



Week 8:

Module 1: Cloud Concepts Overview

Module 3: AWS Global Infrastructure Overview

AWS Academy Cloud Foundations

Module overview

Topics

- Introduction to cloud computing
- Introduction to Amazon Web Services (AWS)
- AWS Global Infrastructure
- AWS Services and Categories



Knowledge check

Section 1: Introduction to cloud computing

Module 1: Cloud Concepts Overview

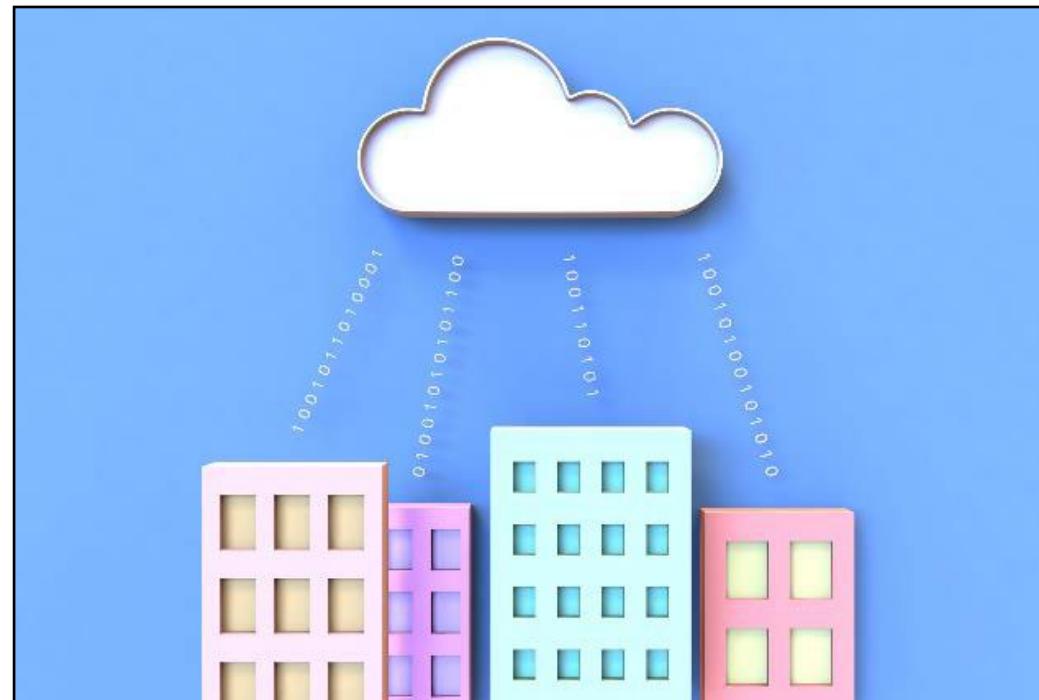


What is cloud computing?



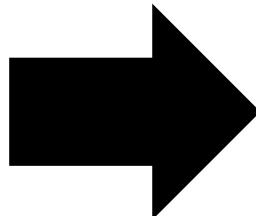
Cloud computing defined

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**.

A grid of binary code (0s and 1s) arranged in a grid pattern. The grid is composed of several columns and rows of binary digits, representing data or code. The background of the grid is dark blue.

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



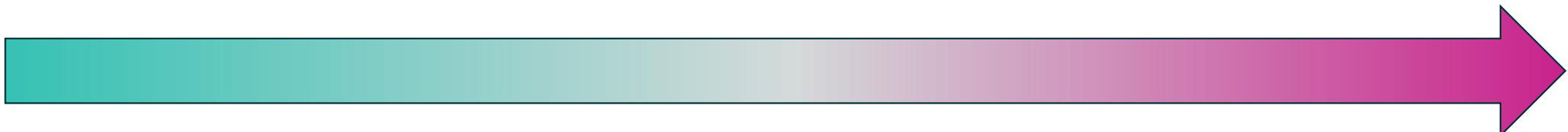
- Infrastructure as software
- Software solutions:
 - Are flexible
 - Can change more quickly, easily, and cost-effectively than hardware solutions
 - Eliminate the undifferentiated heavy-lifting tasks

Cloud service models

IaaS
(infrastructure as a service)

PaaS
(platform as a service)

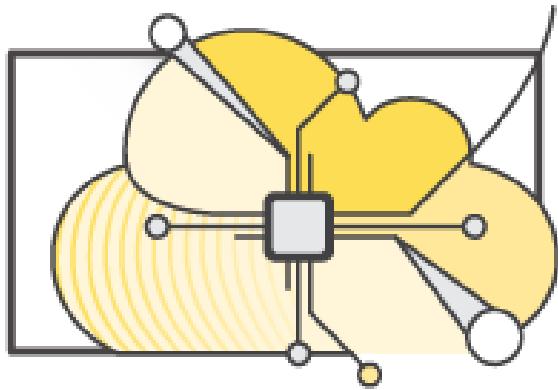
SaaS
(software as a service)



More control
over IT resources

Less control
over IT resources

Cloud computing deployment models



Cloud

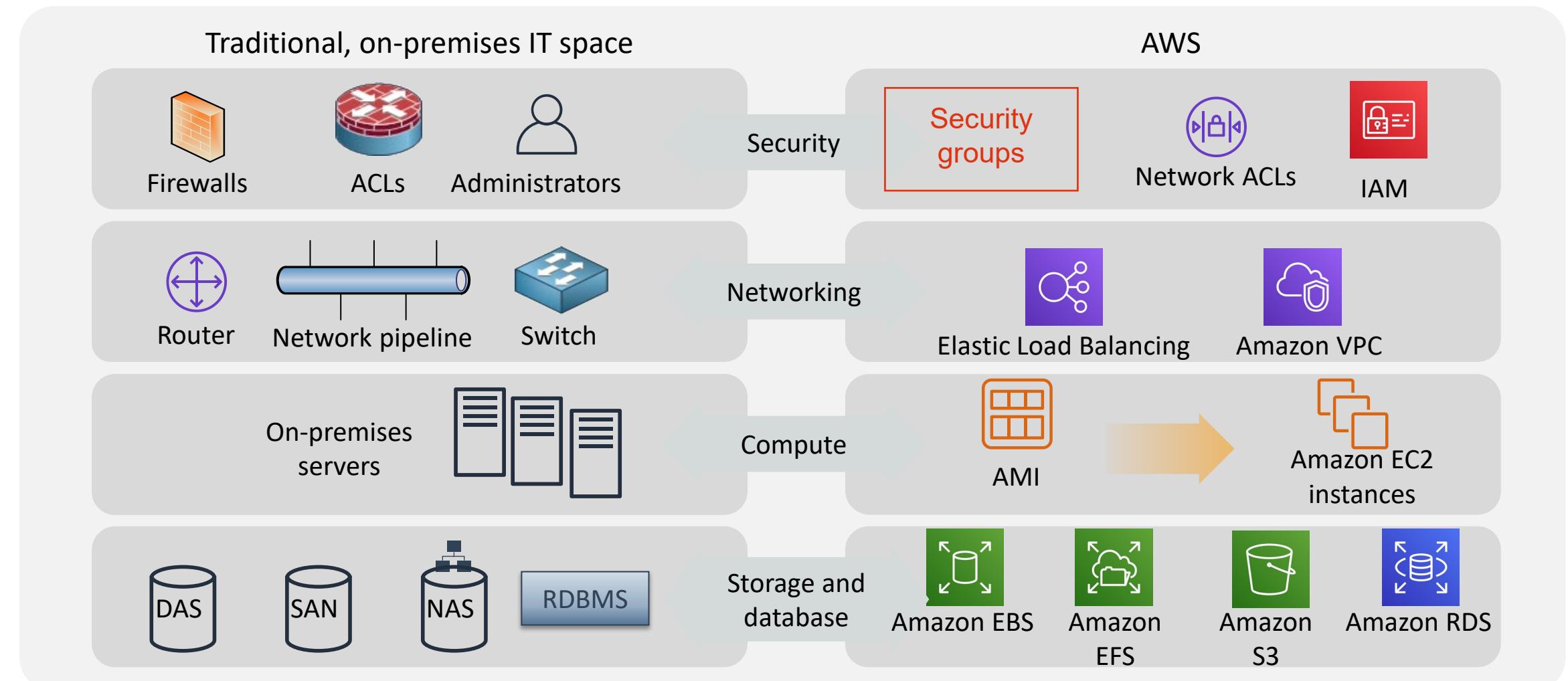


Hybrid



On-premises
(private cloud)

Similarities between AWS and traditional IT



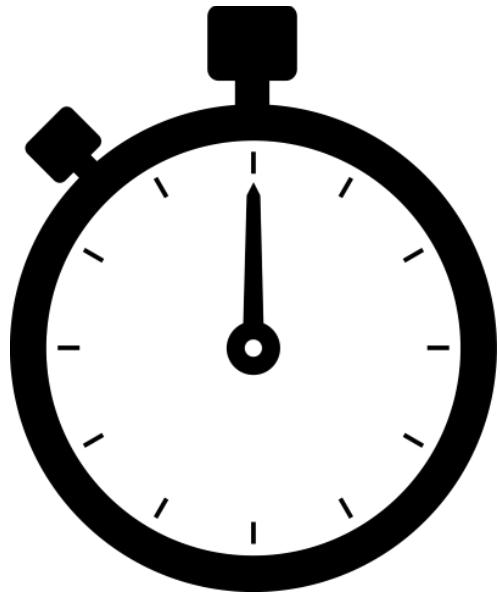
Advantages of Cloud Computing

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

Trade capital expense for variable expense



Data center investment
based on forecast



Pay only for the amount
you consume

Massive economies of scale

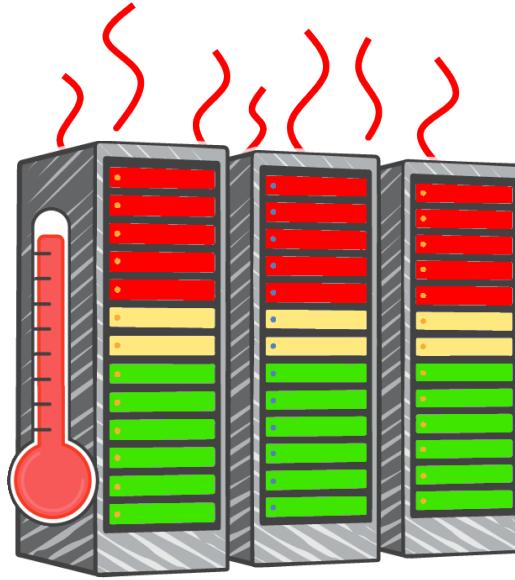
Because of aggregate usage from all customers, AWS can achieve higher economies of scale and pass savings on to customers.



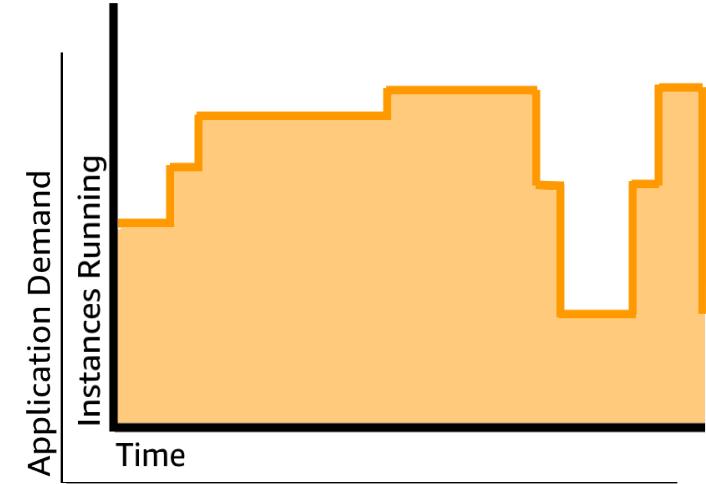
Stop guessing capacity



Overestimated
server capacity



Underestimated
server capacity

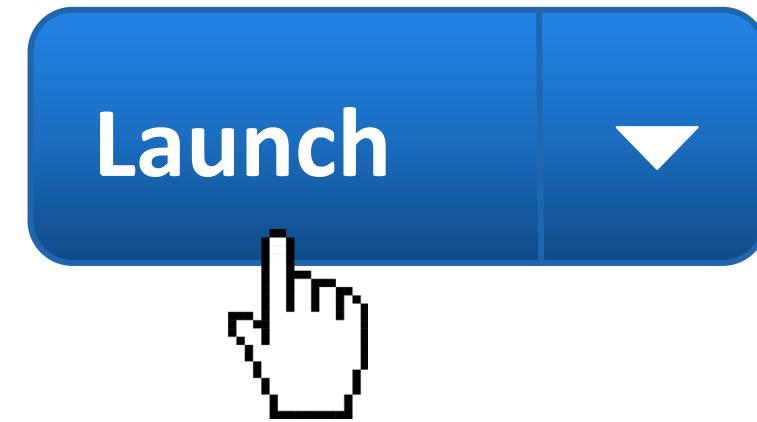


Scaling on demand

Increase speed and agility

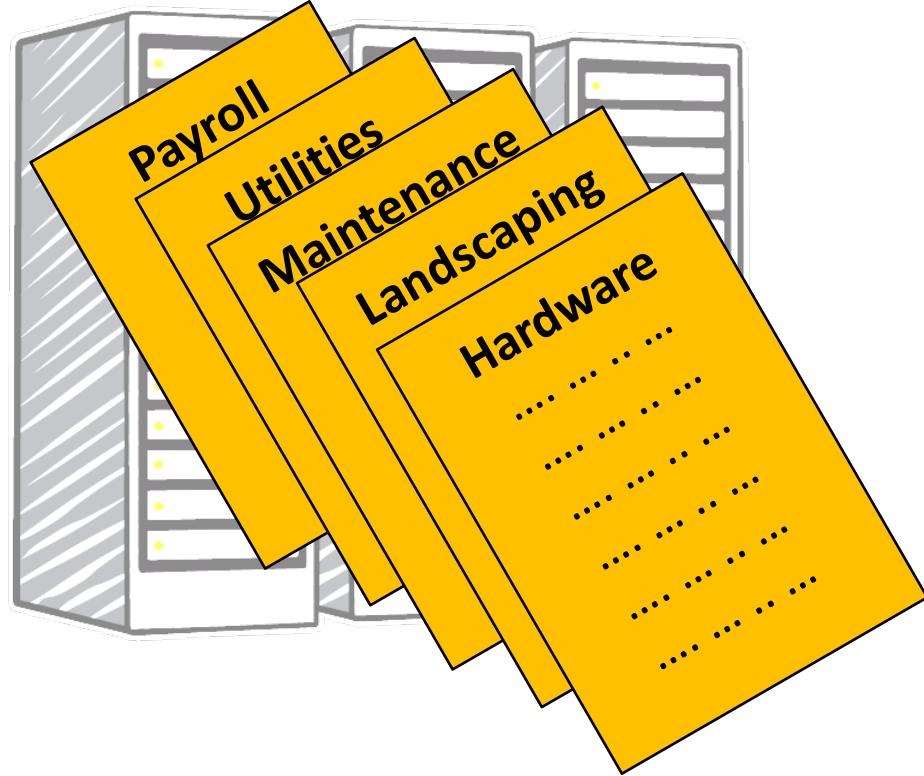


Weeks between wanting resources
and having resources

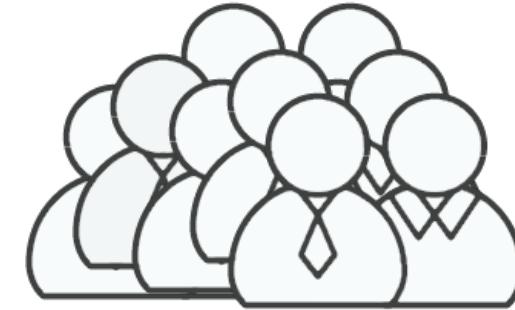
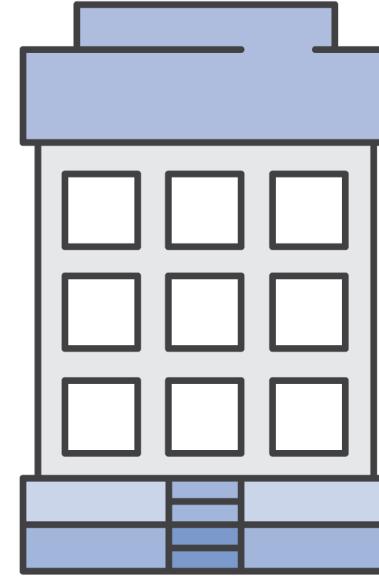
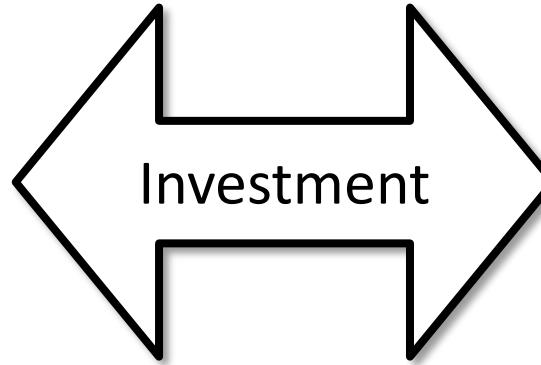


Minutes between wanting
resources and having resources

Stop spending money on running and maintaining data centers

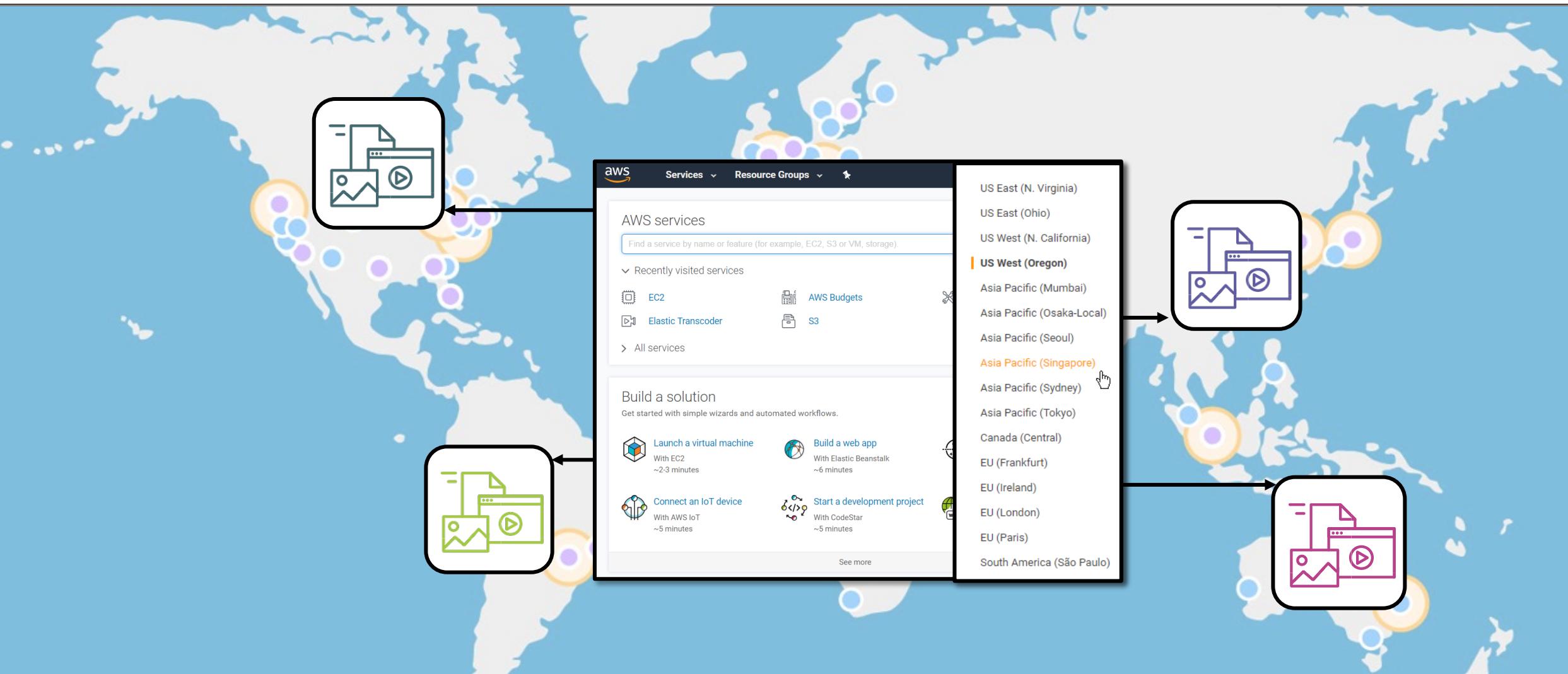


Running data centers



Business and customers

Go global in minutes



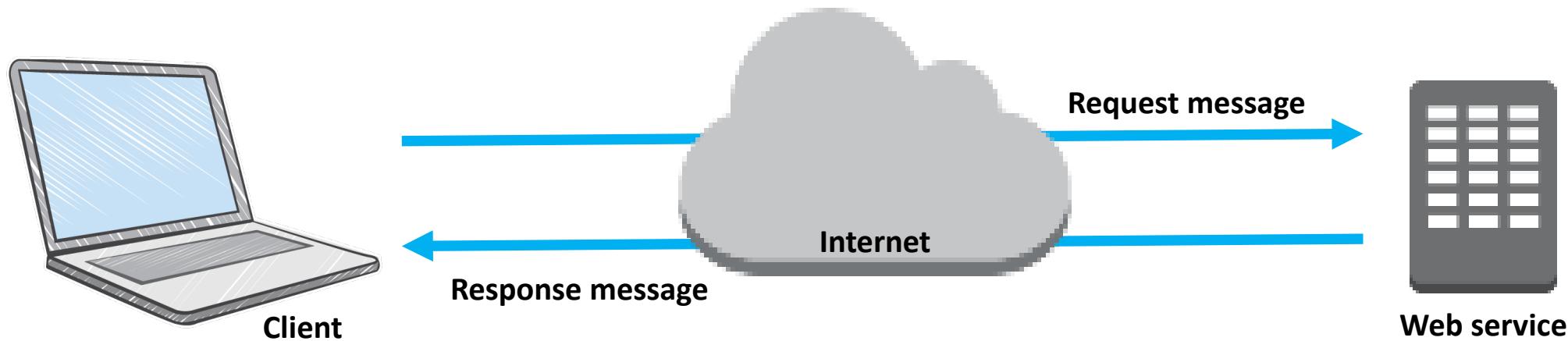
Section 2: Introduction to Amazon Web Services (AWS)

Module 1: Cloud Concepts Overview



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



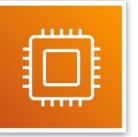
AR and VR



Blockchain



Business
Applications



Compute



Cost
Management



Customer
Engagement



Database



Developer Tools



End User
Computing



Game Tech



Internet
of Things



Machine
Learning



Management and
Governance



Media Services



Migration and
Transfer



Mobile



Networking and
Content Delivery



Robotics



Satellite

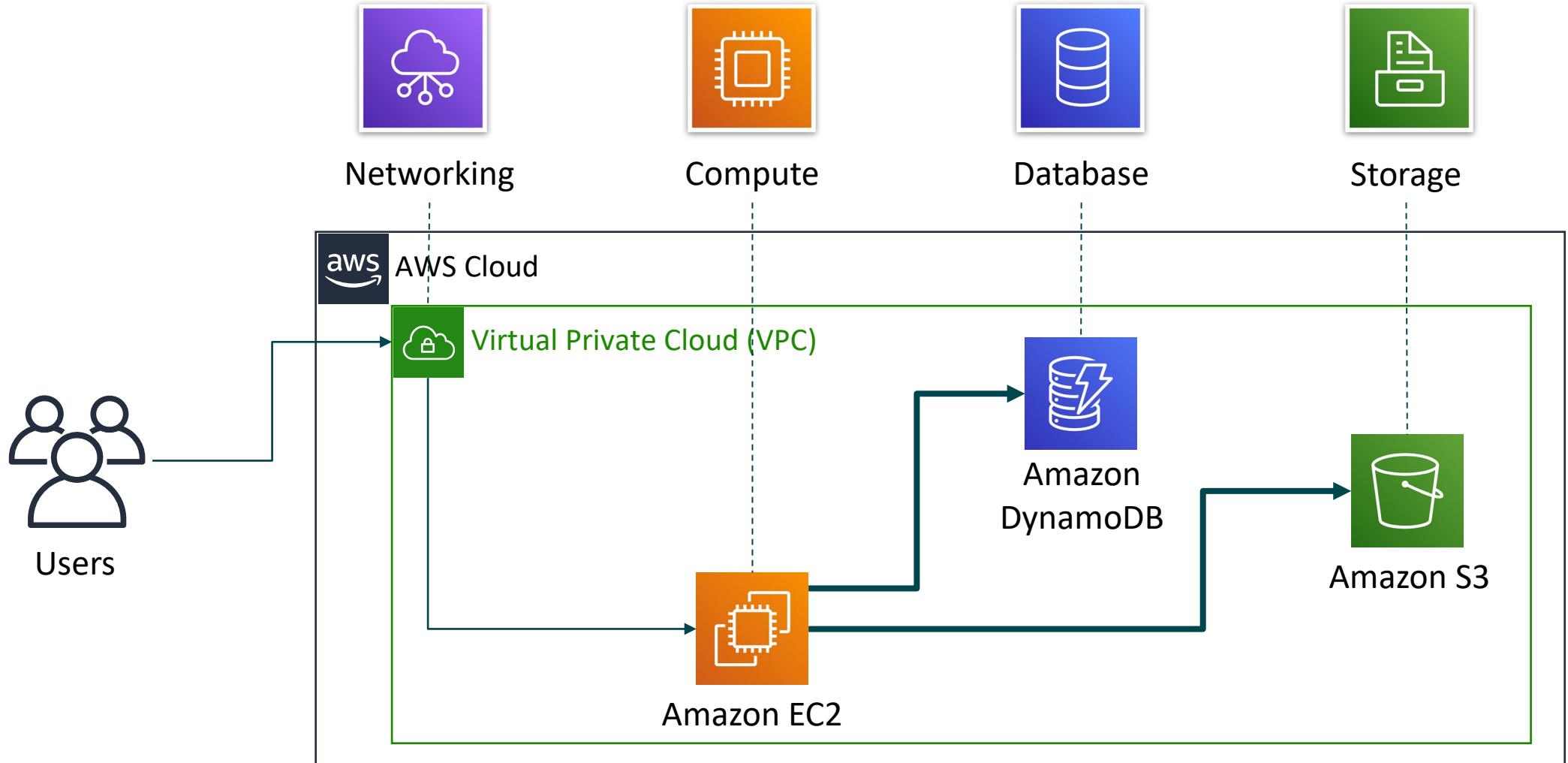


Security, Identity, and
Compliance



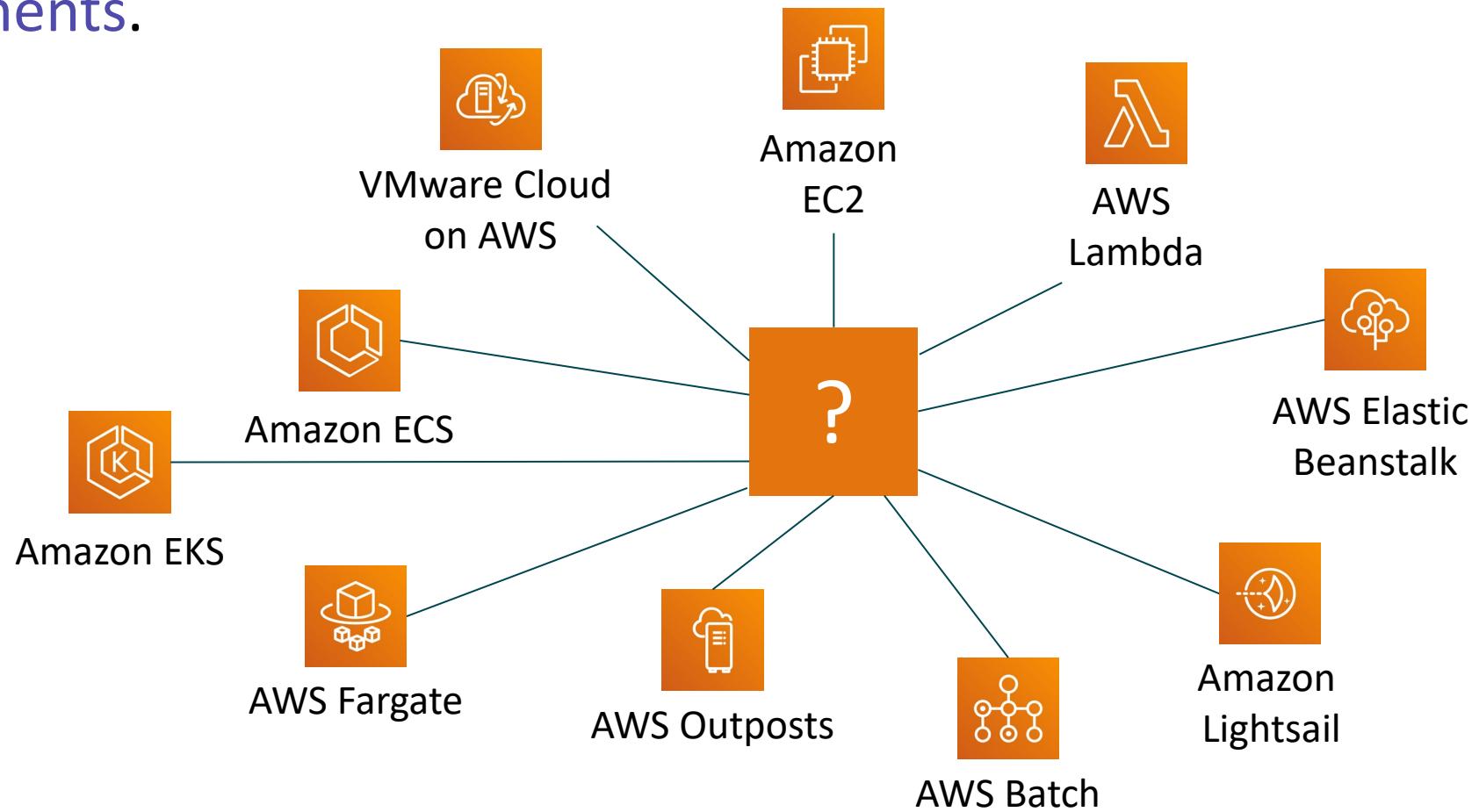
Storage

Simple solution example



Choosing a service

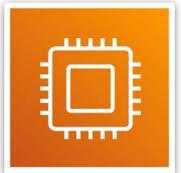
The service you select **depends on your business goals and technology requirements.**



Services covered in this course

Compute services –

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



Storage services –

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



Security, Identity, and Compliance services –

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



Networking and Content Delivery services –

- Amazon VPC
- Amazon Route 53
- Amazon CloudFront
- Elastic Load Balancing



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

```
AWS Storage Gateway Network Configuration
1: Describe Adapter
2: Configure DHCP
3: Configure Static IP
4: Reset all to DHCP
5: Select Network Adapter
6: View DNS Configuration
7: View Routes

Press "x" to exit
Enter command: 2
Available adapters: eth0
Enter Network Adapter: eth0
Reset to DHCP [y/n]: y
Adapter eth0 set to use DHCP
You must exit Network Configuration to complete this configuration.
Press Return to Continue...
```

Command Line Interface (AWS CLI)

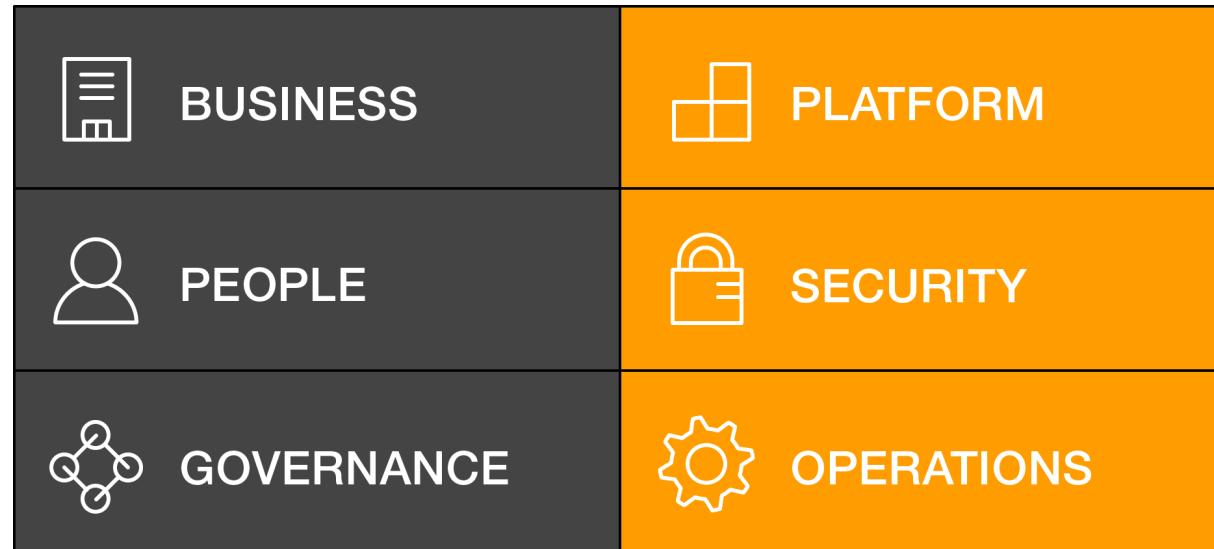
Access to services by discrete commands or scripts



Software Development Kits (SDKs)

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

AWS Cloud Adoption Framework (AWS CAF)



AWS CAF perspectives

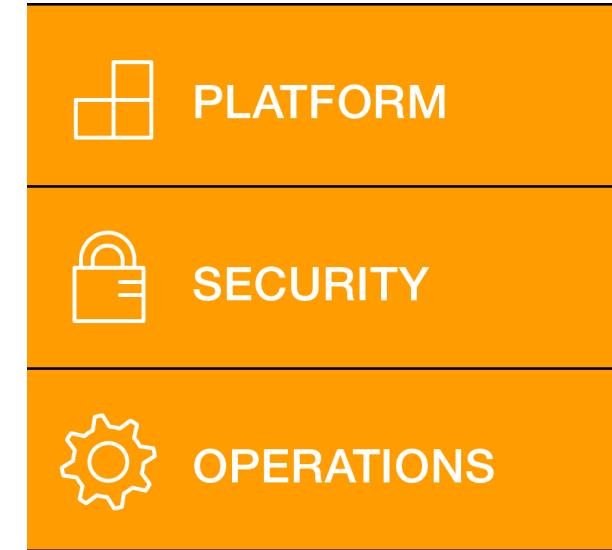
- **AWS CAF provides guidance and best practices to help organizations build a comprehensive approach to cloud computing across the organization and throughout the IT lifecycle to accelerate successful cloud adoption.**

- AWS CAF is organized into **six perspectives**.
- Perspectives consist of sets of **capabilities**.

Six core perspectives

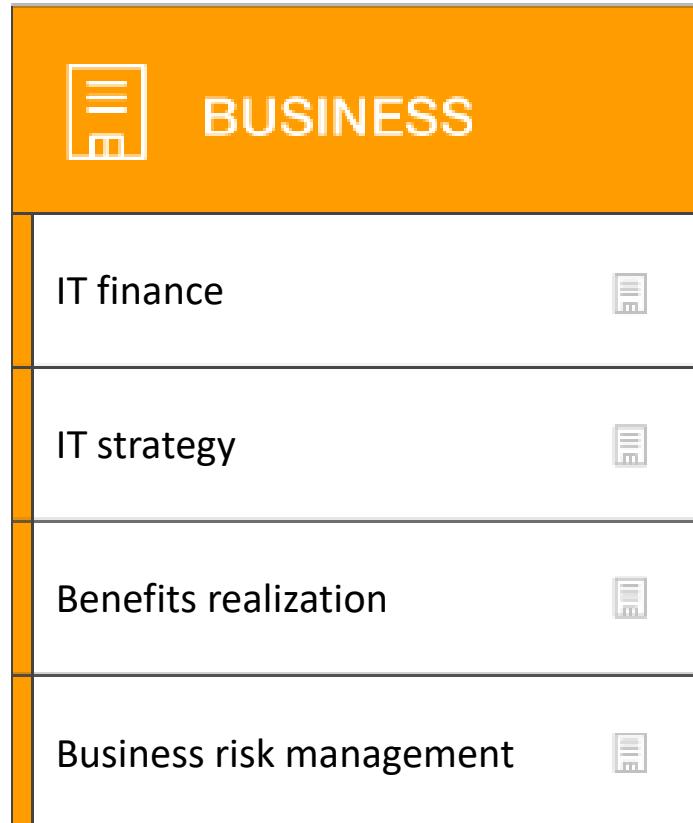


Focus on **business**
capabilities



Focus on **technical**
capabilities

Business perspective



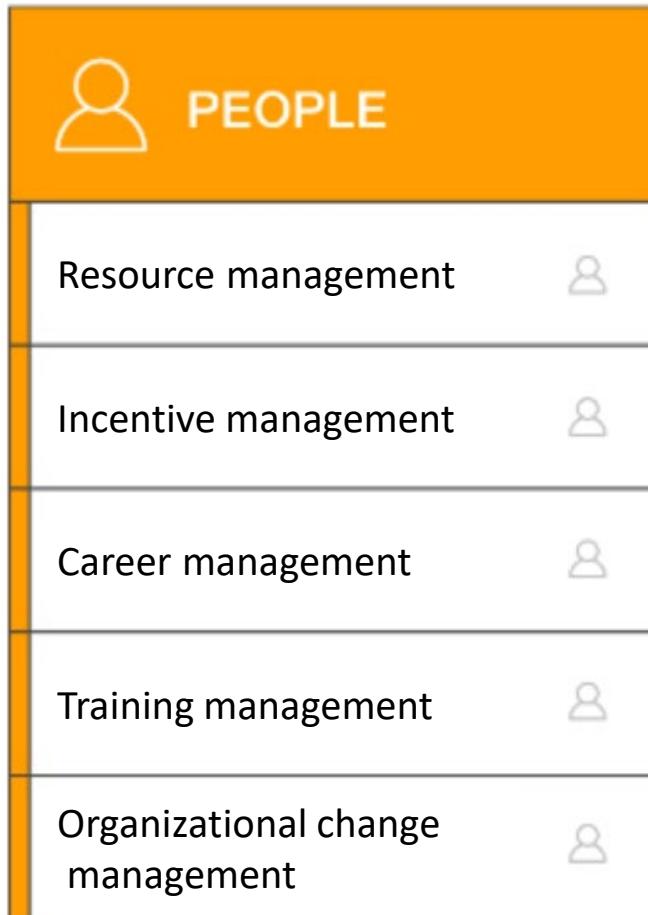
Business perspective capabilities

We must ensure that **IT is aligned with business needs**, and that IT investments can be traced to demonstrable business results.



Business managers, finance managers, budget owners, and strategy stakeholders

People perspective



People perspective capabilities

We must prioritize **training, staffing, and organizational changes** to build an agile organization.



Human resources, staffing,
and people managers

Governance perspective



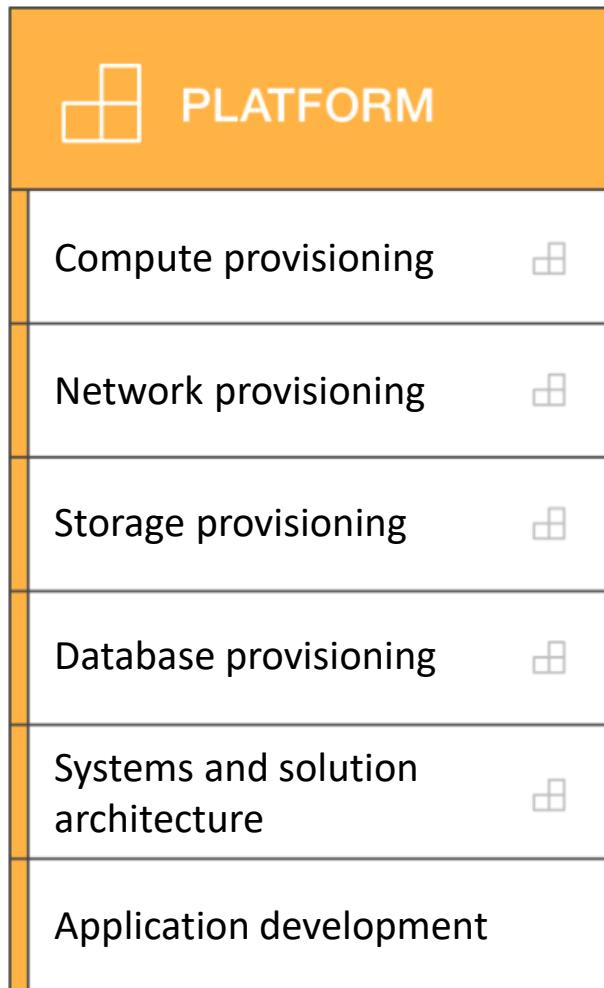
Governance perspective capabilities

We must ensure that **skills and processes align IT strategy and goals with business strategy and goals** so the organization can maximize the business value of its IT investment and minimize business risks.



CIO, program managers, enterprise architects, business analysts, and portfolio managers

Platform perspective



Platform perspective capabilities

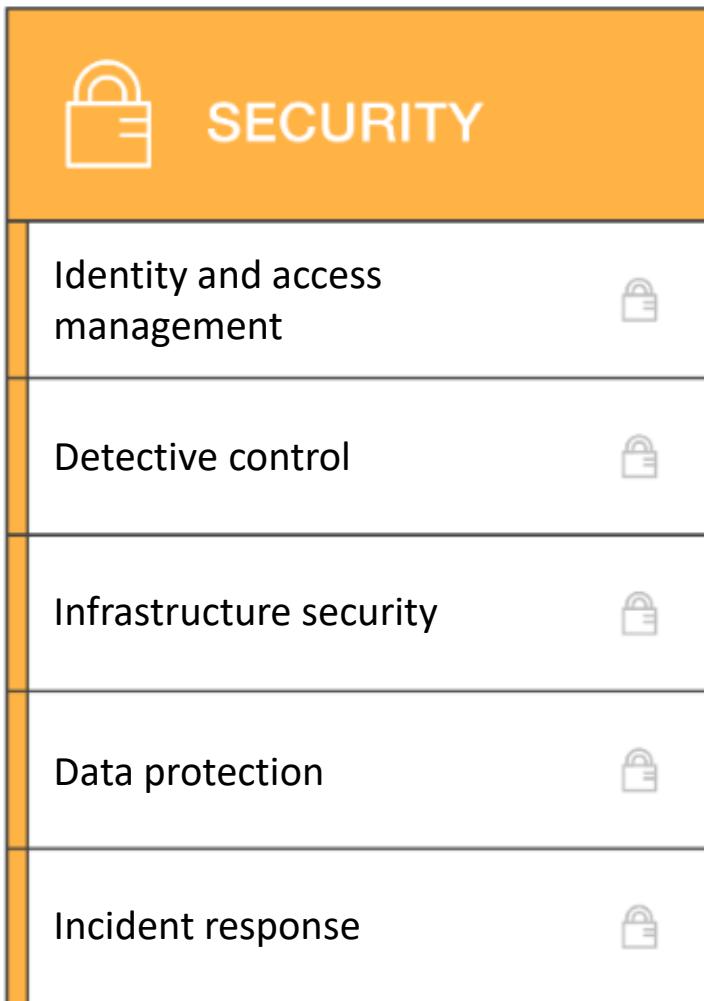


We must **understand and communicate the nature of IT systems and their relationships**. We must be able to **describe the architecture of the target state environment** in detail.



CTO, IT managers, and
solutions architects

Security perspective



Security perspective capabilities

We must ensure that the organization **meets its security objectives**.



CISO, IT security managers,
and IT security analysts

Operations perspective



Operations perspective capabilities

We align with and support the operations of the business, and **define how day-to-day, quarter-to-quarter, and year-to-year business will be conducted.**



IT operations managers and
IT support managers

Section 3: AWS Global Infrastructure

Module 3: AWS Global Infrastructure Overview

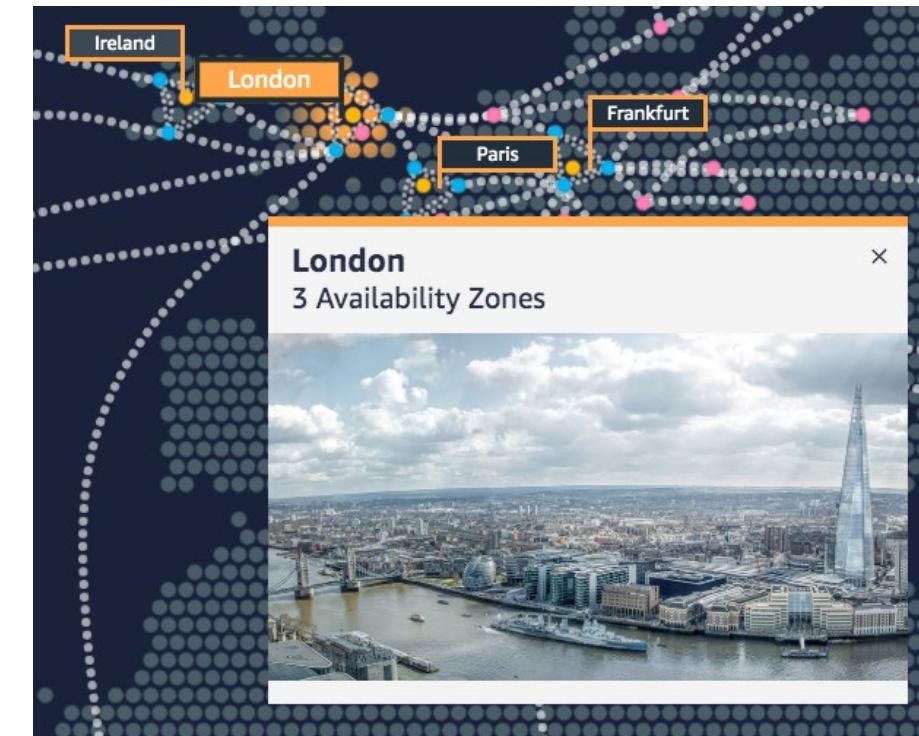
AWS Global Infrastructure

- The **AWS Global Infrastructure** is designed and built to deliver a **flexible, reliable, scalable**, and **secure** cloud computing environment with high-quality **global network performance**.
- AWS continually updates its global infrastructure footprint. Visit one of the following web pages for current infrastructure information:
 - AWS Global Infrastructure Map:
https://aws.amazon.com/about-aws/global-infrastructure/#AWS_Global_Infrastructure_Map
Choose a circle on the map to view summary information about the Region represented by the circle.
 - Regions and Availability Zones:
https://aws.amazon.com/about-aws/global-infrastructure/regions_az/
Choose a tab to view a map of the selected geography and a list of Regions, Edge locations, Local zones, and Regional Caches.



AWS Regions

- An **AWS Region** is a geographical area.
 - Data replication across Regions is controlled by you.
 - Communication between Regions uses AWS backbone network infrastructure.
- Each Region provides full redundancy and connectivity to the network.
- A Region typically consists of two or more **Availability Zones**.



Example: London Region

Selecting a Region

Determine the right Region for your services, applications, and data based on these factors



Data governance, legal requirements



Proximity to customers (latency)



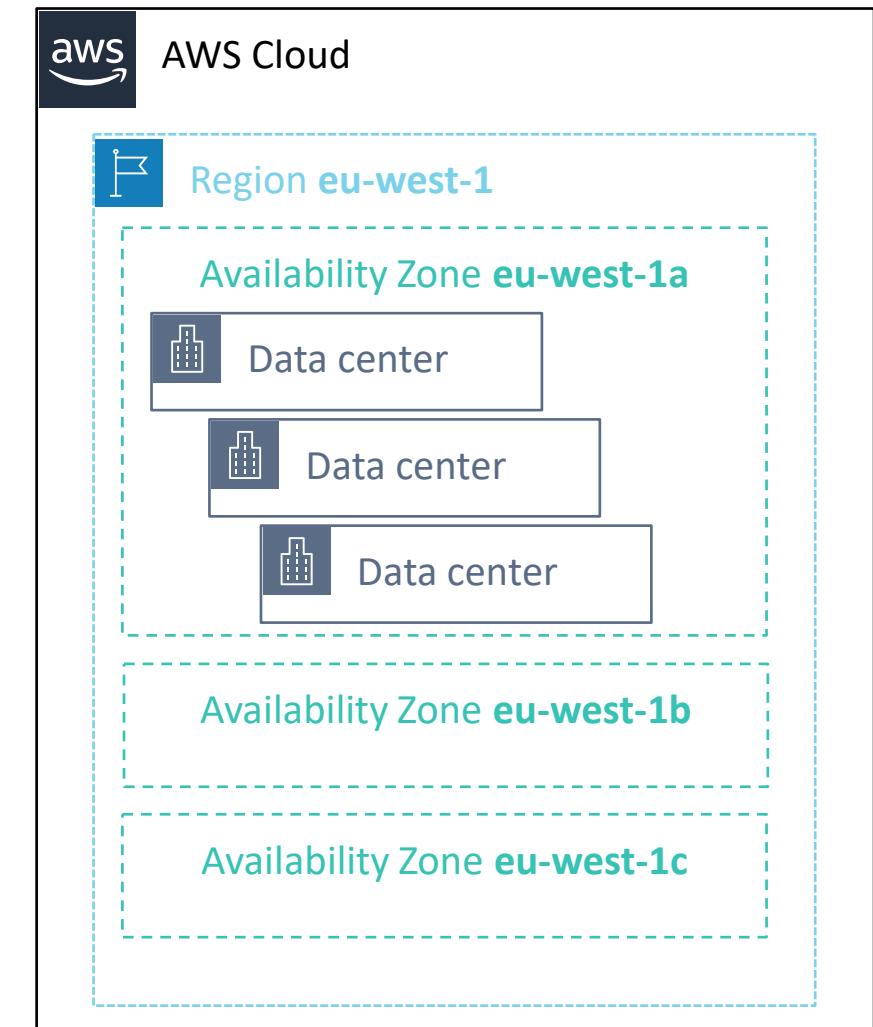
Services available within the Region



Costs (vary by Region)

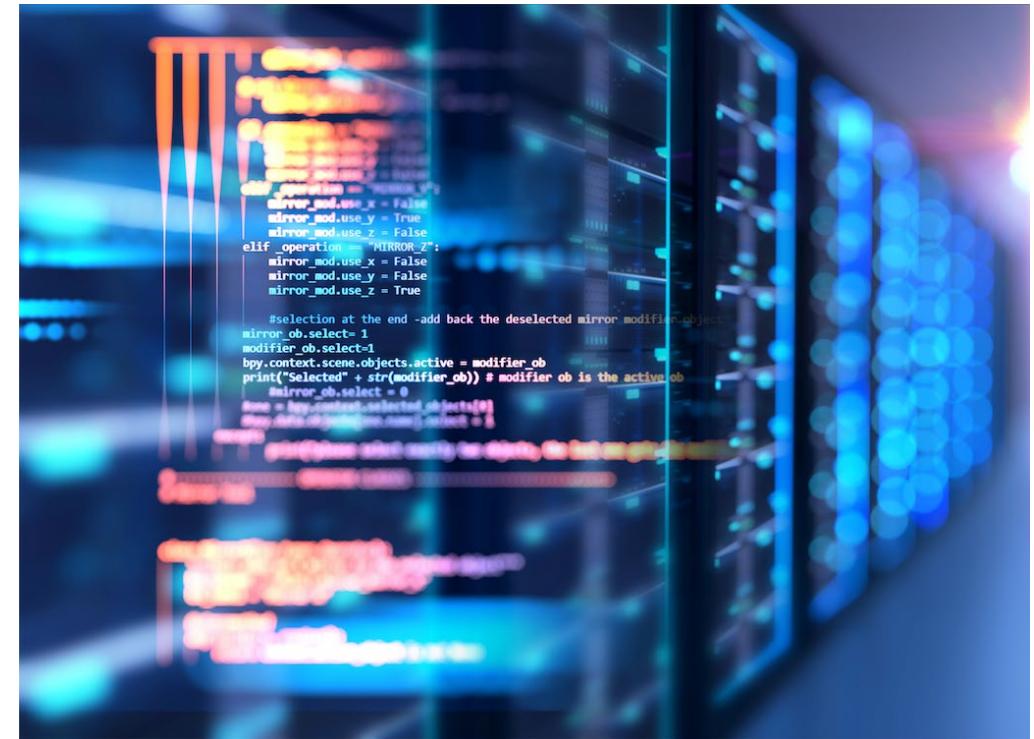
Availability Zones

- Each **Region** has multiple Availability Zones.
- Each **Availability Zone** is a fully isolated partition of the AWS infrastructure.
 - Availability Zones consist of discrete **data centers**
 - They are designed for fault isolation
 - They are interconnected with other Availability Zones by using high-speed private networking
 - You choose your Availability Zones.
 - **AWS recommends replicating data and resources across Availability Zones** for resiliency.



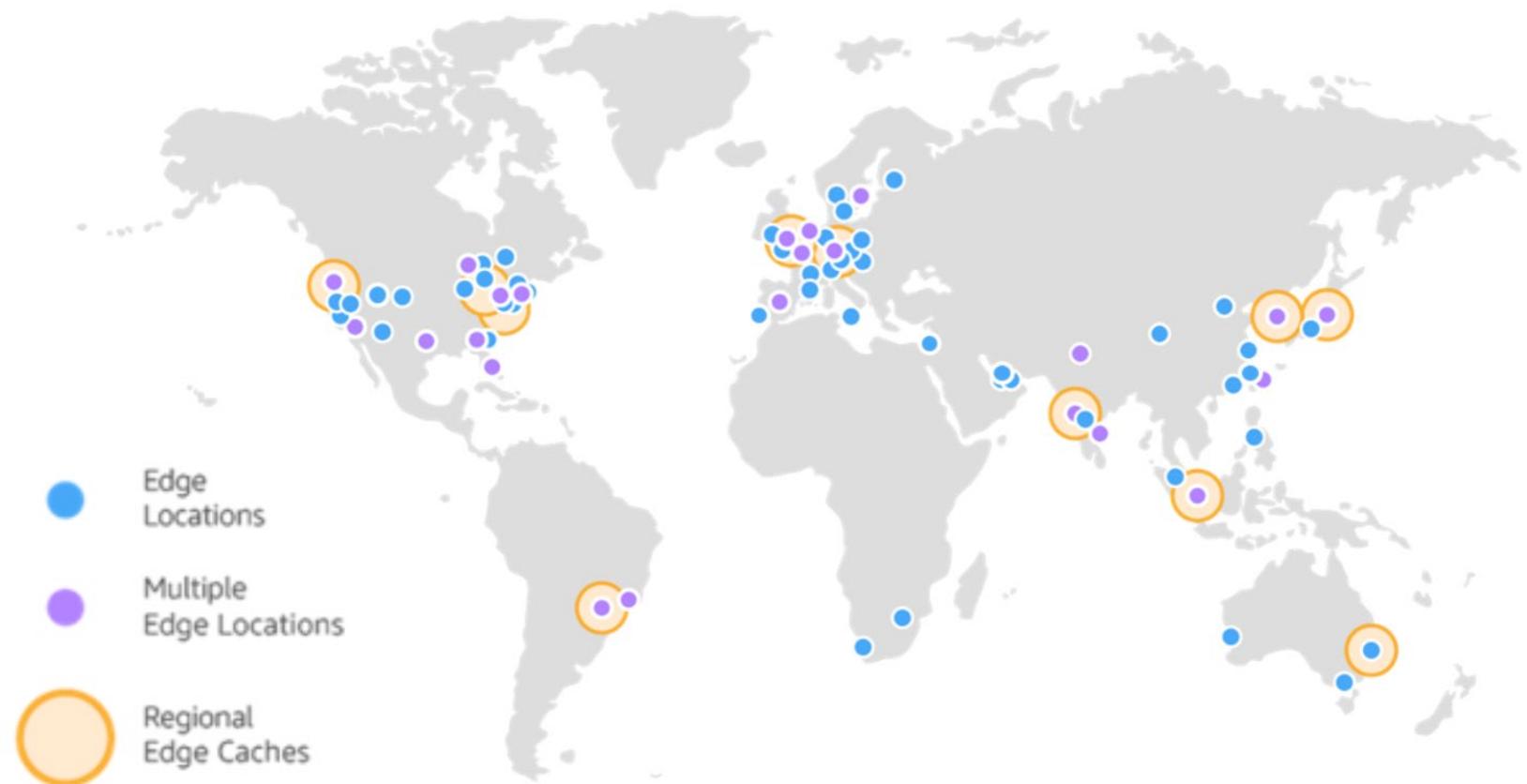
AWS data centers

- AWS data centers are designed for security.
- Data centers are where the data resides and data processing occurs.
- Each data center has redundant power, networking, and connectivity, and is housed in a separate facility.
- A data center typically has 50,000 to 80,000 physical servers.



Points of Presence

- AWS provides a global network of Points of Presence locations
- Consists of **edge locations** and a much smaller number of **Regional edge caches**
- Used with Amazon CloudFront
 - A global Content Delivery Network (CDN), that delivers content to end users with **reduced latency**
- Regional edge caches used for content with infrequent access.



AWS infrastructure features

- Elasticity and scalability

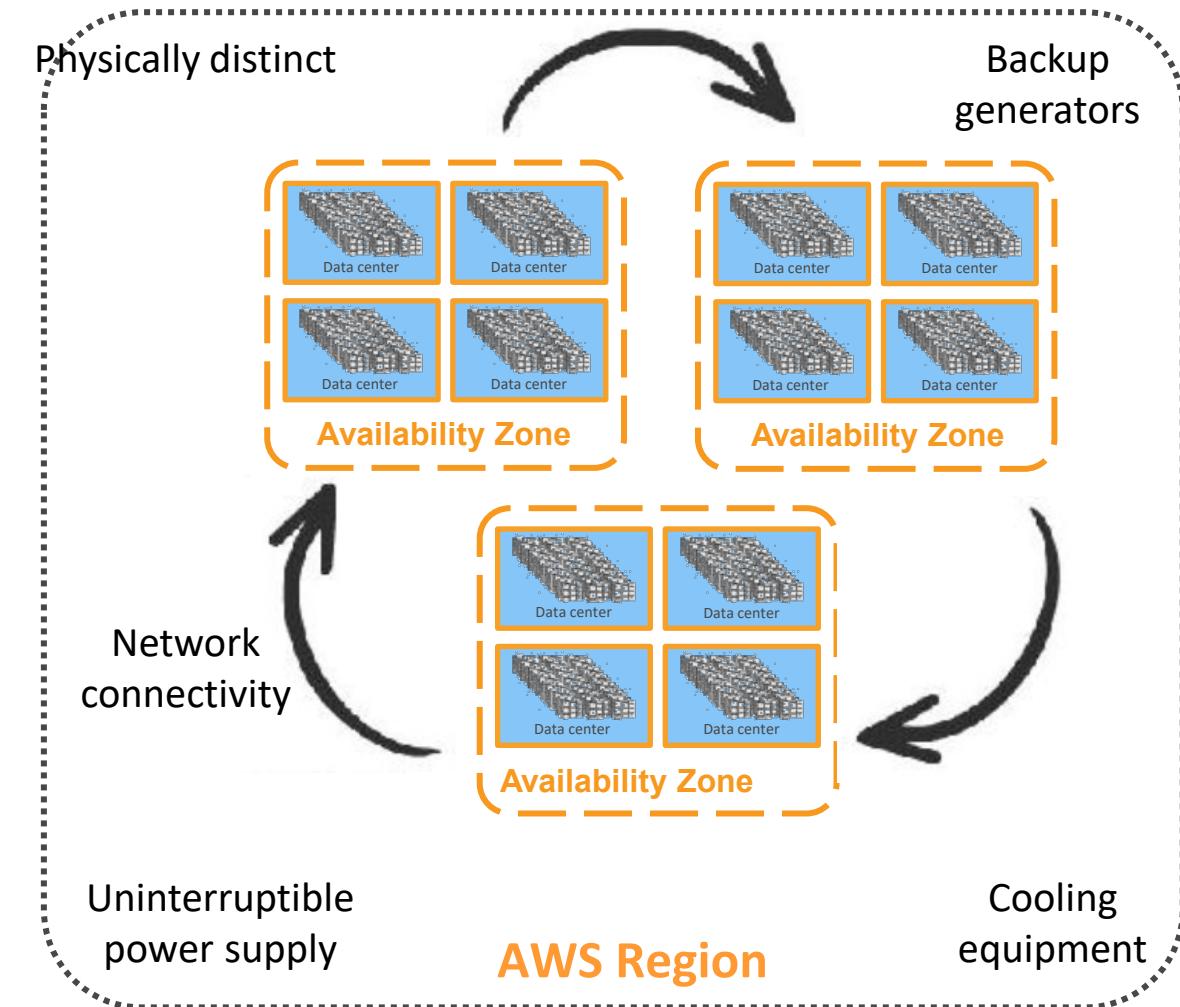
- Elastic infrastructure; dynamic adaption of capacity
- Scalable infrastructure; adapts to accommodate growth

- Fault-tolerance

- Continues operating properly in the presence of a failure
- Built-in redundancy of components

- High availability

- High level of operational performance
- Minimized downtime
- No human intervention

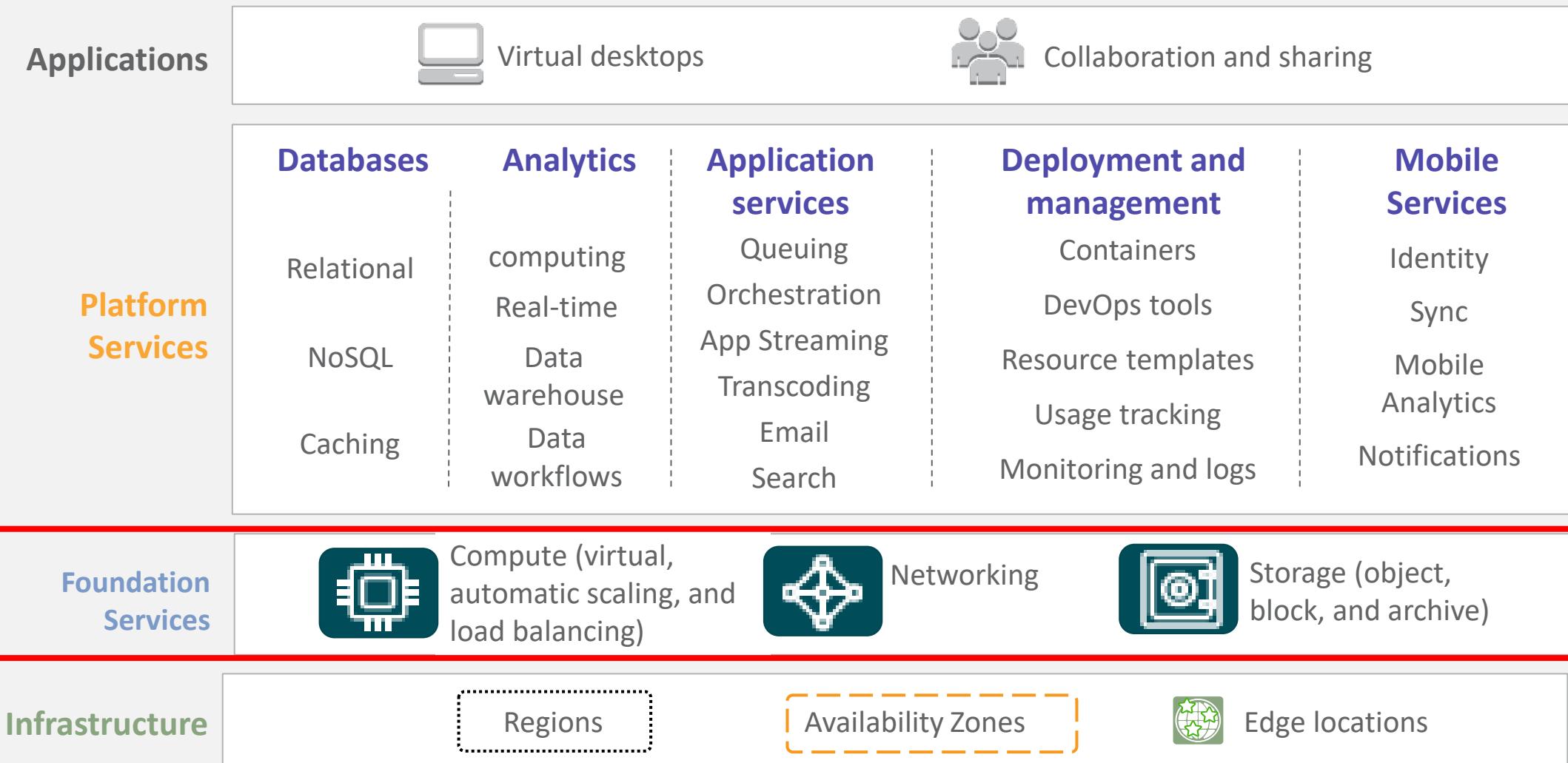


Section 4: AWS services and service category overview

Module 3: AWS Global Infrastructure Overview



AWS foundational services



AWS categories of services



Analytics



Application
Integration



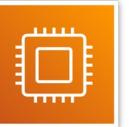
AR and VR



Blockchain



Business
Applications



Compute



Cost
Management



Customer
Engagement



Database



Developer Tools



End User
Computing



Game Tech



Internet
of Things



Machine
Learning



Management and
Governance



Media Services



Migration and
Transfer



Mobile



Networking and
Content Delivery



Robotics



Satellite



Security, Identity, and
Compliance



Storage

Storage service category



Photo from <https://www.pexels.com/photo/black-and-grey-device-159282/>



AWS storage services



Amazon Simple Storage
Service (Amazon S3)



Amazon Elastic
Block
Store (Amazon EBS)



Amazon Elastic
File System
(Amazon EFS)



Amazon Simple Storage
Service
Glacier

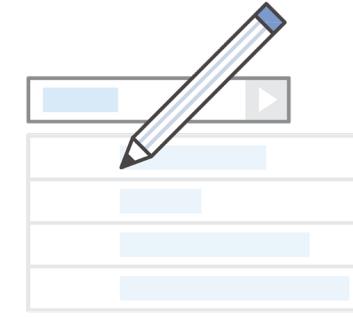


Amazon S3 overview

- 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

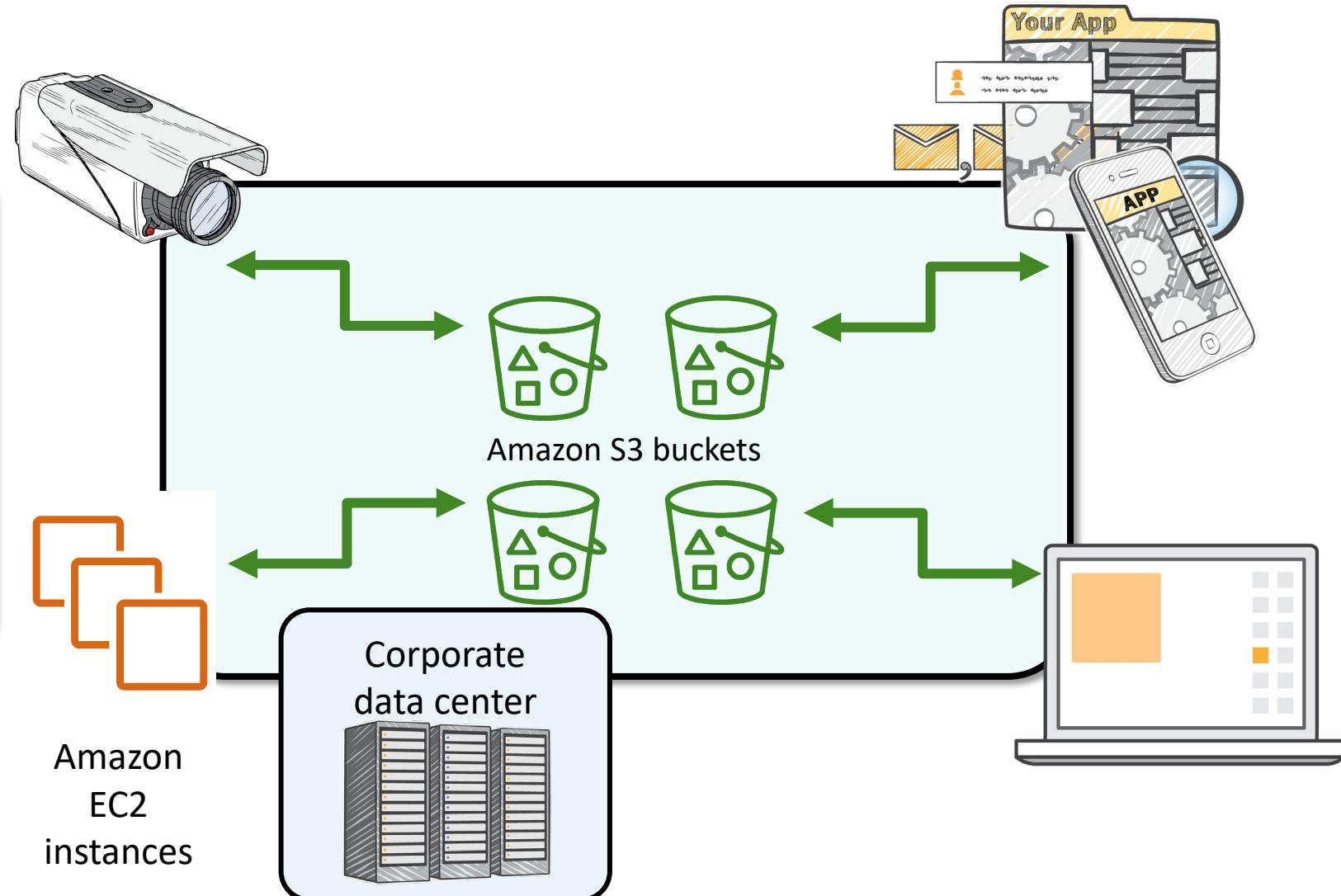
Common use cases

- Storing application assets
- Static web hosting
- Backup and disaster recovery (DR)
- Staging area for big data
- *Many more....*

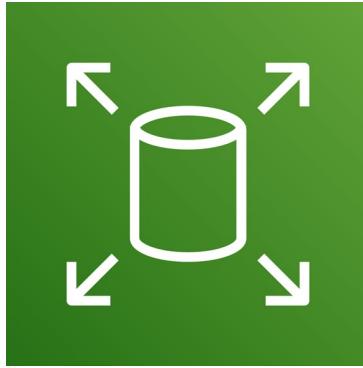


Amazon S3 common scenarios

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

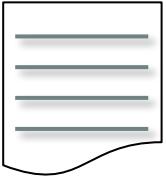


Storage

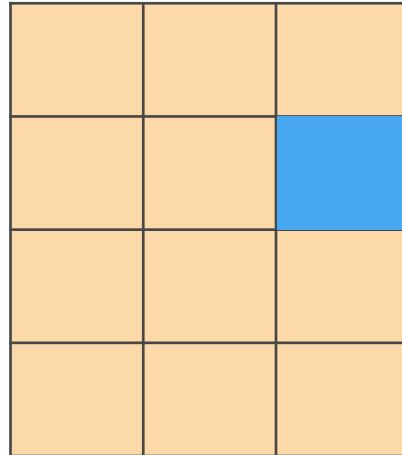


Amazon Elastic Block Store
(Amazon EBS)

AWS storage options: Block storage versus object storage



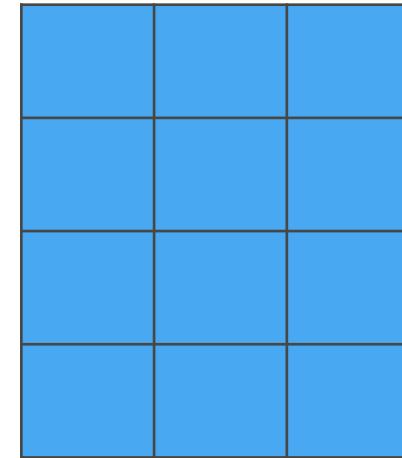
What if you want to change **one character** in a 1-GB file?



Block storage

Change one block (piece of the file)

that contains the character



Object storage

Entire file must be updated

Amazon EBS

Amazon EBS enables you to **create individual storage volumes** and **attach them** to an Amazon EC2 instance:

- Amazon EBS offers block-level storage.
- Volumes are automatically replicated within its Availability Zone.
- It can be backed up automatically to Amazon S3 through snapshots.
- Uses include –
 - Boot volumes and storage for Amazon Elastic Compute Cloud (Amazon EC2) instances
 - Data storage with a file system
 - Database hosts
 - Enterprise applications

Amazon EBS volume type use cases

Solid State Drives (SSD)		Hard Disk Drives (HDD)	
General Purpose	Provisioned IOPS	Throughput-Optimized	Cold
<ul style="list-style-type: none">This type is recommended for most workloads	<ul style="list-style-type: none">Critical business applications that require sustained IOPS performance, or more than 16,000 IOPS or 250 MiB/second of throughput per volumeLarge database workloads	<ul style="list-style-type: none">Streaming workloads that require consistent, fast throughput at a low price	<ul style="list-style-type: none">Throughput-oriented storage for large volumes of data that is infrequently accessed
<ul style="list-style-type: none">System boot volumesVirtual desktopsLow-latency interactive applicationsDevelopment and test environments		<ul style="list-style-type: none">Big dataData warehousesLog processing	<ul style="list-style-type: none">Scenarios where the lowest storage cost is importantIt cannot be a boot volume
		<ul style="list-style-type: none">It cannot be a boot volume	

Storage

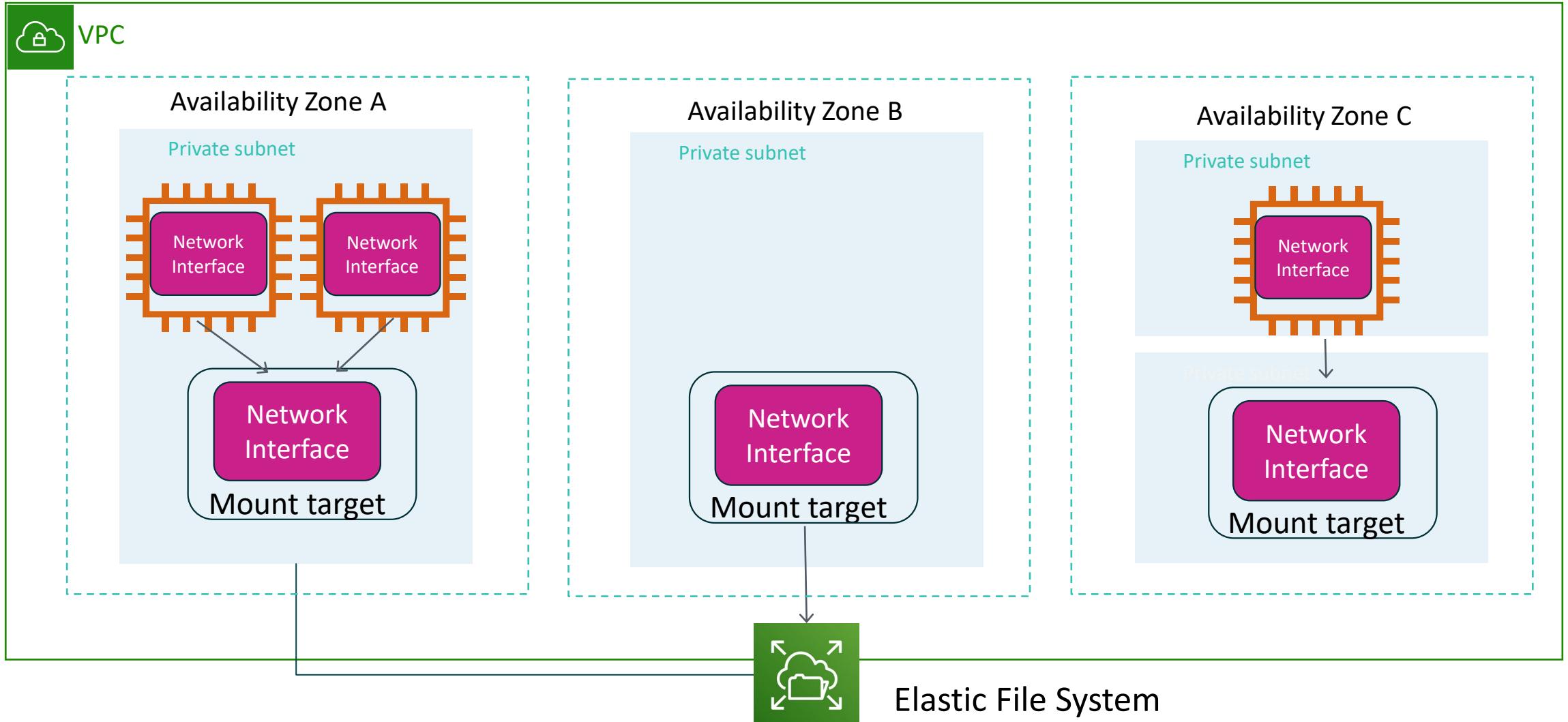


Amazon Elastic File System
(Amazon EFS)

Amazon EFS features

- File storage in the AWS Cloud
- Works well for big data and analytics, media processing workflows, content management, web serving, and home directories
- Petabyte-scale, low-latency file system
- Shared storage
- Elastic capacity
- Supports Network File System (NFS) versions 4.0 and 4.1 (NFSv4)
- Compatible with all Linux-based AMIs for Amazon EC2

Amazon EFS architecture



Storage

Amazon S3 Glacier

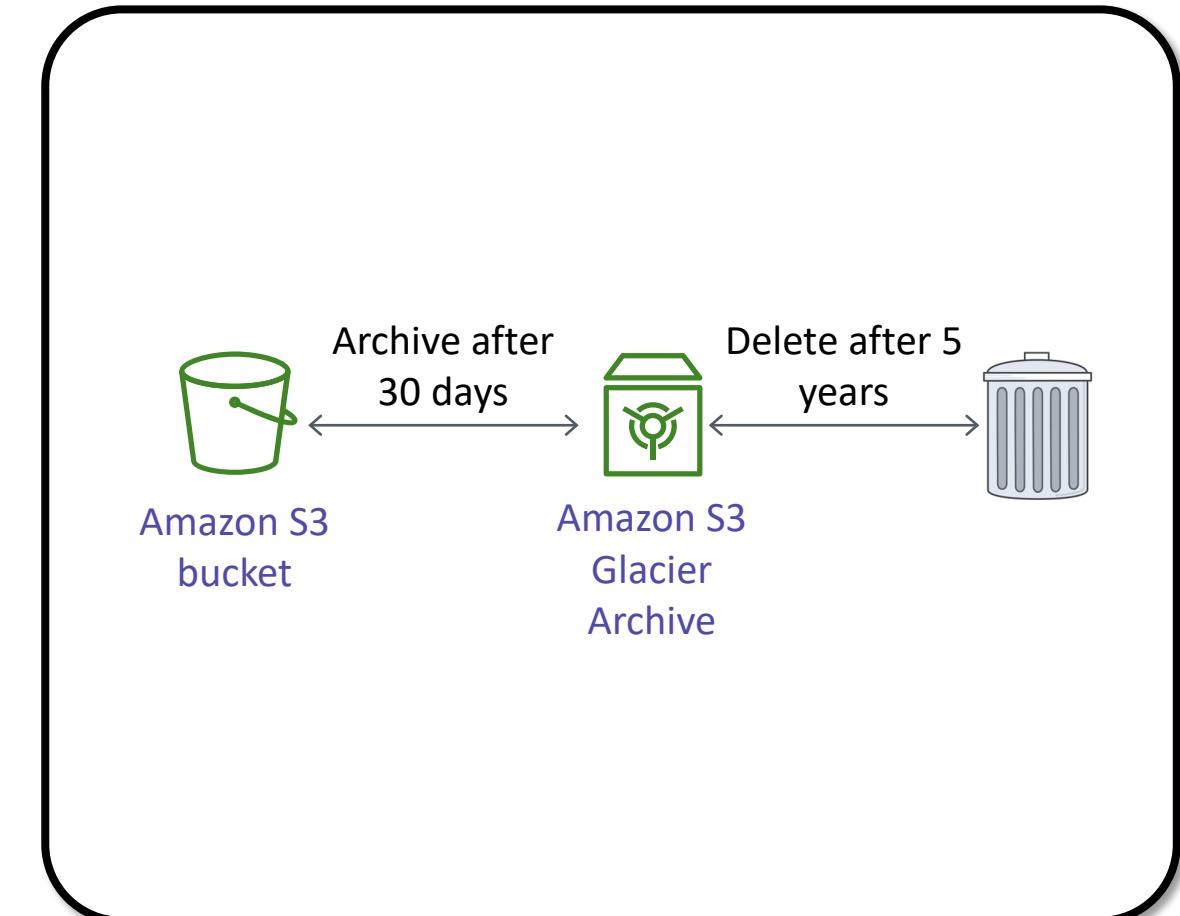


Amazon S3 Glacier is a **data archiving service** that is designed for **security, durability, and an extremely low cost**.

- Amazon S3 Glacier is designed to provide 11 9s of durability for objects.
- It supports the encryption of data in transit and at rest through Secure Sockets Layer (SSL) or Transport Layer Security (TLS).
- The Vault Lock feature enforces compliance through a policy.
- Extremely low-cost design works well for long-term archiving.
 - Provides three options for access to archives—expedited, standard, and bulk—retrieval times range from a few minutes to several hours.

Amazon S3 Glacier

- Storage service for low-cost data archiving and long-term backup
- You can configure lifecycle archiving of Amazon S3 content to Amazon S3 Glacier
- Retrieval options –
 - Standard: 3–5 hours
 - Bulk: 5–12 hours
 - Expedited: 1–5 minutes



Amazon S3 Glacier use cases



Media asset archiving



Healthcare information archiving



Regulatory and compliance archiving



Scientific data archiving



Digital preservation



Magnetic tape replacement

Compute service category

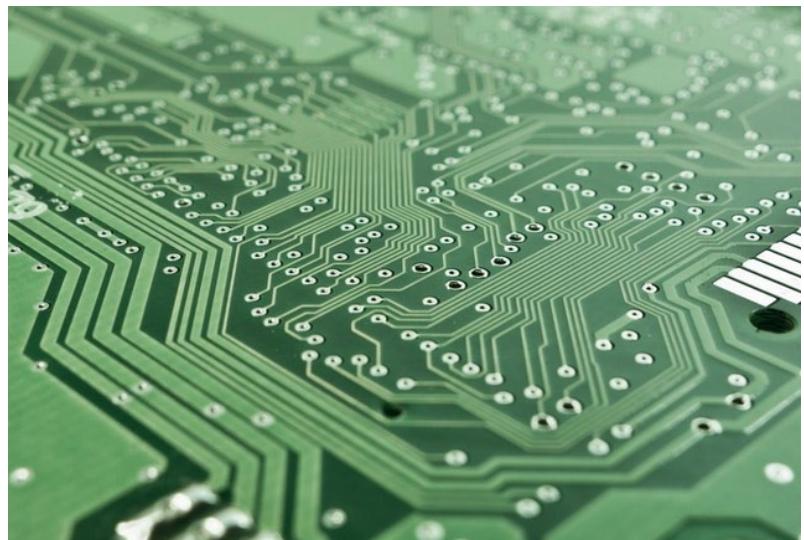
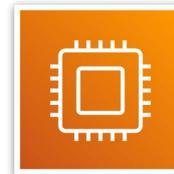
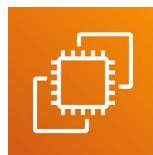


Photo from <https://www.pexels.com/photo/technology-computer-lines-board-50711/>



AWS Compute services



Amazon EC2



Amazon EC2
Auto Scaling



Amazon Elastic
Container Service
(Amazon ECS)



Amazon EC2
Container Registry



AWS Elastic
Beanstalk



AWS Lambda



Amazon Elastic
Kubernetes Service
(Amazon EKS)



AWS Fargate

Categorizing compute services

Services	Key Concepts	Characteristics	Ease of Use
• Amazon EC2	<ul style="list-style-type: none">• Infrastructure as a service (IaaS)• Instance-based• Virtual machines	<ul style="list-style-type: none">• Provision virtual machines that you can manage as you choose	A familiar concept to many IT professionals.
• AWS Lambda	<ul style="list-style-type: none">• Serverless computing• Function-based• Low-cost	<ul style="list-style-type: none">• Write and deploy code that runs on a schedule or that can be triggered by events• Use when possible (architect for the cloud)	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	<ul style="list-style-type: none">• Container-based computing• Instance-based	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• Platform as a service (PaaS)• For web applications	<ul style="list-style-type: none">• 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.

Choosing the optimal compute service

- The optimal compute service or services that you use will depend on your use case
- Some aspects to consider –
 - What is your application design?
 - What are your usage patterns?
 - Which configuration settings will you want to manage?
- Selecting the wrong compute solution for an architecture can lead to lower performance efficiency
- A good starting place—Understand the available compute options

Database service category



Photo from <https://aws.amazon.com/compliance/data-center/data-centers/>



AWS Database services



Amazon
Relational
Database Service



Amazon Aurora



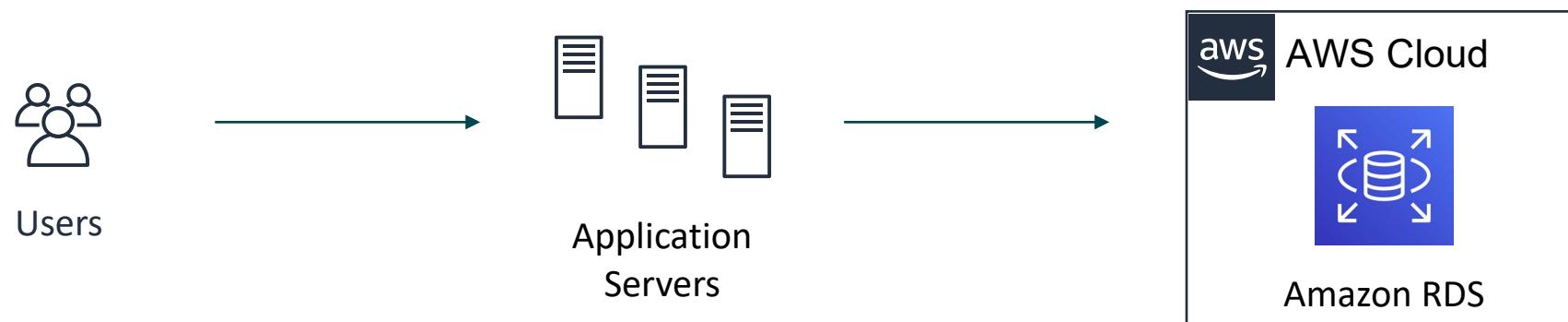
Amazon Redshift



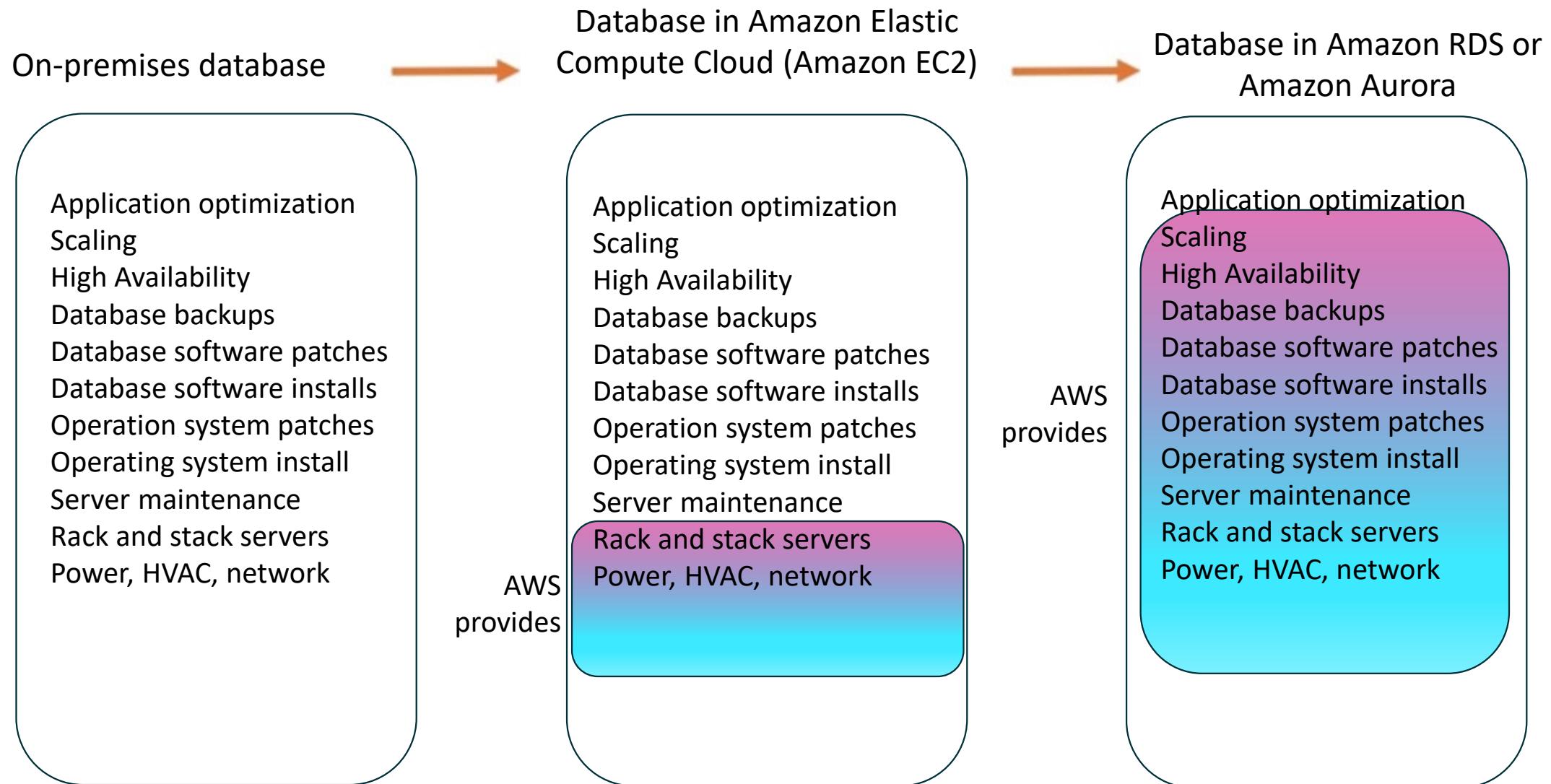
Amazon
DynamoDB

Amazon RDS

Managed service that sets up and operates a relational database in the cloud.



From on-premises databases to Amazon RDS



Use cases

Web and mobile applications	<ul style="list-style-type: none">✓ High throughput✓ Massive storage scalability✓ High availability
Ecommerce applications	<ul style="list-style-type: none">✓ Low-cost database✓ Data security✓ Fully managed solution
Mobile and online games	<ul style="list-style-type: none">✓ Rapidly grow capacity✓ Automatic scaling✓ Database monitoring



What is Amazon DynamoDB?

Fast and flexible NoSQL database service for any scale



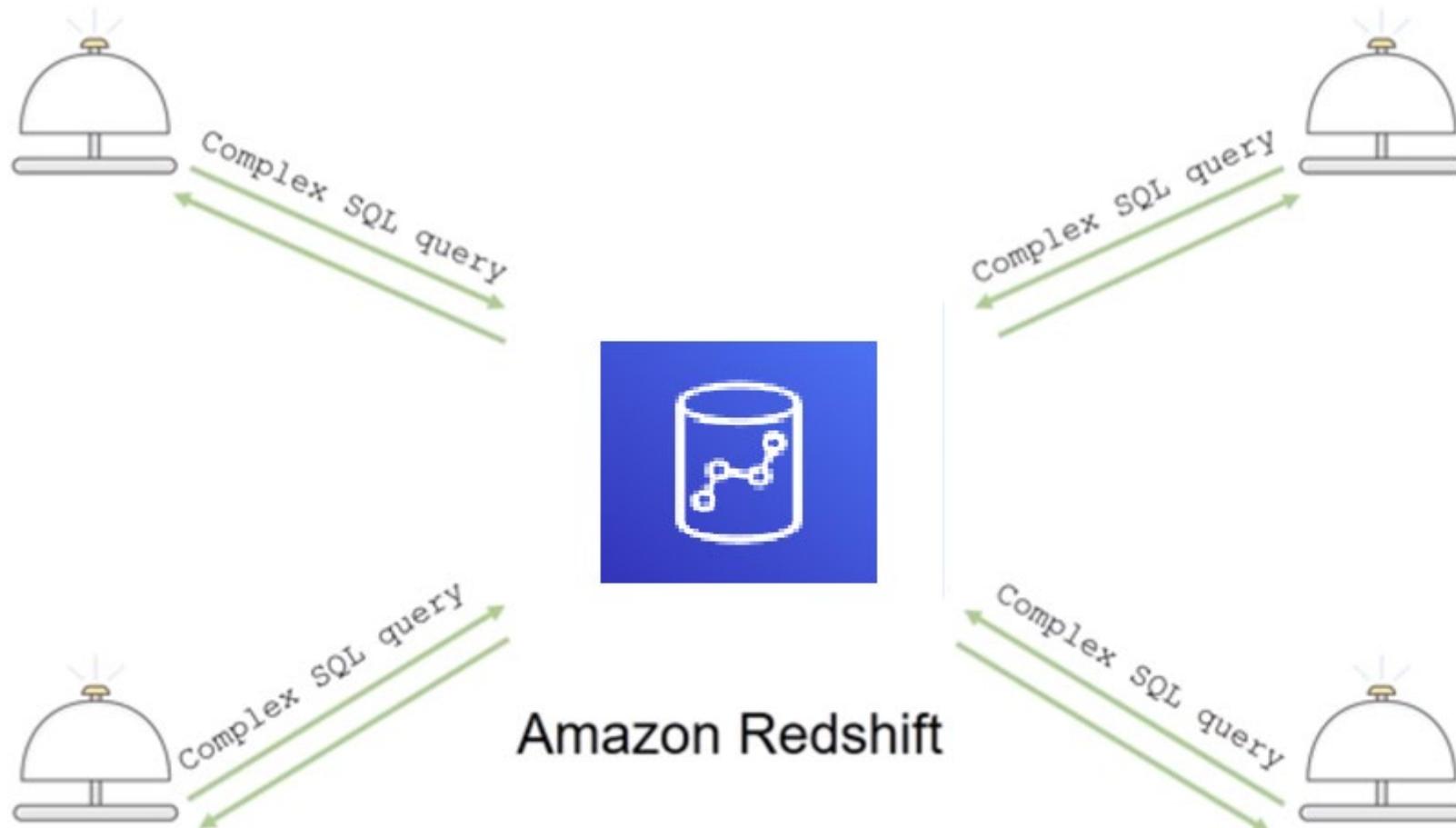
Amazon DynamoDB

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

Relational versus non-relational databases

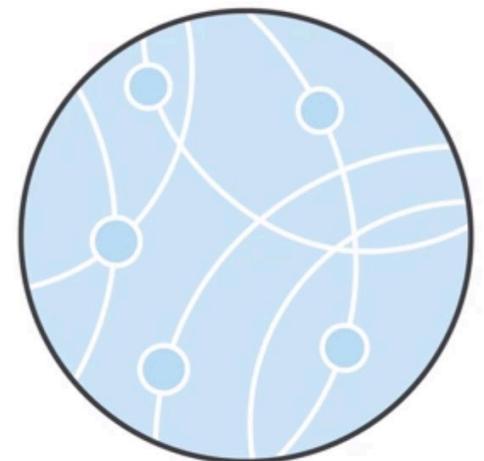
	Relational (SQL)	Non-Relational												
Data Storage	Rows and columns	Key-value, document, graph												
Schemas	Fixed	Dynamic												
Querying	Uses SQL	Focuses on collection of documents												
Scalability	Vertical	Horizontal												
Example	<table><thead><tr><th>ISBN</th><th>Title</th><th>Author</th><th>Format</th></tr></thead><tbody><tr><td>3111111223439</td><td>Withering Depths</td><td>Jackson, Mateo</td><td>Paperback</td></tr><tr><td>3122222223439</td><td>Wily Willy</td><td>Wang, Xiulan</td><td>Ebook</td></tr></tbody></table>	ISBN	Title	Author	Format	3111111223439	Withering Depths	Jackson, Mateo	Paperback	3122222223439	Wily Willy	Wang, Xiulan	Ebook	{ ISBN: 3111111223439, Title: "Withering Depths", Author: "Jackson, Mateo", Format: "Paperback" }
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Introduction to Amazon Redshift



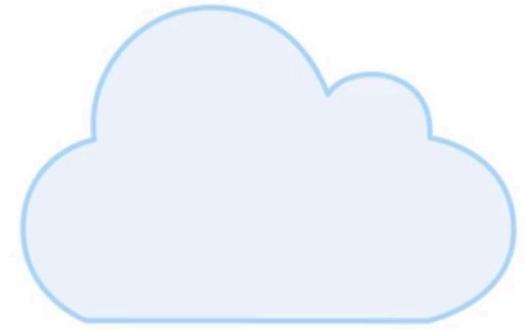
Amazon Redshift use cases (1 of 2)

- Enterprise data warehouse (EDW)
 - Migrate at a pace that customers are comfortable with
 - Experiment without large upfront cost or commitment
 - Respond faster to business needs
- Big data
 - Low price point for small customers
 - Managed service for ease of deployment and maintenance
 - Focus more on data and less on database management



Amazon Redshift use cases (2 of 2)

- Software as a service (SaaS)
 - Scale the data warehouse capacity as demand grows
 - Add analytic functionality to applications
 - Reduce hardware and software costs



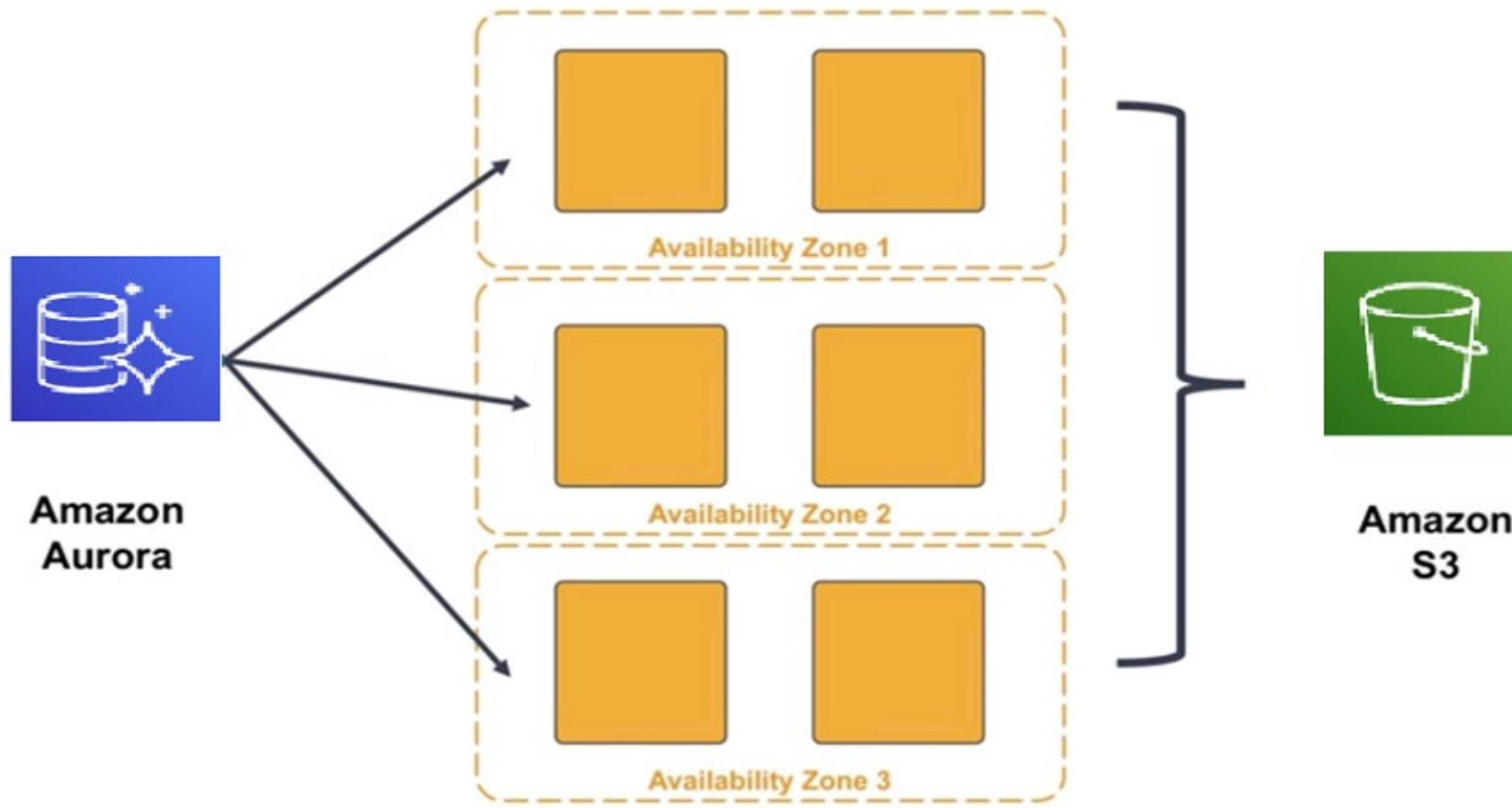
Amazon Aurora



Amazon Aurora

- Enterprise-class relational database
- Compatible with MySQL or PostgreSQL
- Automate time-consuming tasks (such as provisioning, patching, backup, recovery, failure detection, and repair).

High availability



Networking and content delivery service category



Photo by Umberto on Unsplash



**AWS networking
and content delivery services**



Amazon VPC



Elastic Load
Balancing



Amazon
CloudFront



AWS Transit
Gateway



Amazon
Route 53



AWS Direct
Connect



AWS VPN

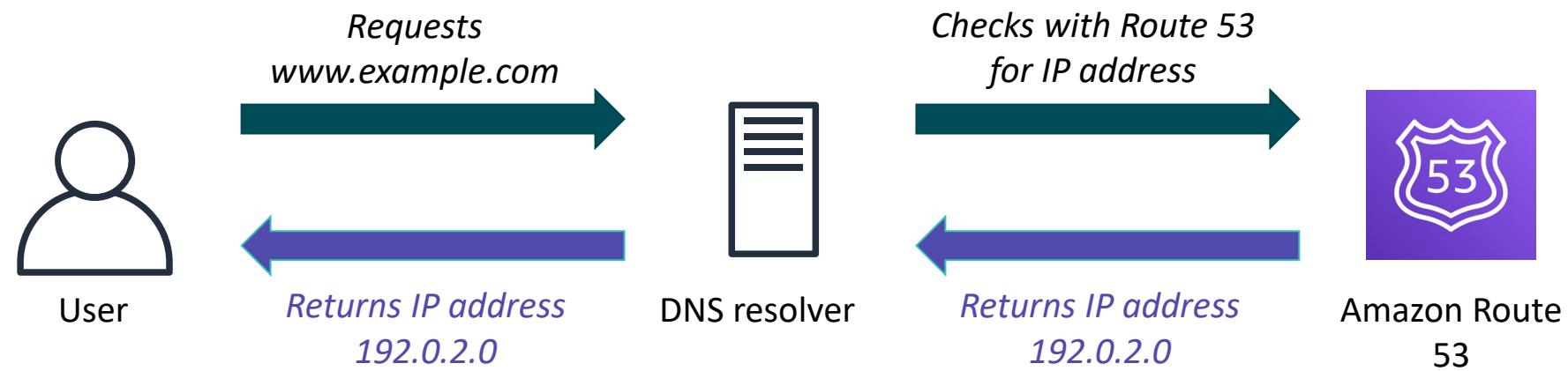
Amazon Route 53



Amazon
Route 53

- Is a highly available and scalable Domain Name System (DNS) web service
- Is used to route end users to internet applications by translating names (like www.example.com) into numeric IP addresses (like 192.0.2.1) that computers use to connect to each other
- Is fully compliant with IPv4 and IPv6
- Connects user requests to infrastructure running in AWS and also outside of AWS
- Is used to check the health of your resources
- Features traffic flow
- Enables you to register domain names

Amazon Route 53 DNS resolution



Security, identity, and compliance service category



Photo by Paweł Czerwiński on Unsplash



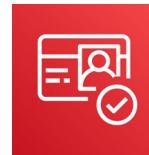
**AWS security, identity,
and compliance** services



AWS Identity and Access
Management (IAM)



AWS
Organizations



Amazon Cognito



AWS Artifact



AWS Key
Management
Service



AWS Shield

AWS Identity and Access Management (IAM) - Example 1

- Use **IAM** to manage access to **AWS resources** –
 - A resource is an entity in an AWS account that you can work with
 - Example resources; An Amazon EC2 instance or an Amazon S3 bucket
- *Example* – Control who can terminate Amazon EC2 instances
- Define fine-grained access rights –
 - **Who** can access the resource
 - **Which** resources can be accessed and what can the user do to the resource
 - **How** resources can be accessed
- IAM is a no-cost AWS account feature

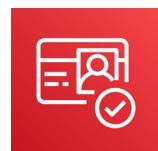


AWS Identity and Access
Management
(IAM)

Amazon Cognito – Example 2

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

AWS Shield – Example 3

- **AWS Shield** features:
 - Is a managed distributed denial of service (DDoS) protection service
 - Safeguards applications running on AWS
 - Provides always-on detection and automatic inline mitigations
 - *AWS Shield Standard* enabled for at no additional cost. *AWS Shield Advanced* is an optional paid service.
- Use it to **minimize application downtime and latency.**



AWS Shield

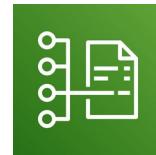
AWS cost management service category



Photo by Alexander Mils on Unsplash



AWS cost management
services



AWS Cost and
Usage Report



AWS Budgets



AWS Cost
Explorer

Management and governance service category

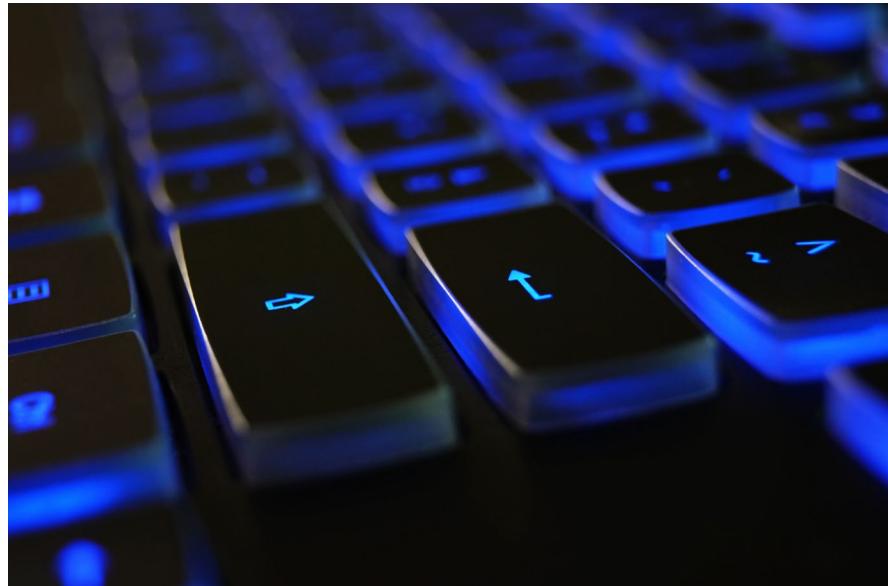


Photo by Marta Branco from Pexels



AWS management and governance services



AWS Management
Console



AWS Config



Amazon
CloudWatch



AWS Auto
Scaling



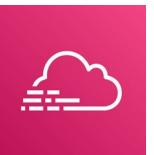
AWS Command
Line Interface



AWS Trusted
Advisor



AWS Well-
Architected Tool



AWS
CloudTrail

Module wrap-up

Module 1: Cloud Concepts Overview

Module 3: AWS Global Infrastructure



Additional resources

- Cloud computing with AWS website: <https://aws.amazon.com/what-is-aws/>
- Overview of Amazon Web Services whitepaper:
<https://d1.awsstatic.com/whitepapers/aws-overview.pdf>
- An Overview of the AWS Cloud Adoption Framework whitepaper:
[https://d1.awsstatic.com/whitepapers/aws cloud adoption framework.pdf](https://d1.awsstatic.com/whitepapers/aws_cloud_adoption_framework.pdf)
- 6 Strategies for Migrating Applications to the Cloud AWS Cloud Enterprise Strategy blog post: <https://aws.amazon.com/blogs/enterprise-strategy/6-strategies-for-migrating-applications-to-the-cloud/>

Thank you

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