Cloud Concepts Overview & AWS

AWS Academy Cloud Foundations

Overview

Topics

- Introduction to cloud computing
- Advantages of cloud computing
- Introduction to Amazon Web Services (AWS)
  - Compute
  - Security
  - Web Hosting
  - Data Base
  - Storage
- AWS Academy

Introduction to cloud computing

What is cloud computing?

Cloud computing defined

Cloud computing is the **on-demand** delivery of compute power, database, storage, applications, and other IT resources **via the internet** with **pay-as-you-go** pricing.

Infrastructure as software

Cloud computing enables you to **stop thinking of your infrastructure as hardware**, and instead **think of (and use) it as software.**

Traditional computing model

- Infrastructure as hardware
- Hardware solutions:
  - Require space, staff, physical security, planning, capital expenditure
  - Have a long hardware procurement cycle
  - Require you to provision capacity by guessing theoretical maximum peaks

Cloud computing model

- Infrastructure as software
- Software solutions:
  - Are flexible
  - Can change more quickly, easily, and cost-effectively than hardware solutions
  - Eliminate the undifferentiated heavy-lifting tasks

Cloud service models

Infrastructure as a service (IaaS)

- Customer has more flexibility over configuring networking and storage settings
- Customer is responsible for managing more aspects of the security
- Customer configures the access controls

Platform as a service (PaaS)

- Customer does not need to manage the underlying infrastructure
- AWS handles the operating system, database patching, firewall configuration, and disaster recovery
- Customer can focus on managing code or data

Software as a service (SaaS)

- Software is centrally hosted
- Licensed on a subscription model or pay-as-you-go basis.
- Services are typically accessed via web browser, mobile app, or APIs
- Customers do not need to manage the infrastructure that supports the service

More control over IT resources

Less control over IT resources

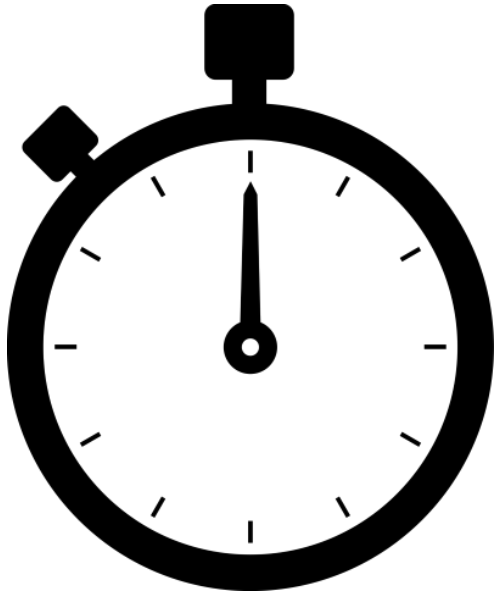
Key takeaways

- Cloud computing is the on-demand delivery of IT resources via the internet with pay-as-you-go pricing.
- Cloud computing enables you to think of (and use) your infrastructure as software.
- Almost anything you can implement with traditional IT can also be implemented as an AWS cloud computing service.
- There are three cloud service models: IaaS, PaaS, and SaaS.
- There are three cloud deployment models: cloud, hybrid, and on-premises or private cloud.

Advantages of cloud computing

Trade capital expense for variable expense

Data center investment based on forecast



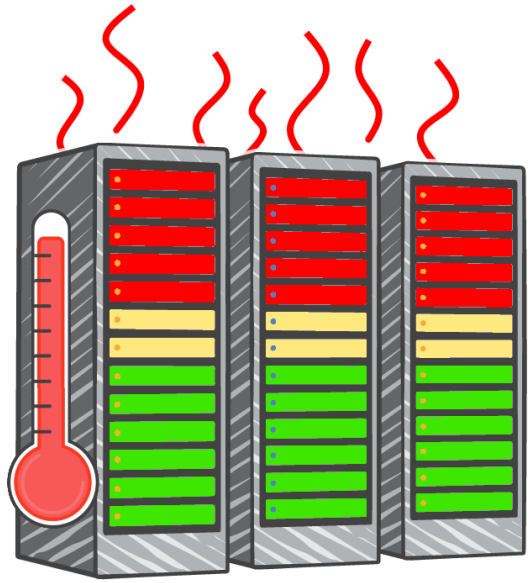
Pay only for the amount you consume

Massive economies of scale

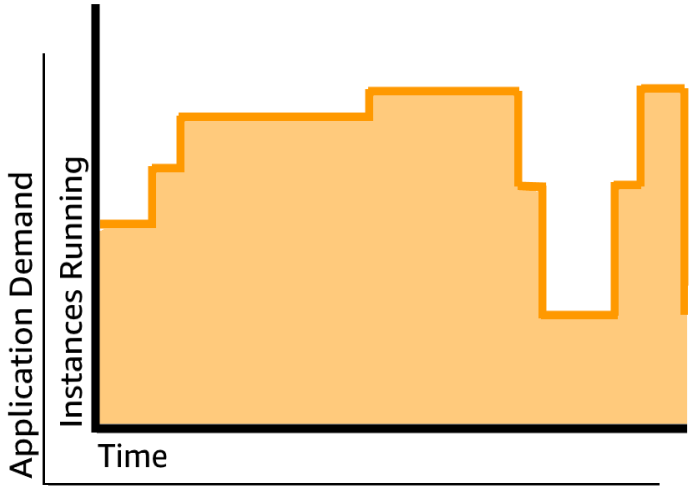
Because of aggregate usage from all customers, AWS can achieve higher economies of scale and pass savings on to customers.

Stop guessing capacity

Overestimated server capacity



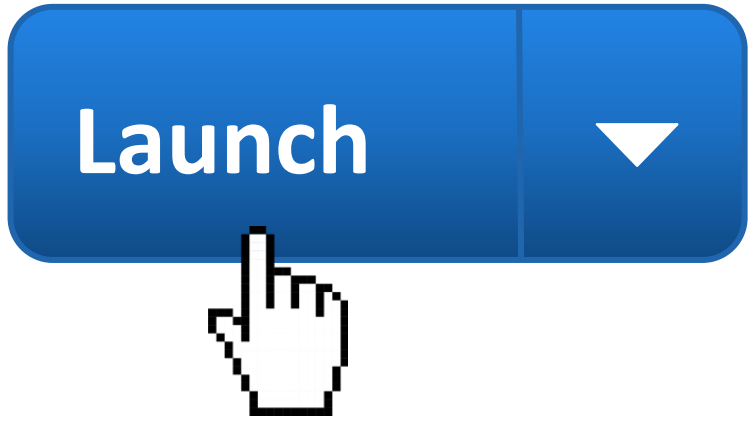
Underestimated server capacity



Scaling on demand

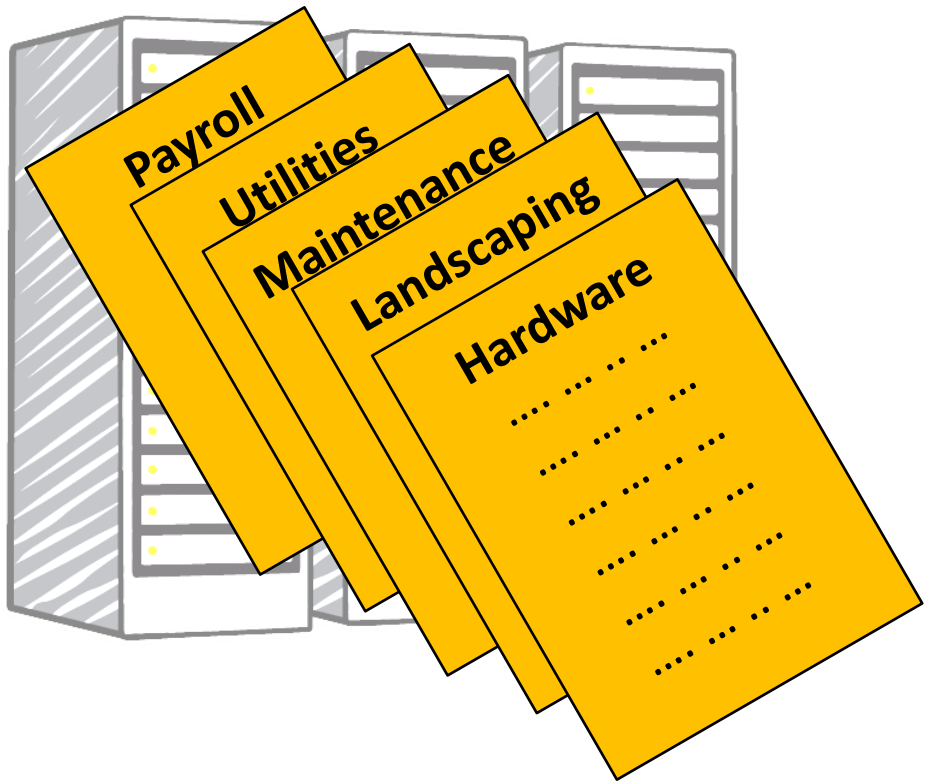
Increase speed and agility

Weeks between wanting resources and having resources

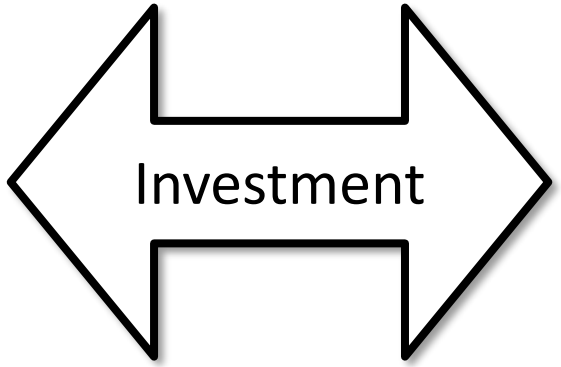


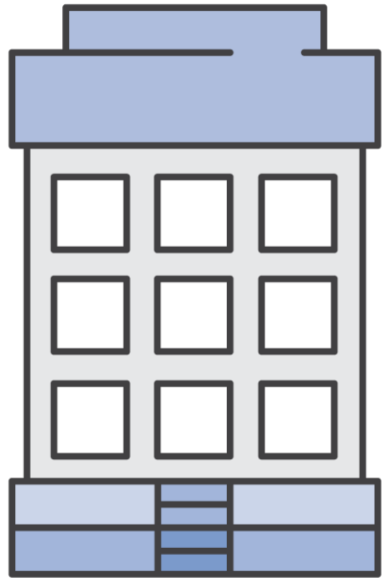
Minutes between wanting resources and having resources

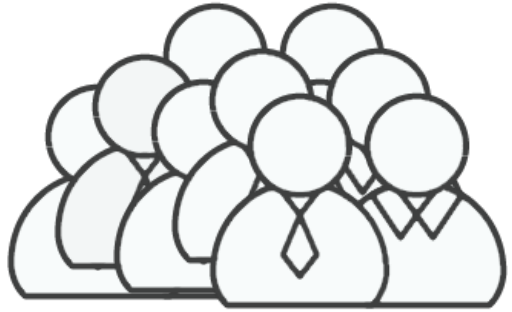
Stop spending money on running and maintaining data centers



Running data centers

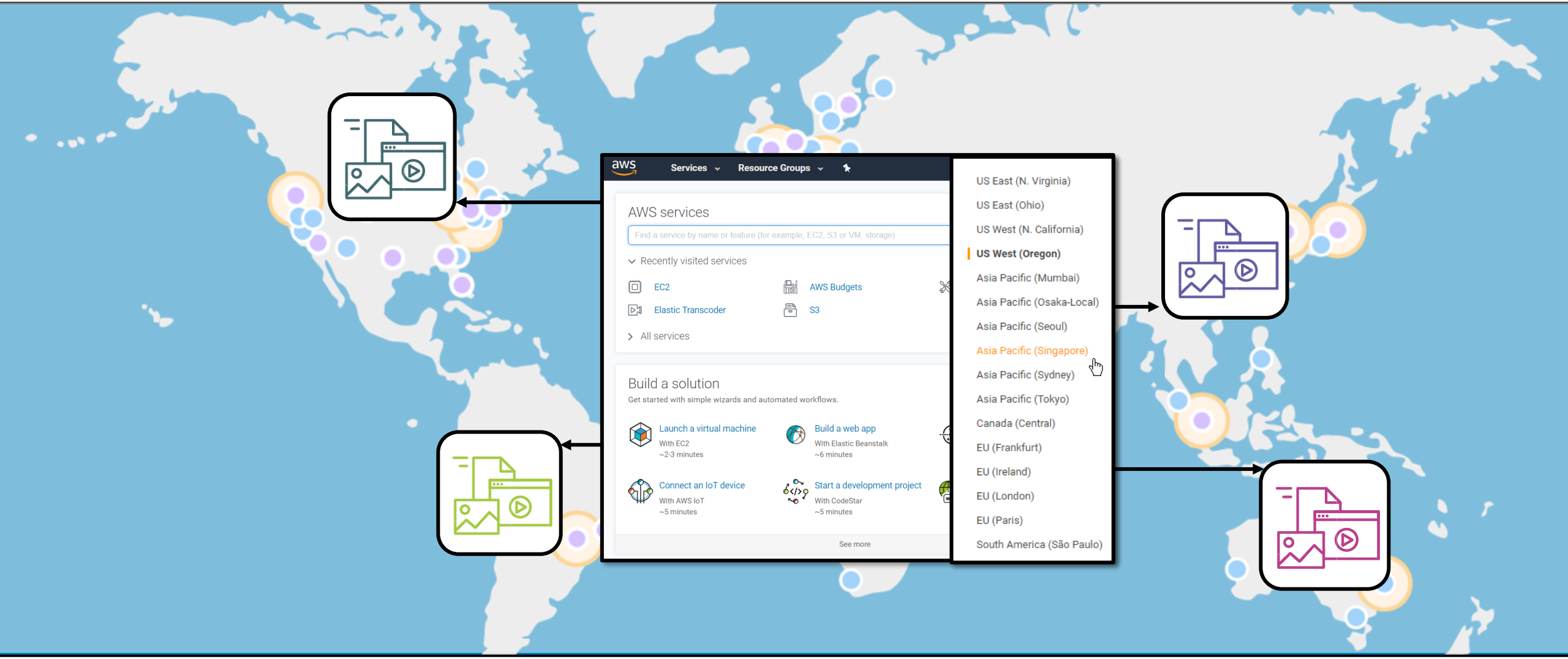






Business and customers

Go global in minutes



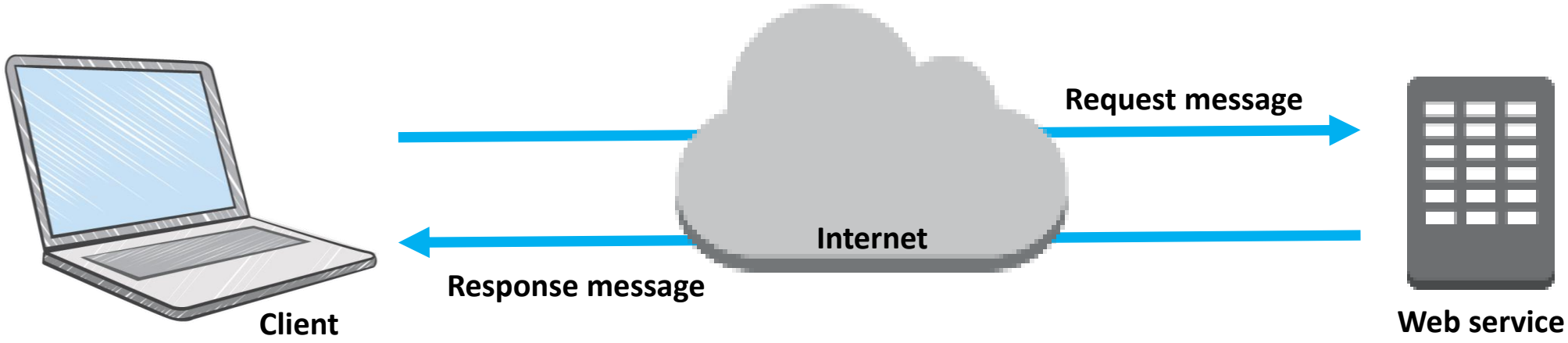
Key takeaways

- Trade capital expense for variable expense
- Benefit from massive economies of scale
- Stop guessing capacity
- Increase speed and agility
- Stop spending money on running and maintaining data centers
- Go global in minutes

Introduction to Amazon Web Services (AWS)

What are web services?

A **web service** is any piece of software that makes itself available over the internet and uses a **standardized format**—such as Extensible Markup Language (XML) or JavaScript Object Notation (JSON)—for the request and the response of an **application programming interface (API) interaction**.



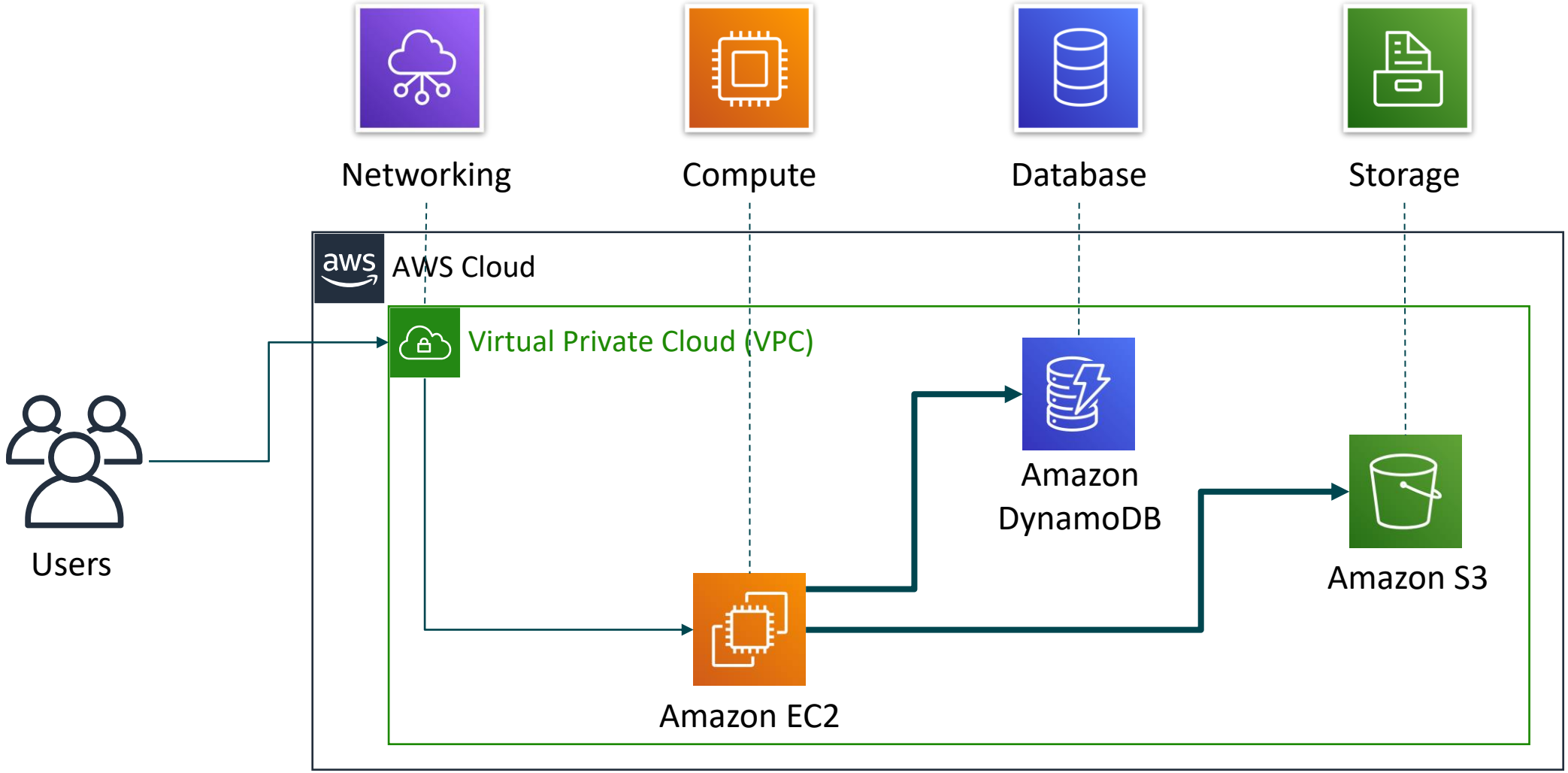
What is AWS?

- AWS is a **secure cloud platform** that offers a **broad set of global cloud-based products**.
- AWS provides you with **on-demand access** to compute, storage, network, database, and other IT resources and management tools.
- AWS offers **flexibility**.
- You **pay only for the individual services you need**, for **as long as you use them**.
- AWS services **work together** like building blocks.

Categories of AWS services

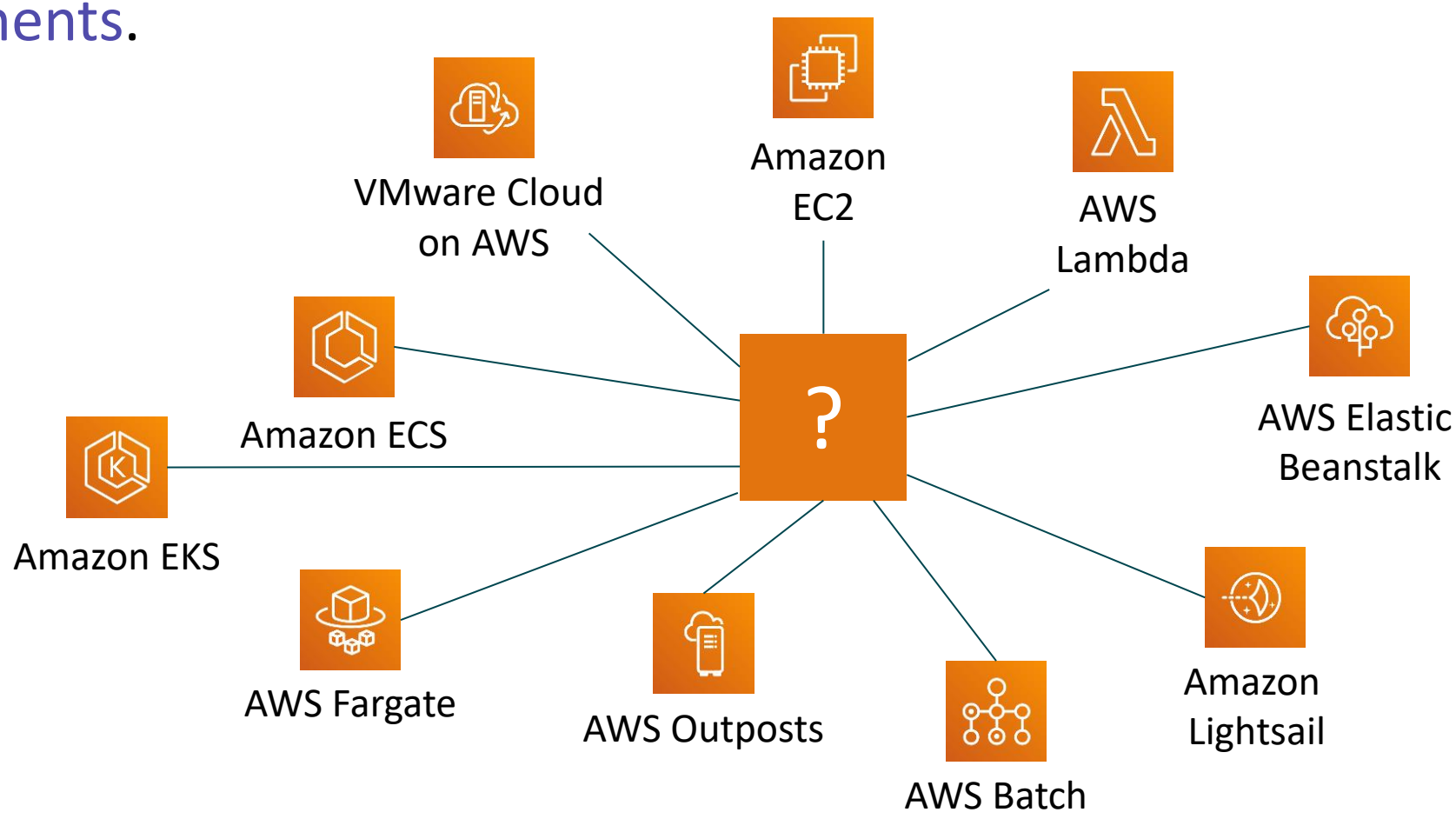
 Analytics	 Application integration	 Blockchain	 Business applications	 Cloud Financial Management	 Compute
 Customer enablement	 Containers	 Databases	 Developer tools	 End user computing	 Front-end web and mobile
 Game tech	 Internet of Things (IoT)	 Machine Learning (ML) and Artificial Intelligence (AI)	 Management and governance	 Media	 Migration and transfer
 Networking and content delivery	 Quantum technologies	 Robotics	 Satellite	 Security, identity, and compliance	 Storage

Simple solution example



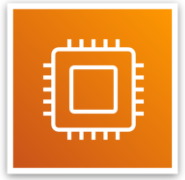
Choosing a service

The service you select depends on your business goals and technology requirements.



Sample Services

Compute services –



- Amazon EC2
- AWS Lambda
- AWS Elastic Beanstalk
- Amazon EC2 Auto Scaling
- Amazon ECS
- Amazon EKS
- Amazon ECR
- AWS Fargate

Security, Identity, and Compliance services –

- AWS IAM
- Amazon Cognito
- AWS Shield
- AWS Artifact
- AWS KMS

Storage services –

- Amazon S3
- Amazon S3 Glacier
- Amazon EFS
- Amazon EBS

Database services –

- Amazon RDS
- Amazon DynamoDB
- Amazon Redshift
- Amazon Aurora

From End Web & Mobile –

- AWS Amplify
- AWS AppSync
- AWS Device Farm
- Amazon Location Service

Management and Governance services –

- AWS Trusted Advisor
- AWS CloudWatch
- AWS CloudTrail
- AWS Well-Architected Tool
- AWS Auto Scaling
- AWS Command Line Interface
- AWS Config
- AWS Management Console
- AWS Organizations

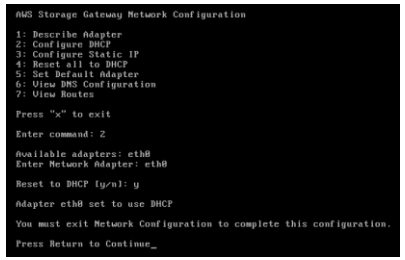
AWS Cost Management services –

- AWS Cost & Usage Report
- AWS Budgets
- AWS Cost Explorer

Three ways to interact with AWS

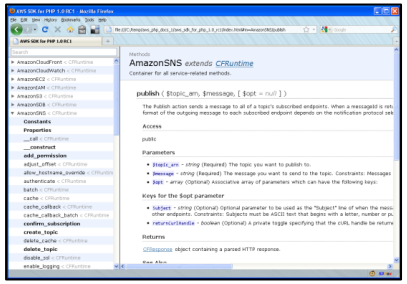
AWS Management Console

Easy-to-use graphical interface



Command Line Interface (AWS CLI)

Access to services by discrete commands or scripts



Software Development Kits (SDKs)

Access services directly from your code (such as Java, Python, and others)

Compute services overview

Focus & Demo - **AWS Lambda**

Categorizing compute services

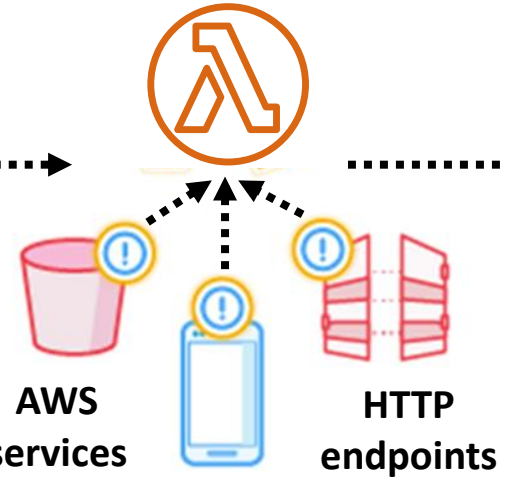
Services	Key Concepts	Characteristics	Ease of Use
• Amazon EC2	• Infrastructure as a service (IaaS) • Instance-based • **Virtual machines**	• Provision virtual machines that you can manage as you choose	A familiar concept to many IT professionals.
• AWS Lambda	• **Serverless** computing • Function-based • Low-cost	• Write and deploy code that runs on a schedule or that can be triggered by events	A relatively new concept for many IT staff members, but easy to use after you learn how.
• Amazon ECS • Amazon EKS • AWS Fargate • Amazon ECR	• **Container-based** computing • Instance-based	• Spin up and run jobs more quickly	AWS Fargate reduces administrative overhead, but you can use options that give you more control.
• AWS Elastic Beanstalk	• Platform as a service (PaaS) • For **web applications**	• Focus on your code (building your application) • Can easily tie into other services—databases, Domain Name System (DNS), etc.	Fast and easy to get started.

AWS Lambda: Run code without servers

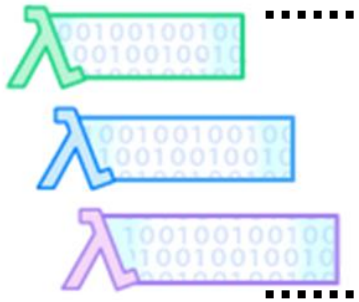
AWS Lambda is a **serverless** compute service.

Upload your code

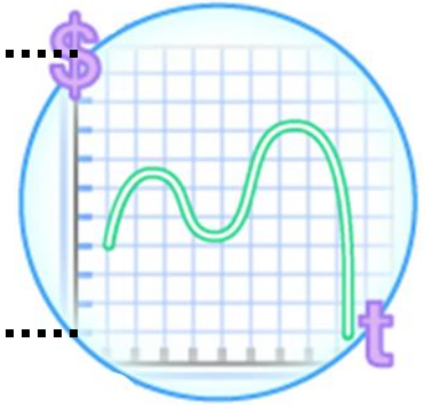
The code you run
is a **Lambda function**



Run your code on a ***schedule***
or in response to ***events***



Your code
runs only when it is
triggered



Pay only for the
compute time that
you use

Benefits of Lambda

AWS Lambda

- It supports multiple programming languages
- Completely automated administration
- Built-in fault tolerance
- It supports the orchestration of multiple functions
- Pay-per-use pricing

AWS Lambda event sources

Event sources

- Amazon S3
- Amazon DynamoDB
- Amazon Simple Notification Service (Amazon SNS)
- Amazon Simple Queue Service (Amazon SQS)
- Amazon API Gateway
- Application Load Balancer

Many more…

Configure other AWS services as **event sources** to invoke your function as shown here.

Alternatively, invoke a Lambda function from the Lambda console, AWS SDK, or AWS CLI.

Lambda function

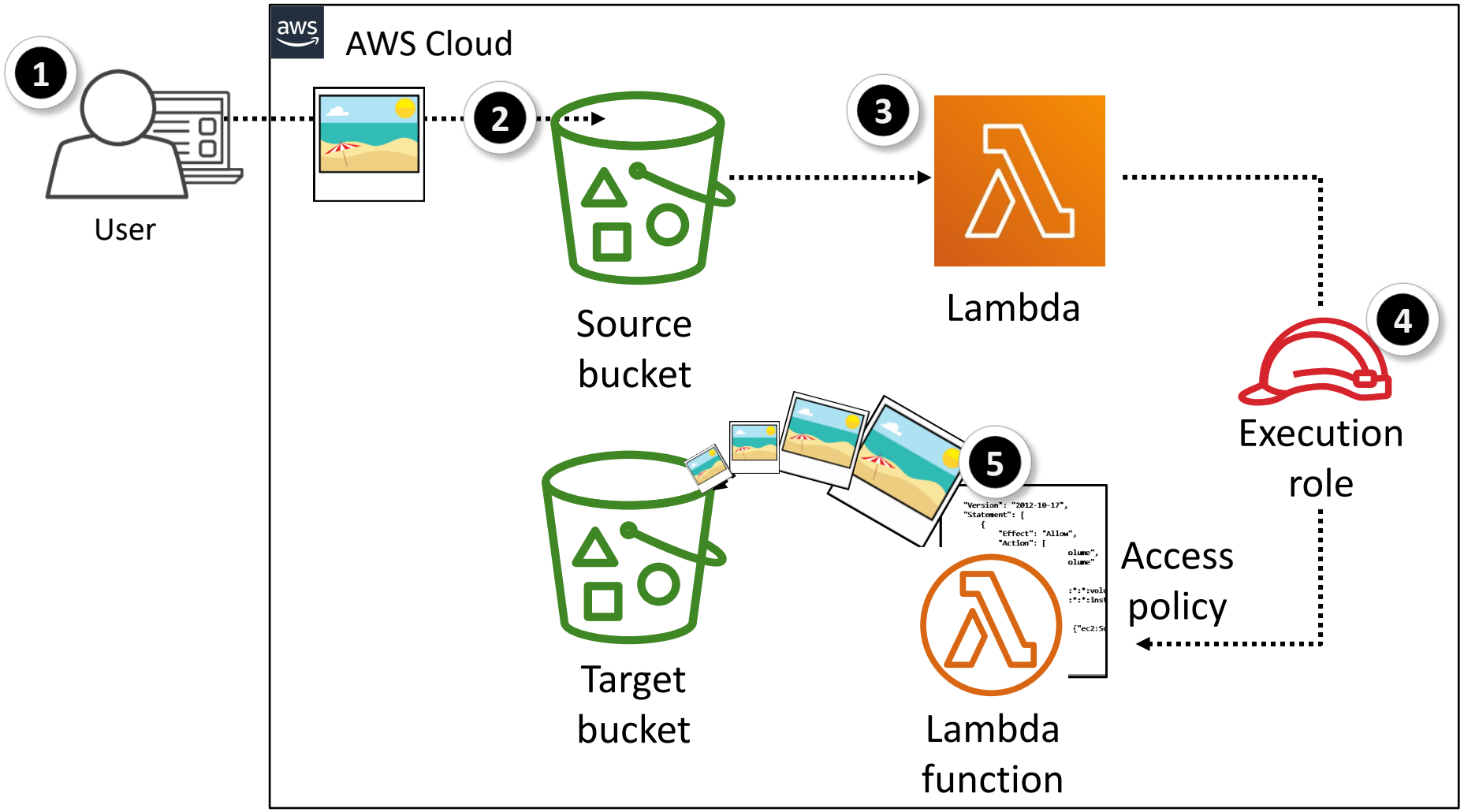
AWS Lambda

Running of your code (only when triggered)

Logging, monitoring, and metrics

Amazon CloudWatch

Event-based Lambda function example: Create thumbnail images



AWS Lambda quotas

Soft limits per Region:

- Concurrent executions = 1,000
- Function and layer storage = 75 GB

Hard limits for individual functions:

- Maximum function memory allocation = 10,240 MB
- Function timeout = 15 minutes
- Deployment package size = 250 MB unzipped, including layers
- Container image code package size = 10 GB

Additional limits also exist. Details are in the AWS Lambda quotas documentation at https://docs.aws.amazon.com/lambda/latest/dg/gettingstarted-limits.html.

AWS Lambda key takeaways

- **Serverless computing** enables you to build and run applications and services without provisioning or managing servers.
- **AWS Lambda is a serverless compute service** that provides built-in fault tolerance and automatic scaling.
- An **event source** is an AWS service or developer-created application that triggers a Lambda function to run.
- The maximum memory allocation for a single Lambda function is 10,240 MB.
- The maximum run time for a Lambda function is 15 minutes.

Security, Identity, and Compliance services overview

Focus & Demo - **Amazon Cognito**

Categorizing Security, Identity, and Compliance Services

Services	Key Concepts	Characteristics	Ease of Use
• AWS Identity and Access Management (IAM)	• **Identity and Access Control** • Fine-grained permissions	• Manage user access and encryption keys • Role-based access for AWS resources	Standard for cloud access control; widely used and well-documented
• Amazon Cognito	• **Serverless** User **Authentication & Authorization** • Identity Federation	• Manages user sign-up, sign-in, and access control • Supports social identity providers (Google, Facebook, etc.)	Easy to integrate with apps; scalable and secure
• AWS Key Management Service (KMS)	• Encryption and **Key Management**	• Create, manage, and control encryption keys • Integrates with many AWS services	Simple interface for managing encryption keys
• AWS Config	• Configuration Management and **Compliance**	• Monitors AWS resource configurations • Ensures compliance with rules	Provides built-in rules and compliance checks

Amazon Cognito

Amazon Cognito features:

- **Adds user sign-up, sign-in, and access control to your web and mobile applications**.
- Scales to millions of users.
- Supports sign-in with social identity providers, such as Facebook, Google, and Amazon; and enterprise identity providers, such as Microsoft Active Directory via Security Assertion Markup Language (SAML) 2.0.

Amazon Cognito

Amazon Database services Overview

Focus & Demo - **Amazon DynamoDB**

Relational versus non-relational databases

<table>
<tr><th></th><th>Relational (SQL)</th><th>Non-Relational</th></tr>
<tr><td>Data Storage</td><td>Rows and columns</td><td>Key-value, document, graph</td></tr>
<tr><td>Schemas</td><td>Fixed</td><td>Dynamic</td></tr>
<tr><td>Querying</td><td>Uses SQL</td><td>Focuses on collection of documents</td></tr>
<tr><td>Scalability</td><td>Vertical (Scale Up)</td><td>Horizontal (Scale Out)</td></tr>
<tr><td>Example</td><td>
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</table>

Categorizing AWS Database Services

Services	Key Concepts	Characteristics	Ease of Use
• Amazon RDS	• Relational Database (SQL) Managed Service (IaaS)	• Supports MySQL, PostgreSQL, Oracle, SQL Server, MariaDB • Automated backups, scaling, and patching	Familiar SQL database with managed operations
• Amazon Aurora	• High-Performance Relational Database • MySQL/PostgreSQL Compatible	• **Serverless** scaling with Aurora Serverless • High availability and durability	Easy to migrate from MySQL/PostgreSQL; automated scaling
• Amazon DynamoDB	• **NoSQL** (Key-Value, Document) Serverless	• **Serverless,** fully managed, automatic scaling • Microsecond latency	Simple API-driven access, no server management needed
• Amazon ElastiCache	• In-memory Data Store **Caching** (Redis, Memcached)	• Sub-millisecond latency for caching Improves app performance	Easy to integrate as a caching layer

What is Amazon DynamoDB?

Fast and flexible NoSQL database service for any scale

Amazon DynamoDB

- NoSQL database tables
- Virtually unlimited storage
- Items can have differing attributes
- Low-latency queries
- Scalable read/write throughput

DynamoDB Key takeaways

Amazon DynamoDB:

- Runs exclusively on SSDs.
- Supports document and key-value store models.
- Replicates your tables automatically across your choice of AWS Regions.
- Works well for mobile, web, gaming, adtech, and Internet of Things (IoT) applications.
- Is accessible via the console, the AWS CLI, and API calls.
- Provides consistent, single-digit millisecond latency at any scale.
- Has no limits on table size or throughput.

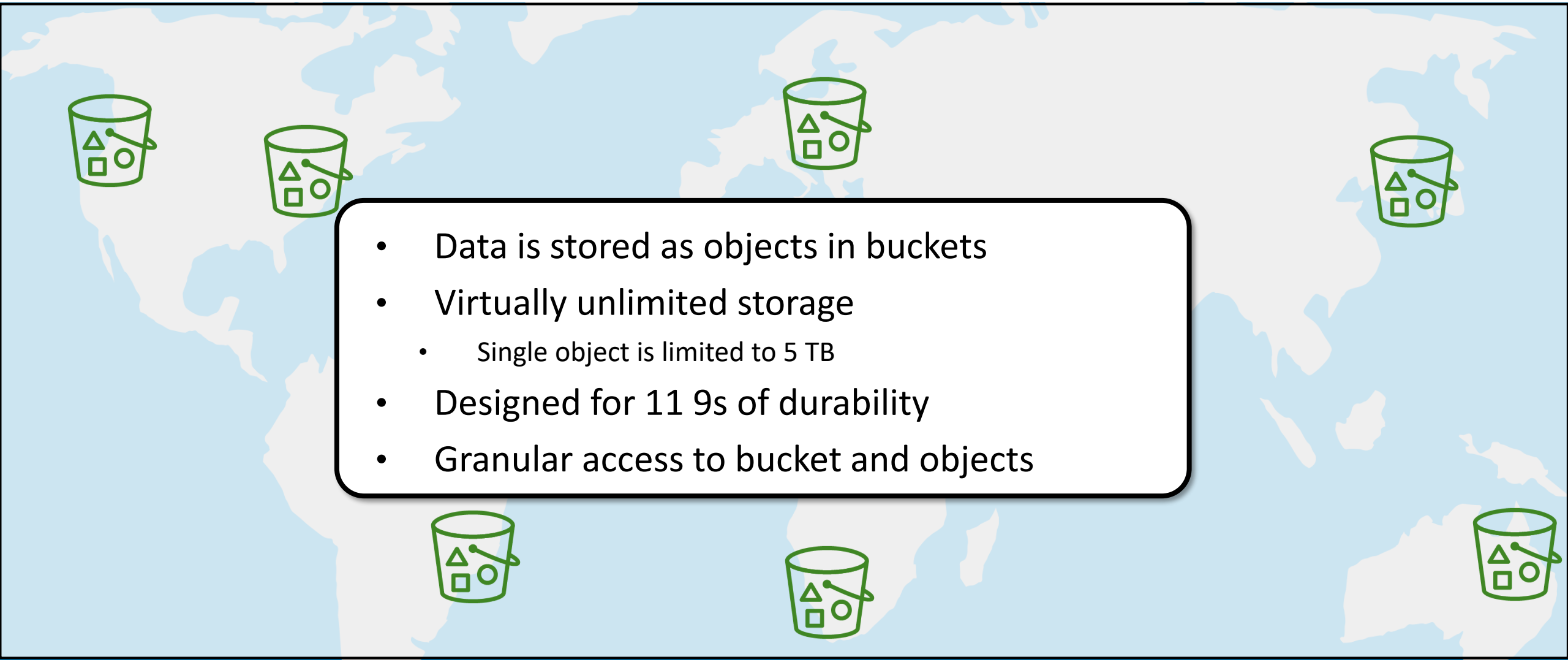
Amazon Storage services Overview

Focus & Demo – **Simple Storage Service (S3)**

Categorizing Storage Services

Services	Key Concepts	Characteristics	Ease of Use
• Amazon S3 (Simple Storage Service)	• **Serverless** Object Storage • Highly Scalable & Durable	• Stores unstructured data as objects (files) • Designed for scalability and high availability	Easy to use via AWS Console, SDK, or CLI
• Amazon EBS (Elastic Block Store)	• Block Storage • **Persistent** Storage for EC2	• High-performance storage volumes for EC2 • Supports SSD (gp3, io2) and HDD (st1, sc1)	Simple to attach/detach with EC2 instances
• Amazon EFS (Elastic File System)	• File Storage • Managed NFS for **Linux-based** workloads	• Scalable and elastic file storage • Accessible by multiple EC2 instances	Managed file system; seamless scaling
• Amazon S3 Glacier & Glacier Deep Archive	• **Archival** Object Storage • Low-Cost Long-Term Storage	• Designed for cold storage and backups • Retrieval times vary (minutes to hours)	Simple tiering from S3; cost-effective for archival needs

Amazon S3 overview



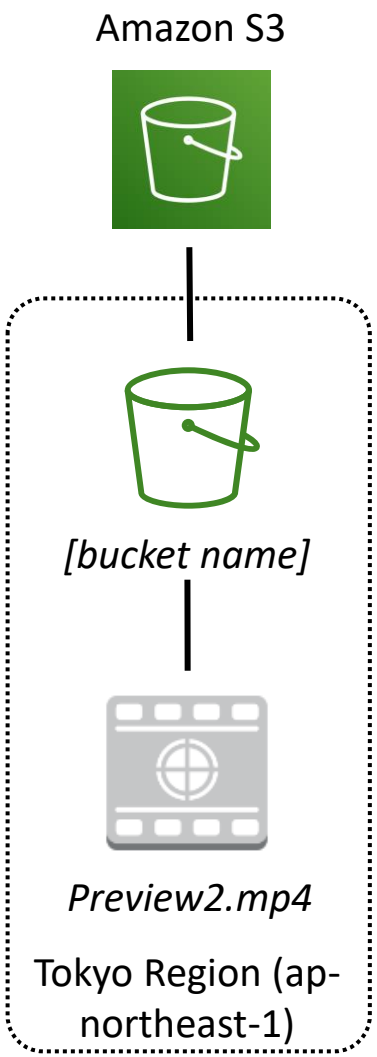
- Data is stored as objects in buckets
- Virtually unlimited storage
  - Single object is limited to 5 TB
- Designed for 11 9s of durability
- Granular access to bucket and objects

Amazon S3 storage classes

Amazon S3 offers a range of object-level storage classes that are designed for different use cases:

- Amazon S3 Standard
- Amazon S3 Intelligent-Tiering
- Amazon S3 Standard-Infrequent Access (Amazon S3 Standard-IA)
- Amazon S3 One Zone-Infrequent Access (Amazon S3 One Zone-IA)
- Amazon S3 Glacier
- Amazon S3 Glacier Deep Archive

Amazon S3 bucket URLs (two styles)



To upload your data:

1. Create a **bucket** in an AWS Region.
2. Upload almost any number of **objects** to the bucket.

Bucket path-style URL endpoint:

https://s3.ap-northeast-1.amazonaws.com/bucket-name

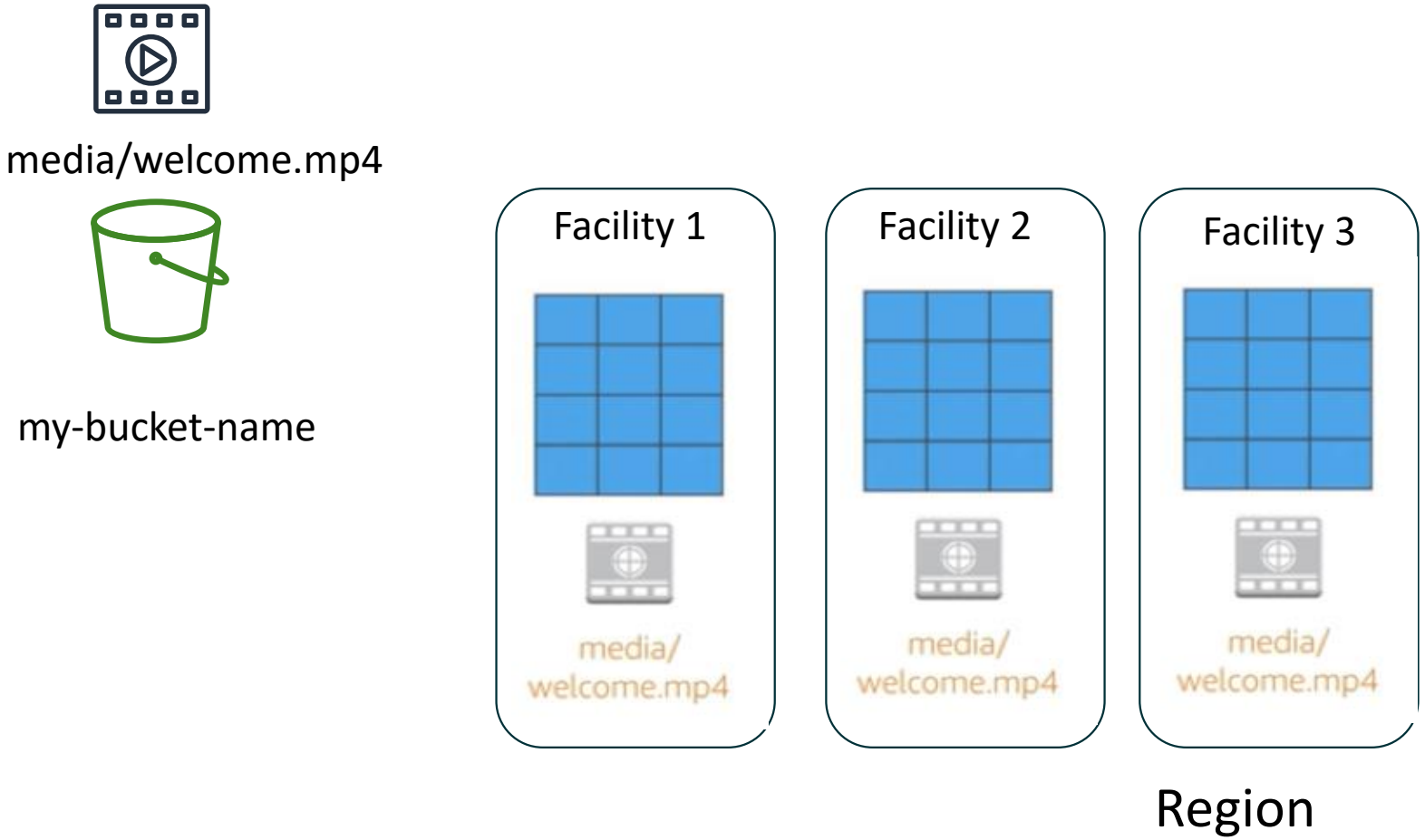
Region code — Bucket name

Bucket virtual hosted-style URL endpoint:

https:// bucket-name.s3-ap-northeast-1.amazonaws.com

Bucket name — Region code

Data is redundantly stored in the Region



Designed for seamless scaling

my-bucket-name

media/welcome.mp4

prod2.mp4

prod3.mp4

prod4.mp4

prod5.mp4

prod6.mp4

prod7.mp4

prod8.mp4

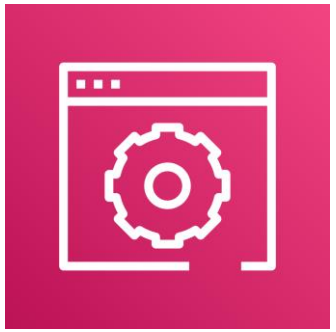
prod9.mp4

prod10.mp4

prod11.mp4

prod12.mp4

Access the data anywhere



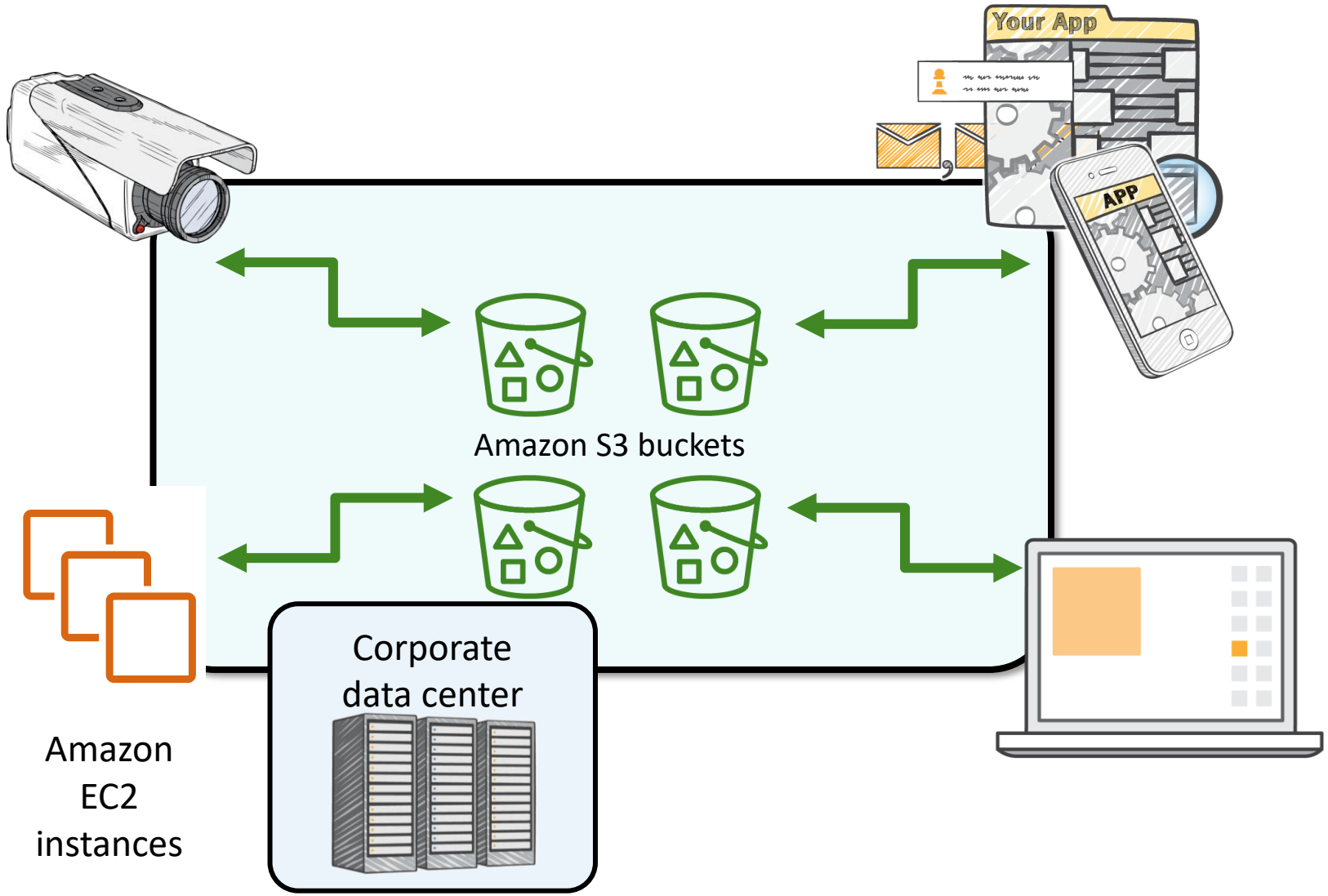
AWS Management Console

AWS Command Line Interface

SDK

Amazon S3 common scenarios

- Backup and storage
- Application hosting
- Media hosting
- Software delivery



S3 key takeaways

- Amazon S3 is a fully managed cloud storage service.
- You can store a virtually unlimited number of objects.
- You pay for only what you use.
- You can access Amazon S3 at any time from anywhere through a URL.
- Amazon S3 offers rich security controls.

AWS Academy

AWS Academy

AWS Academy provides higher education institutions with a **free**, **ready-to-teach cloud computing curriculum** that prepares students to pursue industry-recognized certifications and in-demand cloud jobs.

Getting started

- Educator user (IT FP: Lior Cohen)
- AWS Academy
- Getting started webinars

Courses/Labs You Can Teach

- **Cloud Foundations**
- Cloud Architecting
- Cloud Operations
- Cloud Developing
- Machine Learning Foundations
- Machine Learning for Natural Language Processing
- Engineering Operations Technician
- Data Center Technician
- Cloud Security Foundations
- Data Engineering

- Learner Lab
- Lab Project - Cloud Data Pipeline Builder
- Lab Project - Cloud Web Application Builder
- Lab Project - Cloud Security Builder
- Lab Project - Microservices and CI/CD Pipeline Builder

Thank you

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