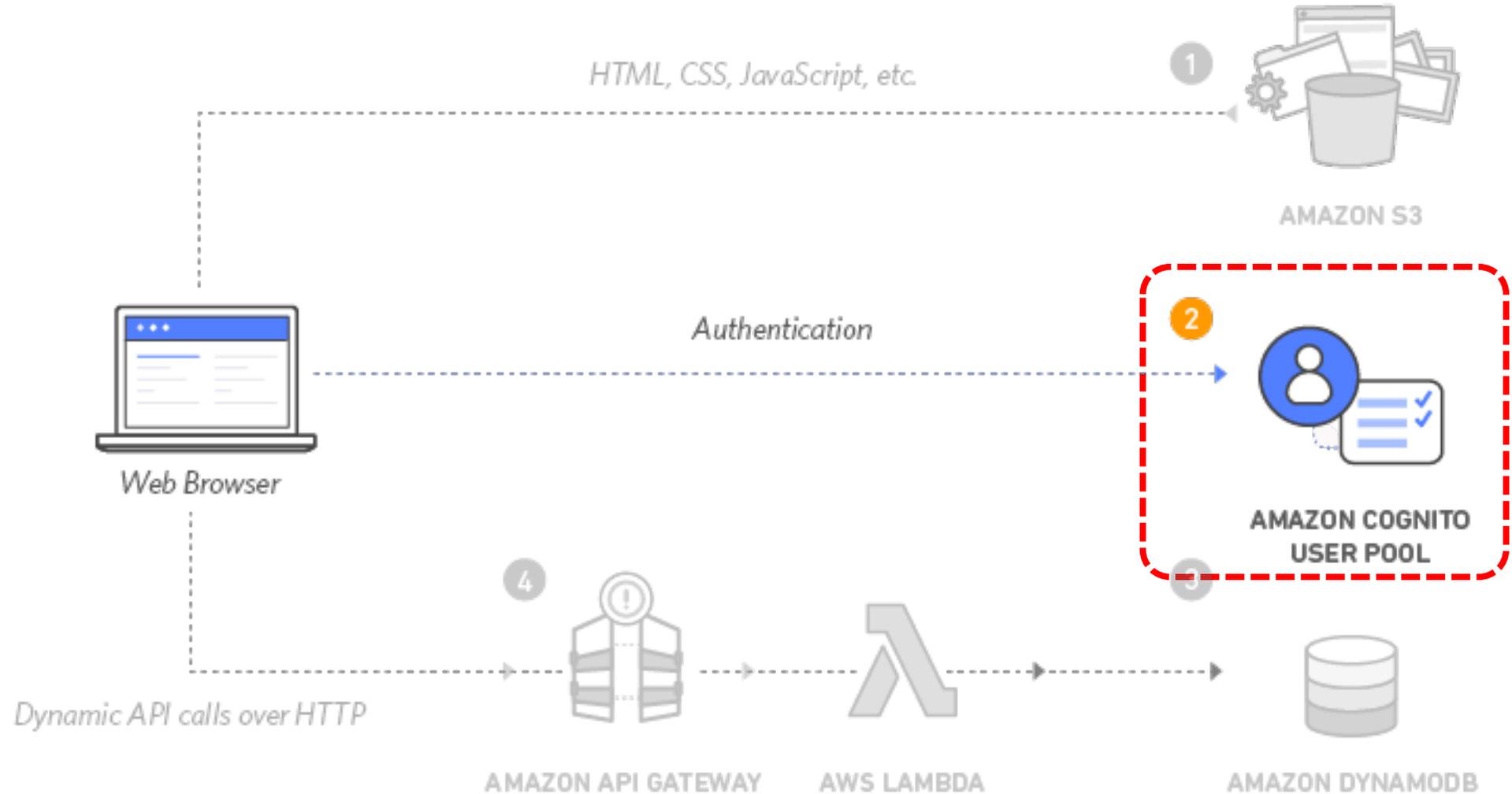




Build a Serverless Web Application

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

2





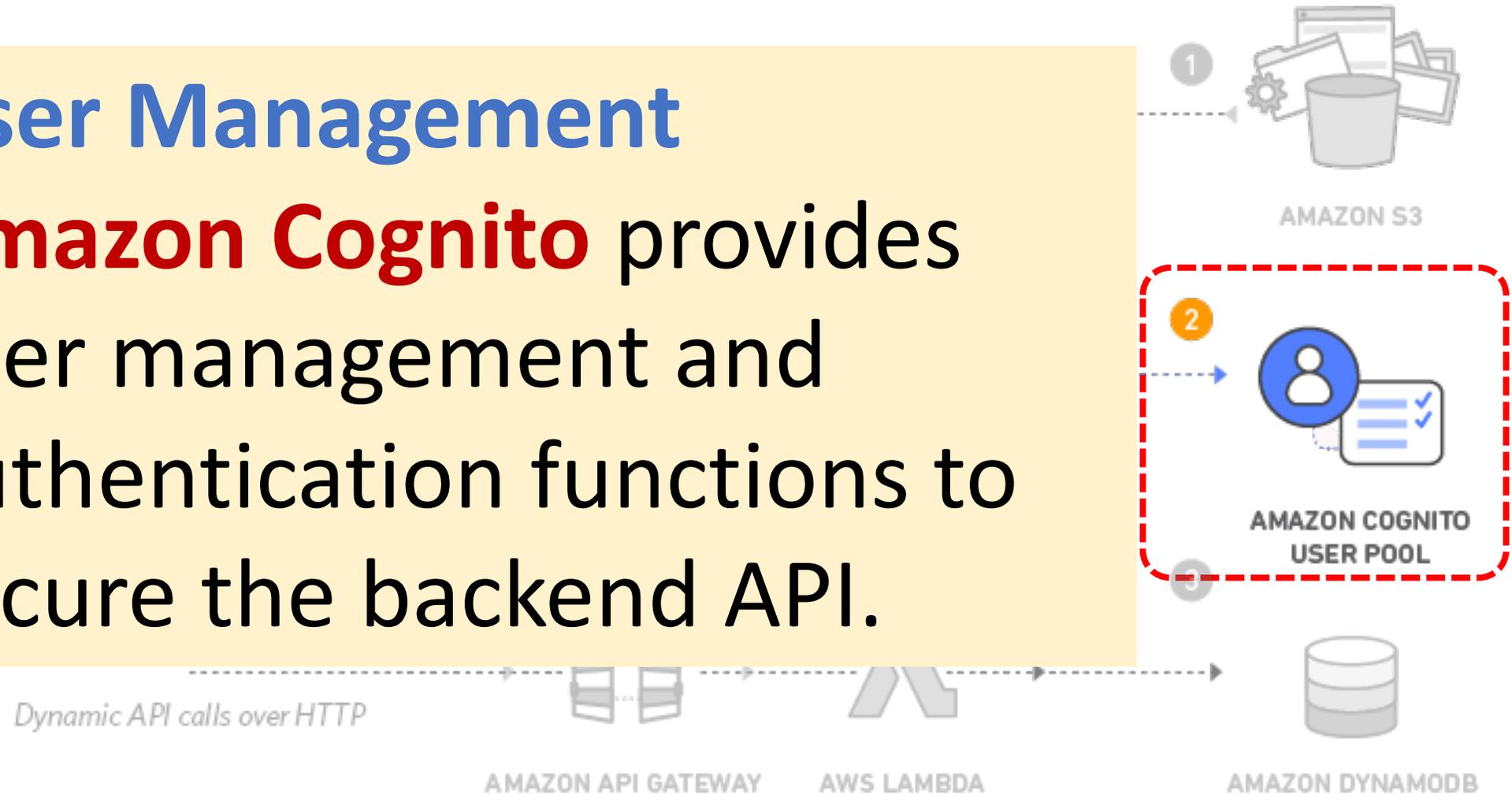
Build a Serverless Web Application

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





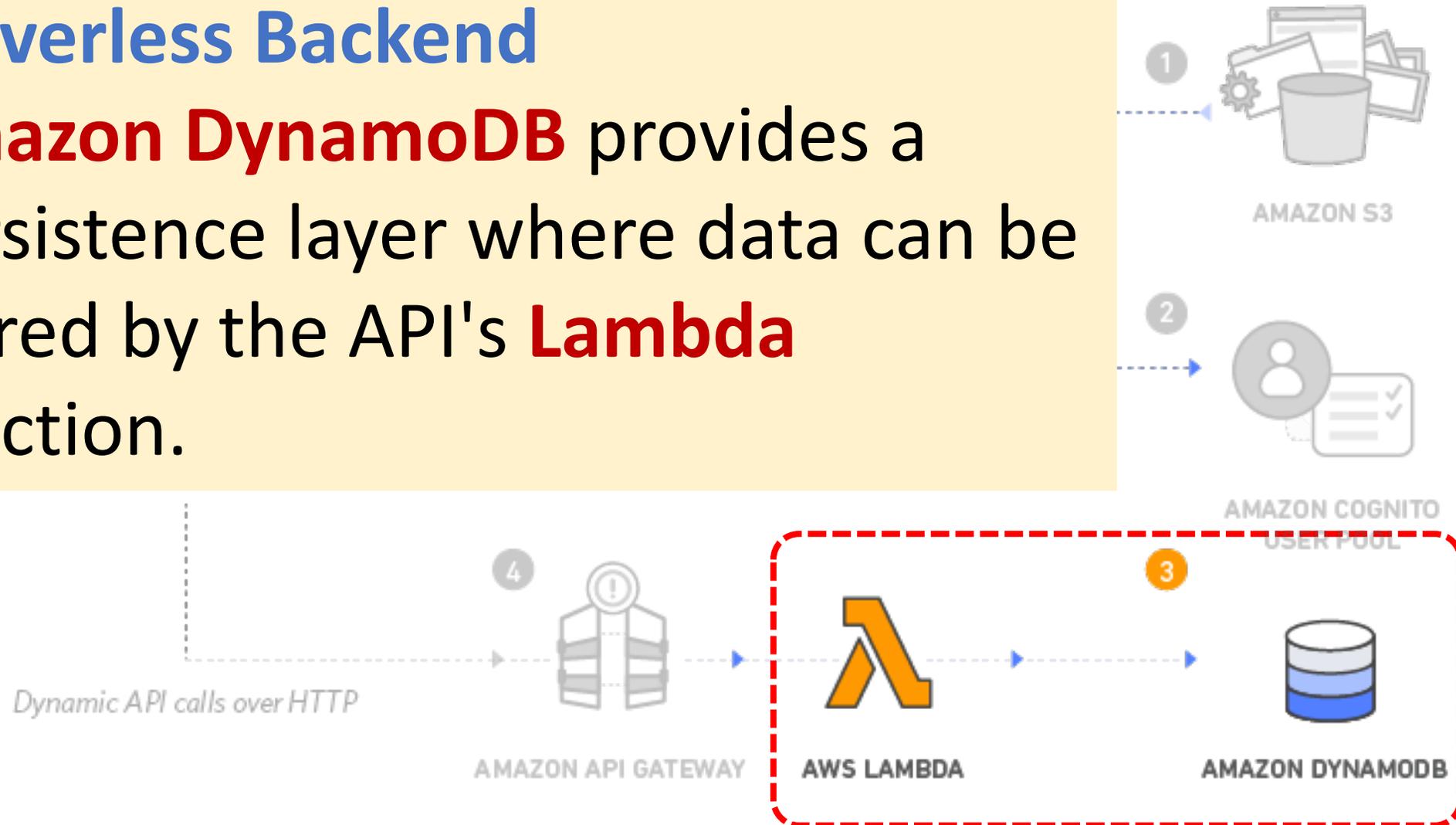
Build a Serverless Web Application

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.

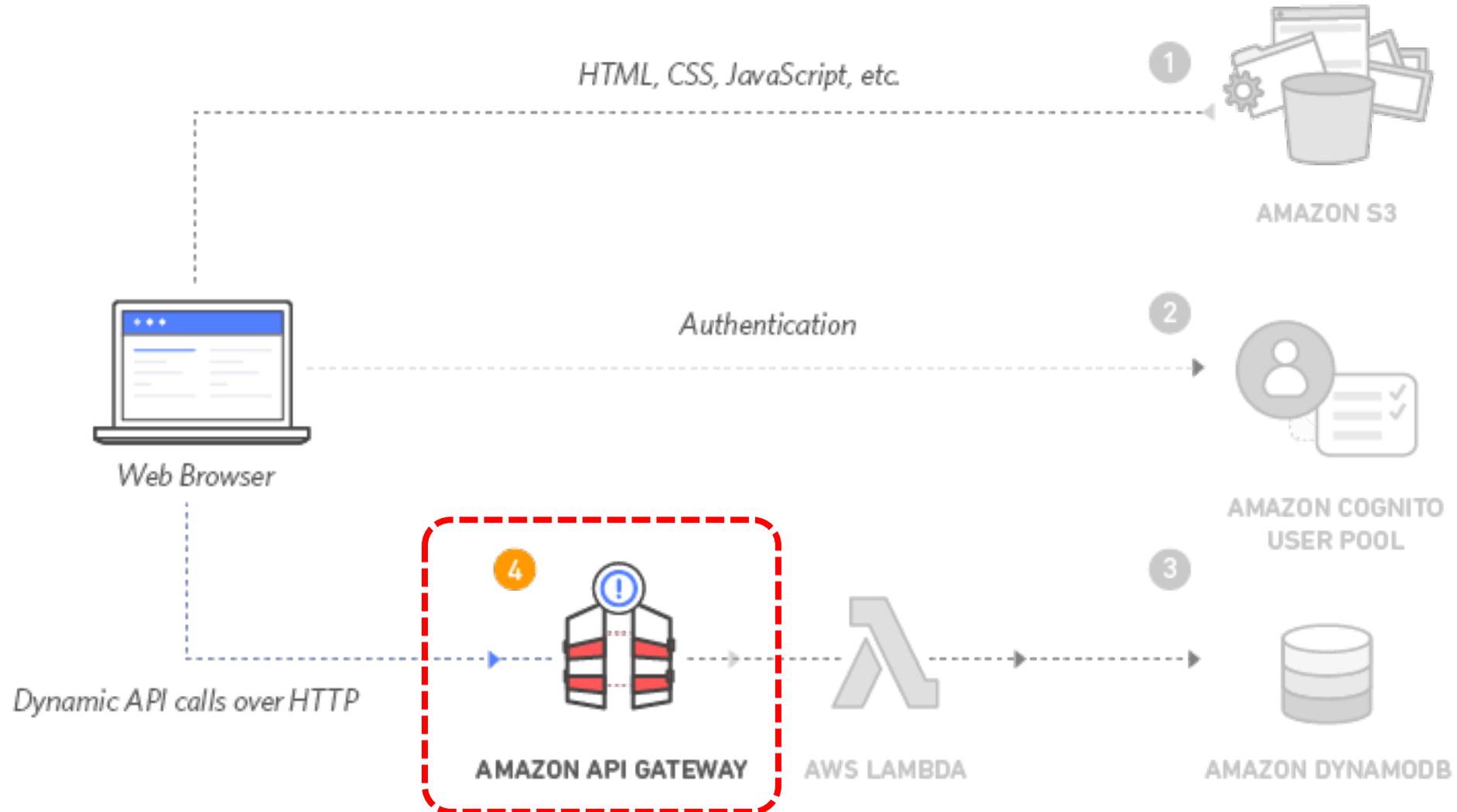




Build a Serverless Web Application

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

4





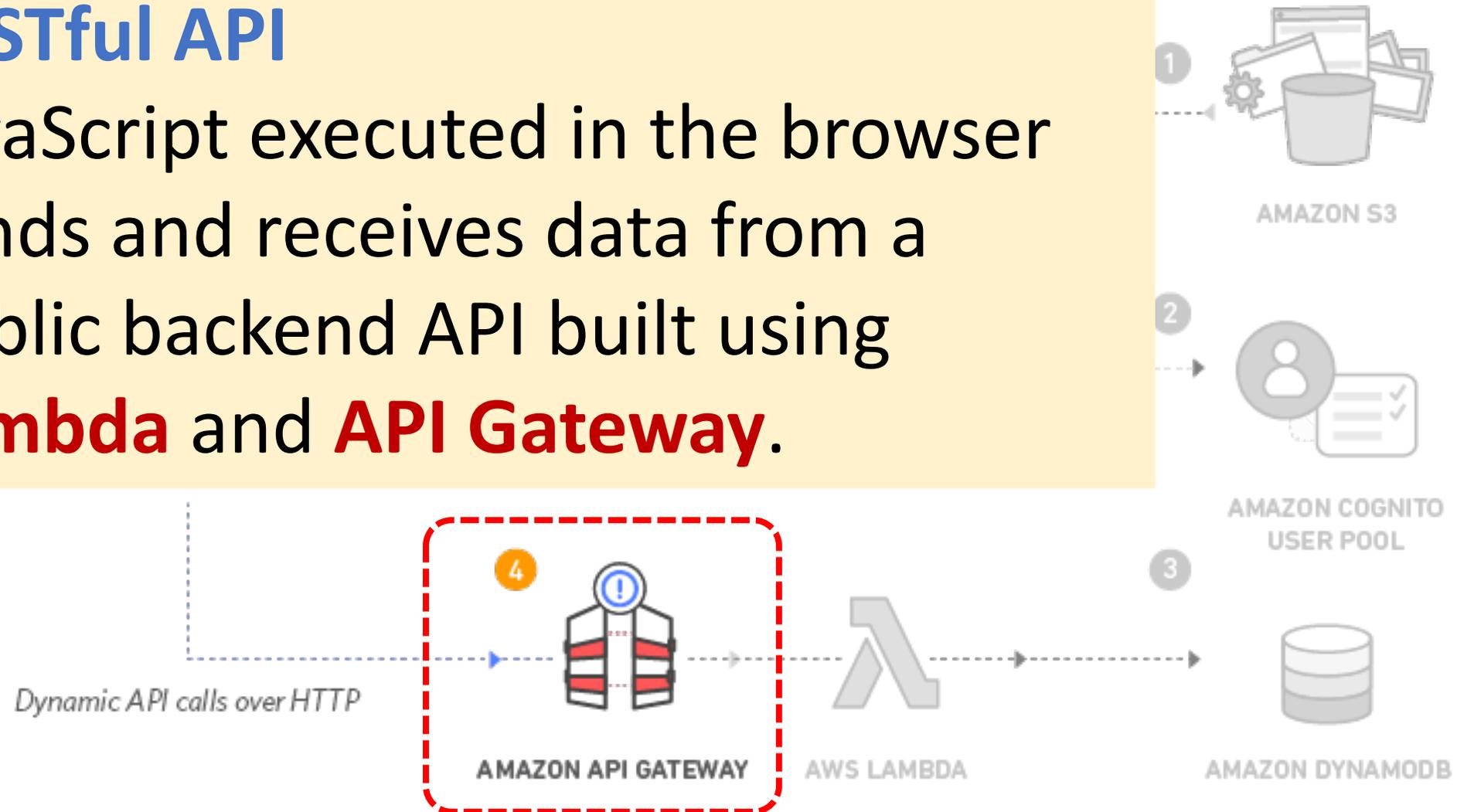
Build a Serverless Web Application

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**.





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.

Summary



1. Cloud Concepts Overview
2. Cloud Economics and Billing
3. AWS Global Infrastructure Overview
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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 2022)
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(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)
(1102) (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) (2022.02 - 2022.06)
(週三 Wed, 6, 7, 8, 14:10-17:00) (台北大學三峽校區 文3F10_L)



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

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<http://web.ntpu.edu.tw/~myday/teaching.htm#1102FBCC>

