

AWS Academy Cloud Foundations

# Module 4: AWS Cloud Security



## Topics

- AWS shared responsibility model
- AWS Identity and Access Management (IAM)
- Securing a new AWS account
- Securing accounts
- Securing data on AWS
- Working to ensure compliance

## Activities

- AWS shared responsibility model activity

## Demo

- Recorded demonstration of IAM

## Lab

- Introduction to AWS IAM



**Knowledge check**

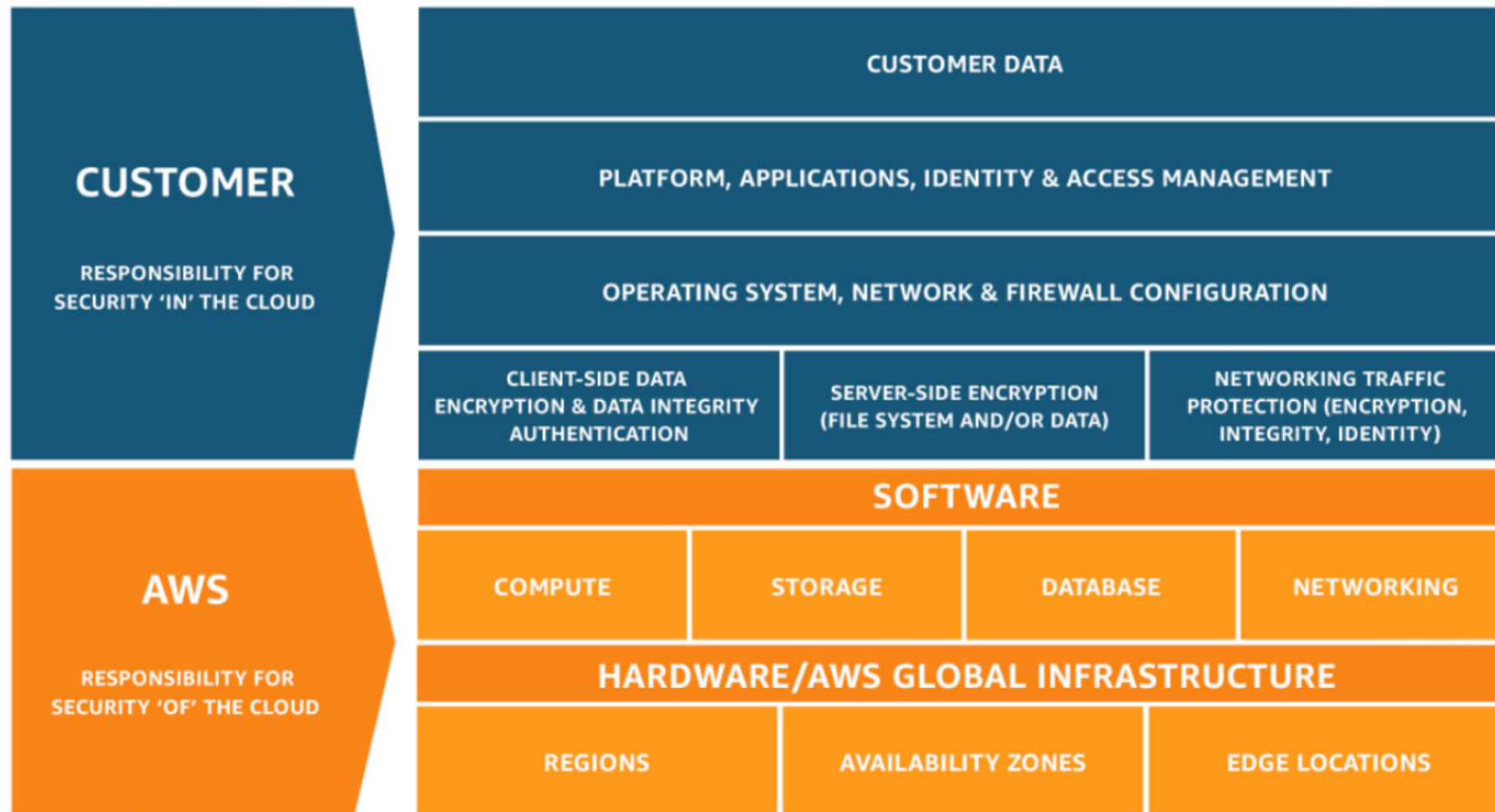
After completing this module, you should be able to:

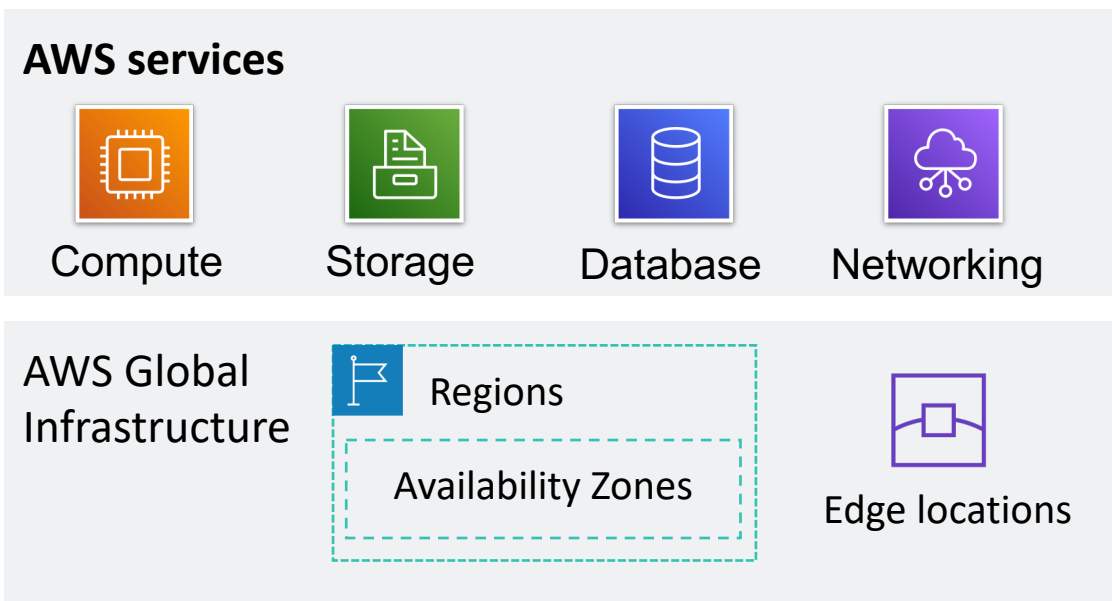
- Recognize the shared responsibility model
- Identify the responsibility of the customer and AWS
- Recognize IAM users, groups, and roles
- Describe different types of security credentials in IAM
- Identify the steps to securing a new AWS account
- Explore IAM users and groups
- Recognize how to secure AWS data
- Recognize AWS compliance programs

## Module 4: AWS Cloud Security

# Section 1: AWS shared responsibility model

# AWS shared responsibility model

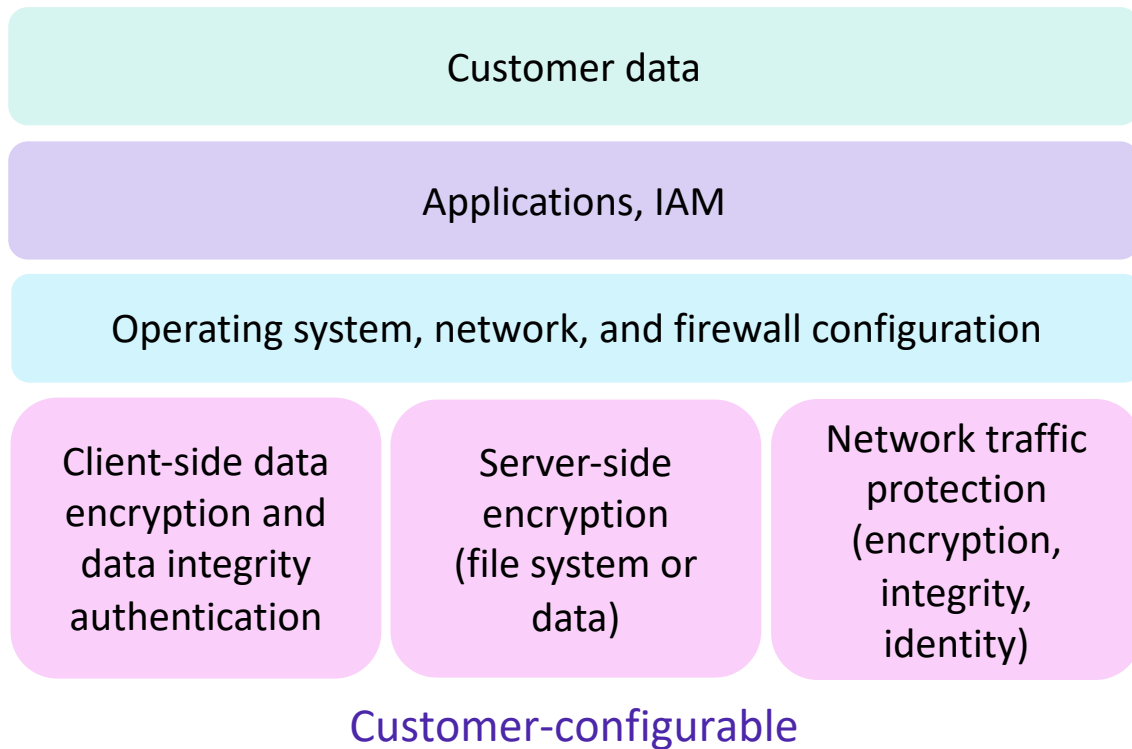




## AWS responsibilities:

- Physical security of data centers
  - Controlled, need-based access
- Hardware and software infrastructure
  - Storage decommissioning, host operating system (OS) access logging, and auditing
- Network infrastructure
  - Intrusion detection
- Virtualization infrastructure
  - Instance isolation





## Customer responsibilities:

- Amazon Elastic Compute Cloud (Amazon EC2) instance **operating system**
  - Including patching, maintenance
- **Applications**
  - Passwords, role-based access, etc.
- **Security group** configuration
- OS or host-based **firewalls**
  - Including intrusion detection or prevention systems
- **Network** configurations
- Account management
  - Login and permission settings for each user

# Service characteristics and security responsibility

## Example services managed by the customer



Amazon EC2



Amazon Elastic Block Store (Amazon EBS)



Amazon Virtual Private Cloud (Amazon VPC)

## Example services managed by AWS



AWS Lambda



Amazon Relational Database Service (Amazon RDS)



AWS Elastic Beanstalk

## 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



## SaaS examples



AWS Trusted  
Advisor



AWS Shield



Amazon Chime

## 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 application programming interface (API)
- Customers do not need to manage the infrastructure that supports the service

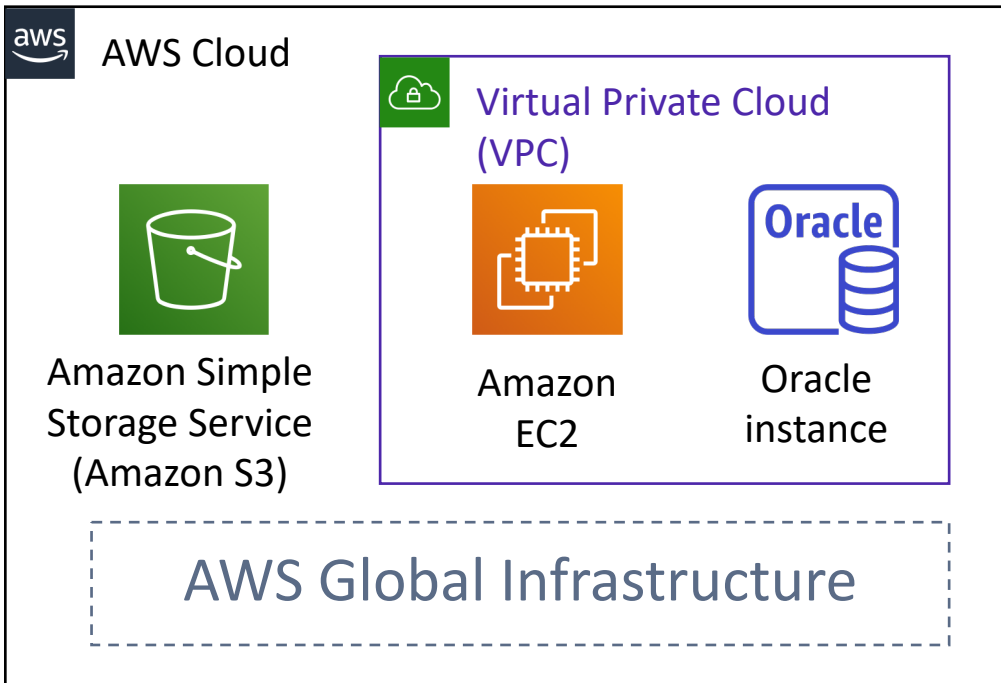
# Activity: AWS shared responsibility model



Photo by Pixabay from Pexels.

# Activity: Scenario 1 of 2

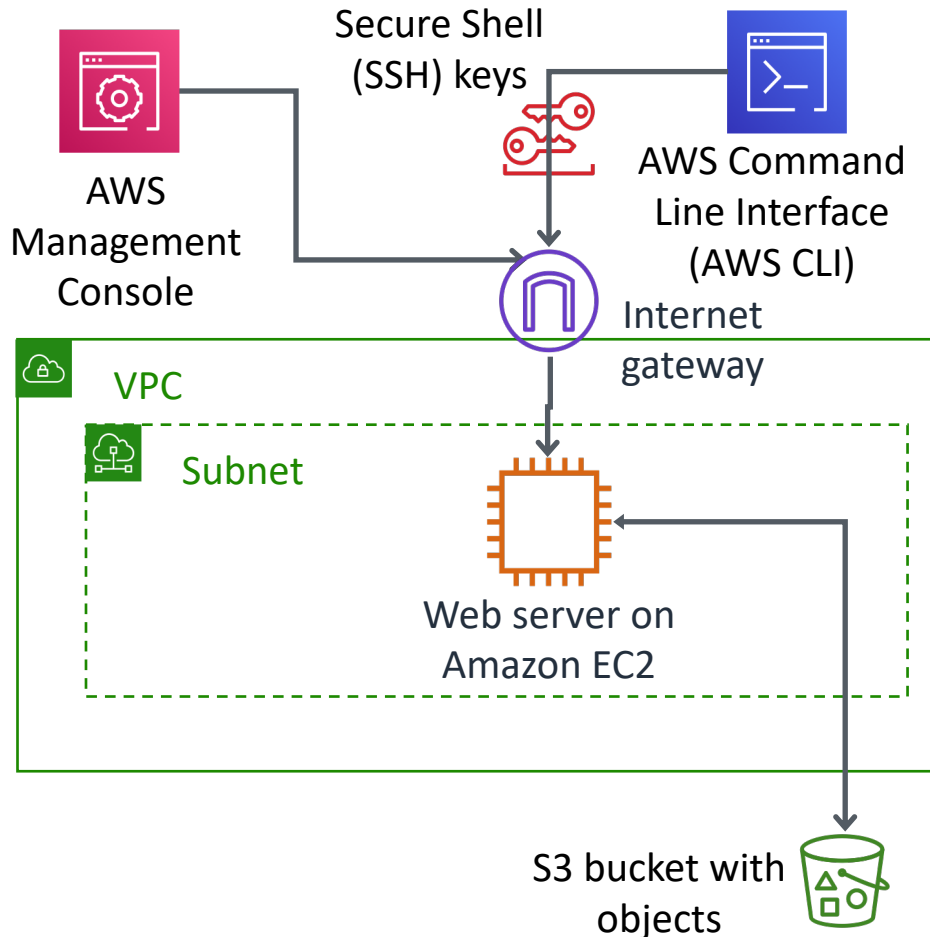
## Consider this deployment. Who is responsible – AWS or the customer?



1. Upgrades and patches to the operating system on the EC2 instance?
  - **ANSWER: The customer**
2. Physical security of the data center?
  - **ANSWER: AWS**
3. Virtualization infrastructure?
  - **ANSWER: AWS**
4. EC2 security group settings?
  - **ANSWER: The customer**
5. Configuration of applications that run on the EC2 instance?
  - **ANSWER: The customer**
6. Oracle upgrades or patches If the Oracle instance runs as an Amazon RDS instance?
  - **ANSWER: AWS**
7. Oracle upgrades or patches If Oracle runs on an EC2 instance?
  - **ANSWER: The customer**
8. S3 bucket access configuration?
  - **ANSWER: The customer**

# Activity: Scenario 2 of 2

## Consider this deployment. Who is responsible – AWS or the customer?



1. Ensuring that the AWS Management Console is not hacked?
  - **ANSWER: AWS**
2. Configuring the subnet?
  - **ANSWER: The customer**
3. Configuring the VPC?
  - **ANSWER: The customer**
4. Protecting against network outages in AWS Regions?
  - **ANSWER: AWS**
5. Securing the SSH keys
  - **ANSWER: The customer**
6. Ensuring network isolation between AWS customers' data?
  - **ANSWER: AWS**
7. Ensuring low-latency network connection between the web server and the S3 bucket?
  - **ANSWER: AWS**
8. Enforcing multi-factor authentication for all user logins?
  - **ANSWER: The customer**

# Section 1 key takeaways



- AWS and the customer share security responsibilities:
  - AWS is responsible for security **of** the cloud
  - Customer is responsible for security **in** the cloud
- **AWS is responsible for protecting the infrastructure**—including hardware, software, networking, and facilities—that run AWS Cloud services
- For services that are categorized as infrastructure as a service (IaaS), the **customer is responsible for performing necessary security configuration and management tasks**
  - For example, guest OS updates and security patches, firewall, security group configurations

Module 4: AWS Cloud Security

## Section 2: AWS Identity and Access Management (IAM)

- 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)



**IAM user**

A **person** or **application** that can authenticate with an AWS account.



**IAM group**

A **collection of IAM users** that are granted identical authorization.



**IAM policy**

The document that defines **which resources can be accessed** and the **level of access** to each resource.



**IAM role**

Useful mechanism to grant a set of permissions for making AWS service requests.



# Authenticate as an IAM user to gain access

When you define an **IAM user**, you select what *types of access* the user is permitted to use.

## *Programmatic access*

- Authenticate using:
  - Access key ID
  - Secret access key
- Provides AWS CLI and AWS SDK access



AWS CLI



AWS Tools and SDKs

## *AWS Management Console access*

- Authenticate using:
  - 12-digit Account ID *or* alias
  - IAM user name
  - IAM password
- If enabled, **multi-factor authentication (MFA)** prompts for an authentication code.



AWS Management Console

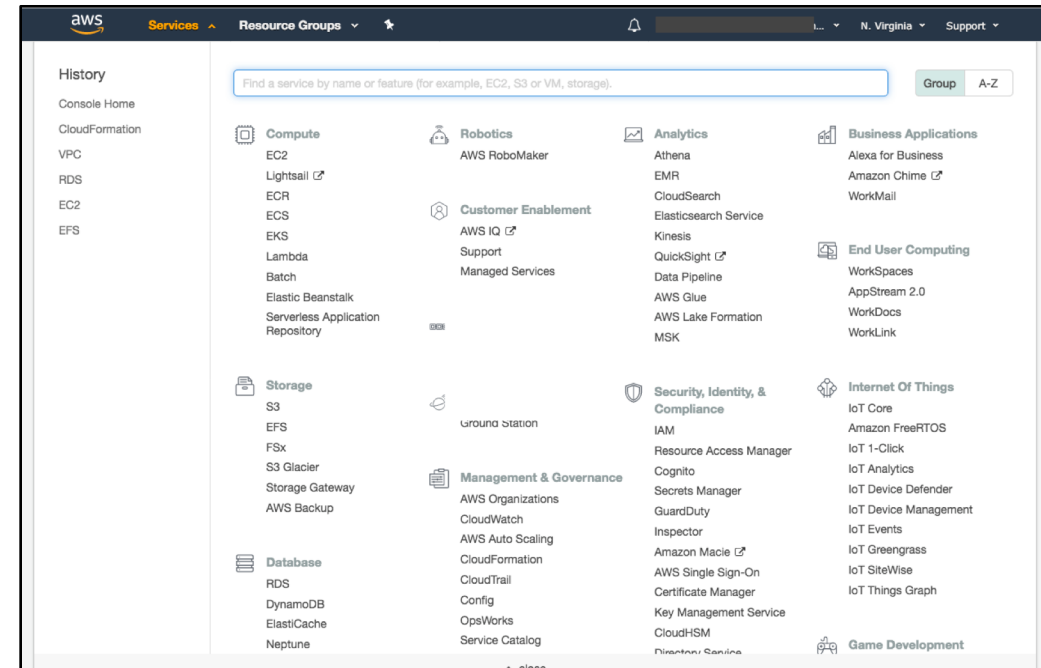
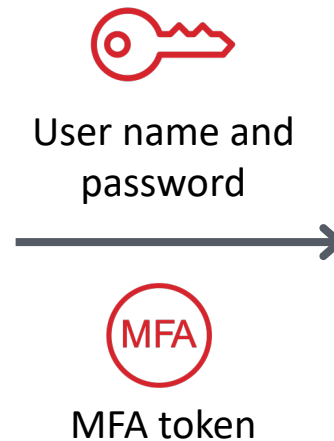
- MFA provides increased security.
- In addition to **user name** and **password**, MFA requires a unique **authentication code** to access AWS services.

Account:

User Name:

Password:

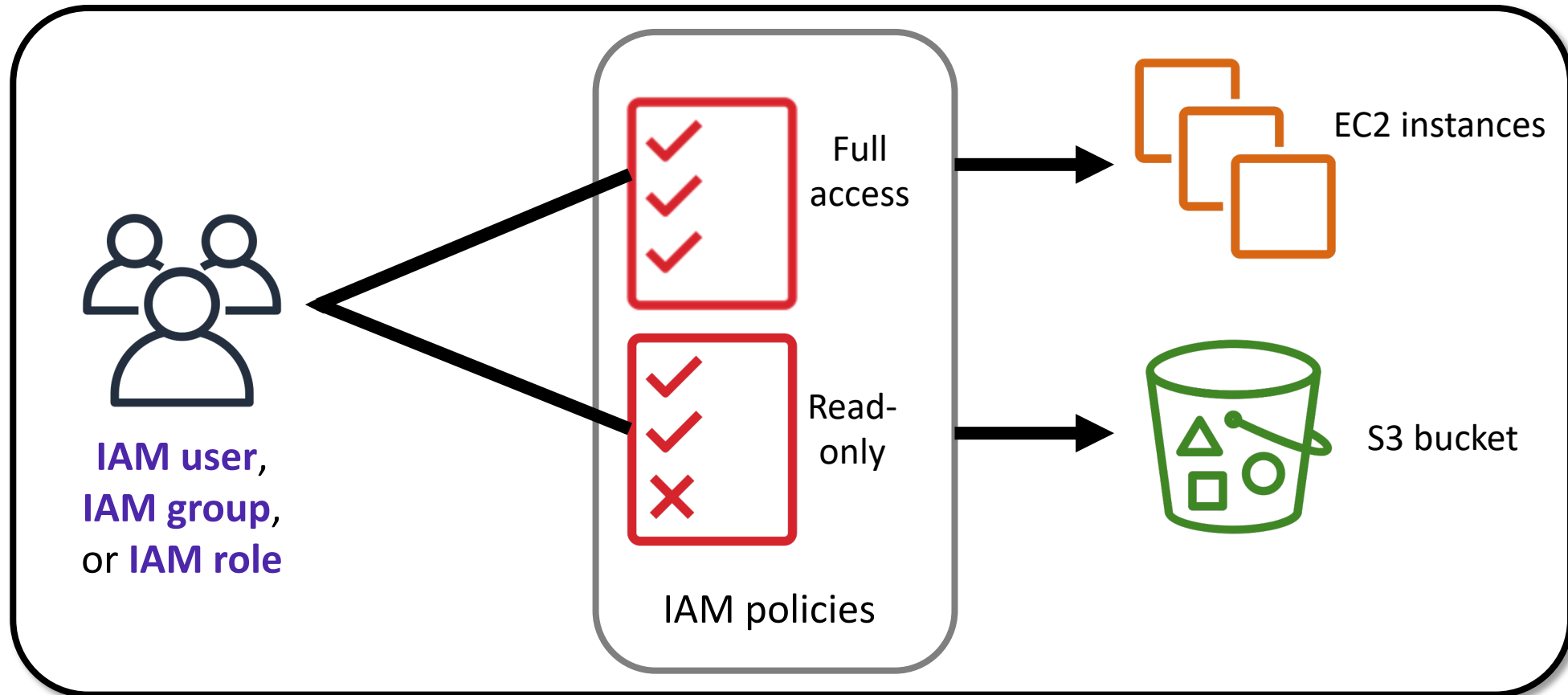
MFA users, enter your code on the next screen.



*AWS Management Console*

# Authorization: What actions are permitted

*After the user or application is connected to the AWS account, what are they allowed to do?*



- Assign permissions by creating an IAM policy.
- Permissions determine **which resources and operations** are allowed:
  - All permissions are implicitly denied by default.
  - If something is explicitly denied, it is never allowed.

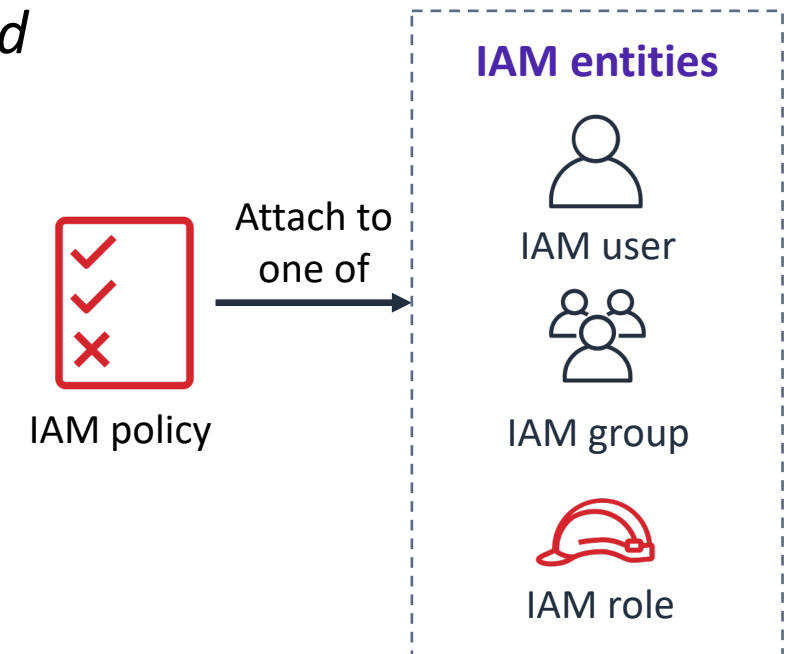
**Best practice:** Follow the **principle of least privilege**.



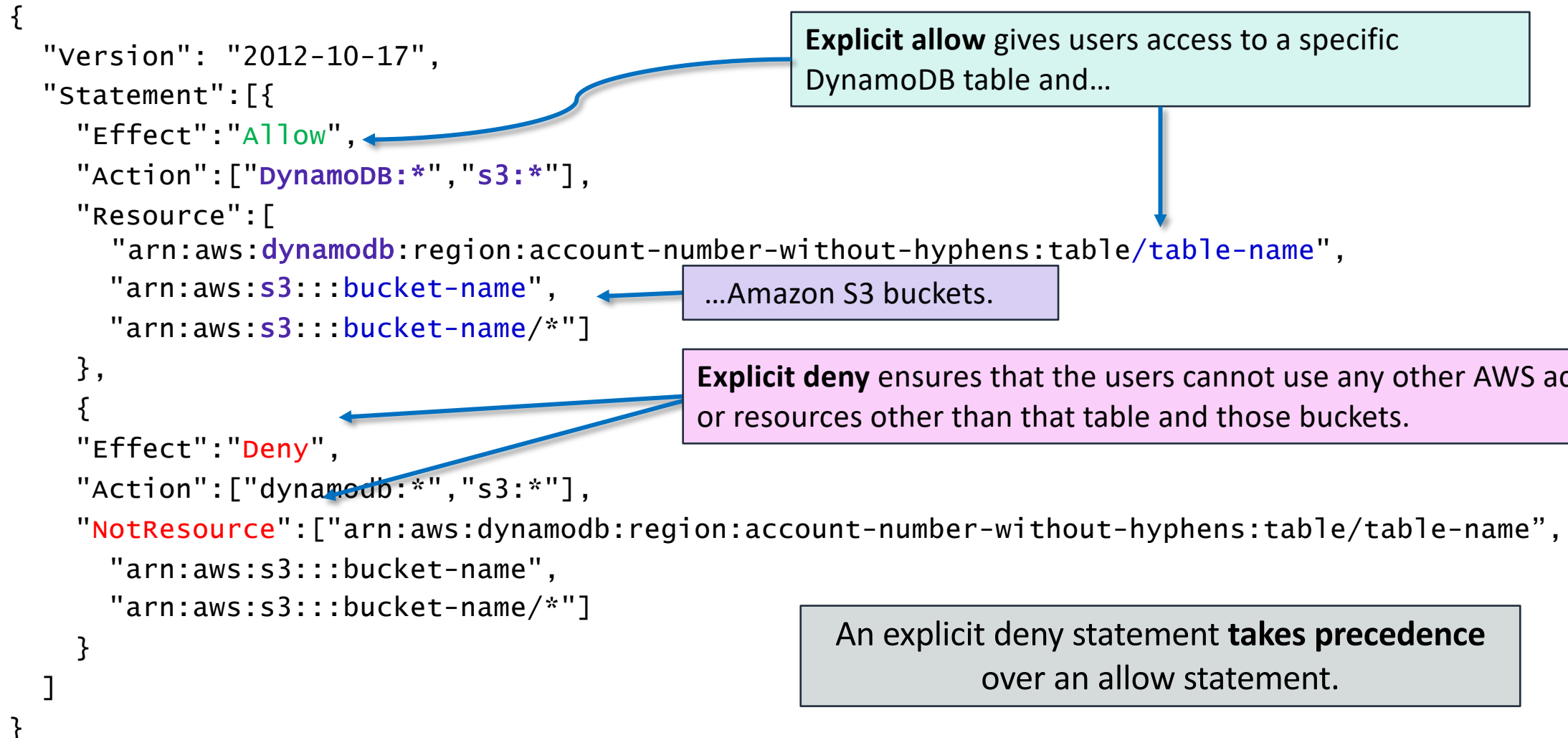
**IAM  
permissions**

Note: The scope of IAM service configurations is **global**. Settings apply across all AWS Regions.

- **An IAM policy is a document that defines permissions**
  - Enables fine-grained access control
- Two types of policies – *identity-based* and *resource-based*
- **Identity-based** policies –
  - Attach a policy to any IAM entity
    - An **IAM user**, an **IAM group**, or an **IAM role**
  - Policies specify:
    - Actions that **may** be performed by the entity
    - Actions that **may not** be performed by the entity
  - A single *policy* can be attached to multiple *entities*
  - A single *entity* can have multiple *policies* attached to it
- **Resource-based** policies
  - Attached to a resource (such as an S3 bucket)

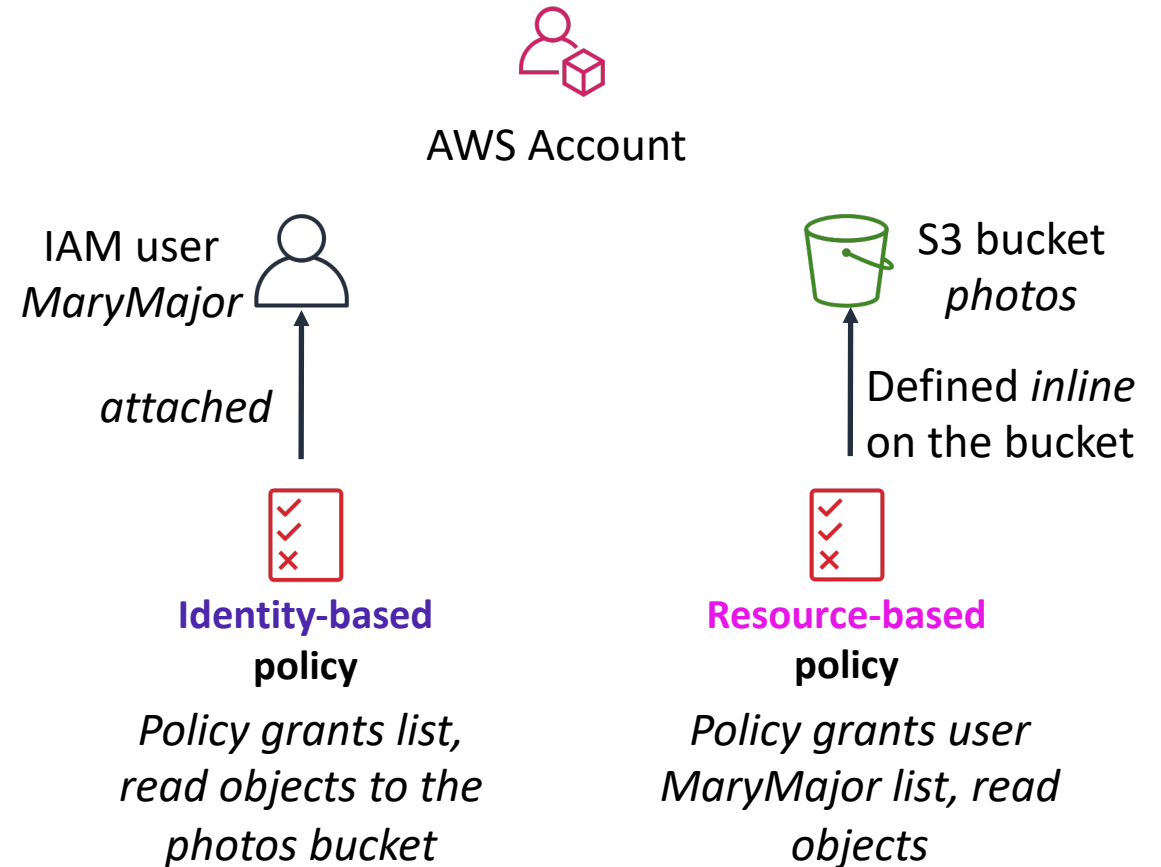


# IAM policy example

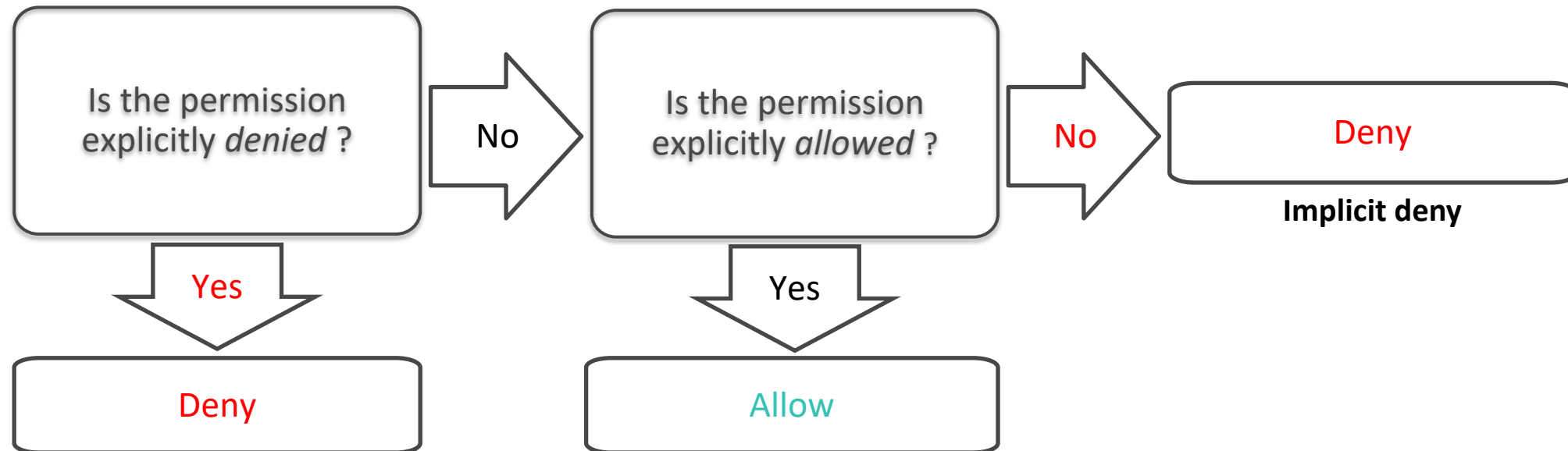


# Resource-based policies

- *Identity-based policies* are attached to a user, group, or role
- **Resource-based policies** are attached to a resource (*not* to a user, group or role)
- Characteristics of resource-based policies –
  - Specifies who has access to the resource and what actions they can perform on it
  - The policies are *inline* only, not managed
- Resource-based policies are supported only by some AWS services

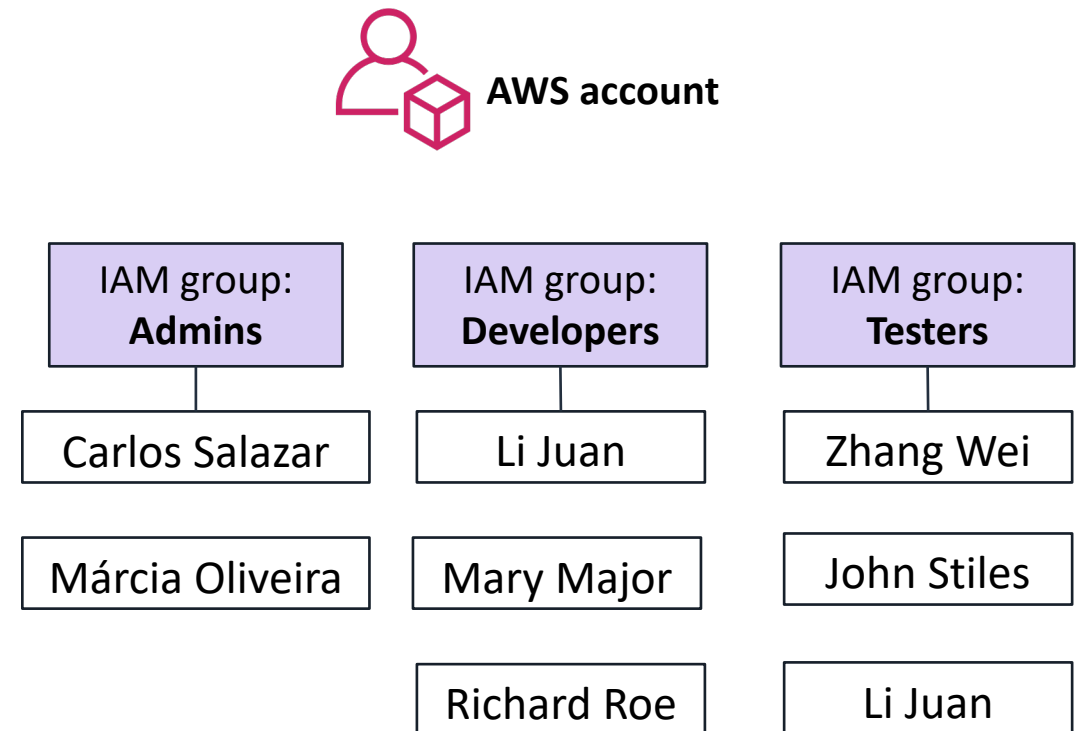


How IAM determines permissions:





- An **IAM group** is a collection of IAM users
- A group is used to grant the same permissions to multiple users
  - Permissions granted by attaching IAM *policy* or policies to the group
- A user can belong to multiple groups
- There is no default group
- Groups cannot be nested



- An **IAM role** is an IAM identity with specific permissions
- Similar to an IAM user
  - Attach permissions policies to it
- Different from an IAM user
  - Not uniquely associated with one person
  - Intended to be *assumable* by a **person**, **application**, or **service**
- Role provides *temporary* security credentials
- Examples of how IAM roles are used to **delegate** access –
  - Used by an IAM user in the same AWS account as the role
  - Used by an AWS service—such as Amazon EC2—in the same account as the role
  - Used by an IAM user in a different AWS account than the role



IAM role

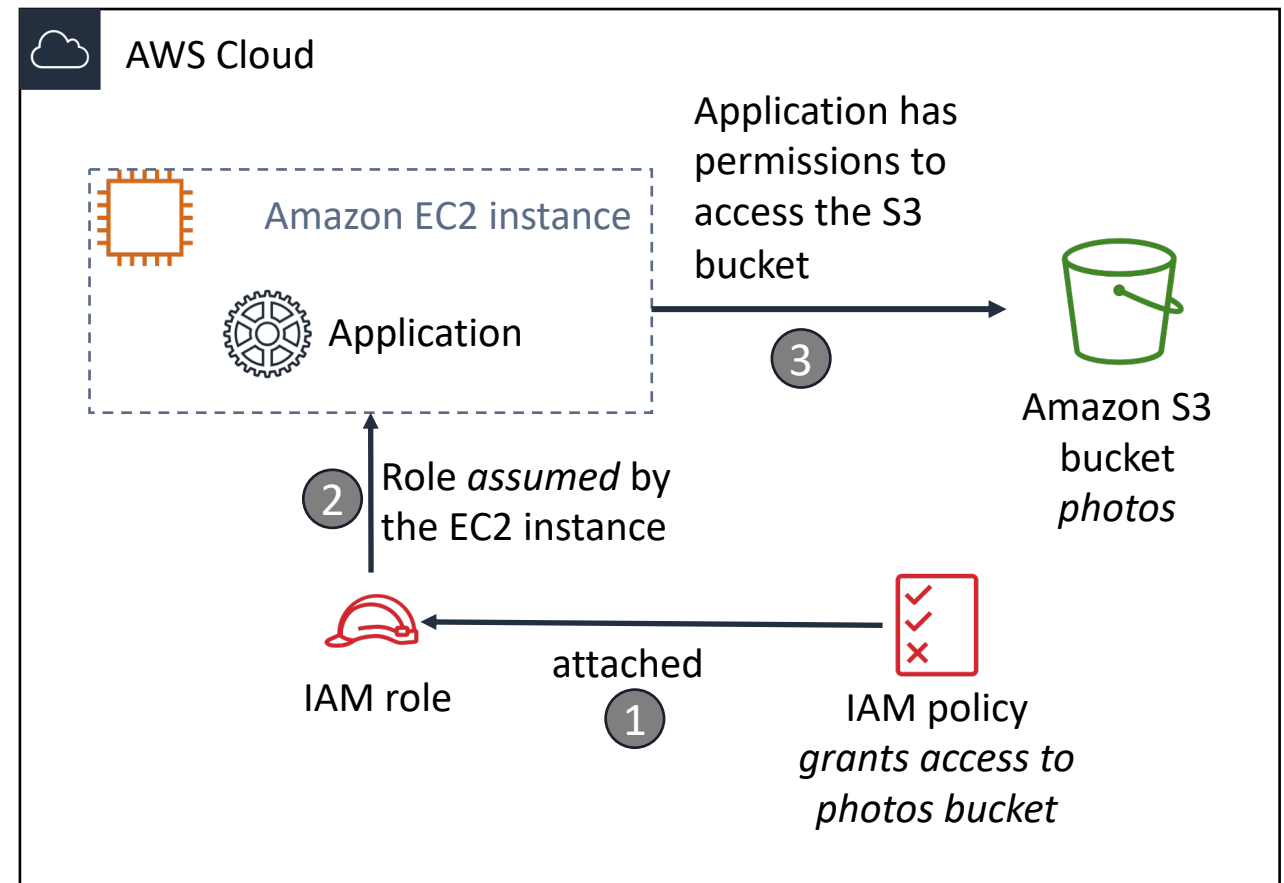
# Example use of an IAM role

## Scenario:

- An application that runs on an EC2 instance needs access to an S3 bucket

## Solution:

- Define an IAM policy that grants access to the S3 bucket.
- Attach the policy to a role
- Allow the EC2 instance to assume the role



# Section 2 key takeaways



- **IAM policies** are constructed with JavaScript Object Notation (JSON) and define permissions.
  - IAM policies can be attached to any **IAM entity**.
  - Entities are IAM users, IAM groups, and IAM roles.
- An **IAM user** provides a way for a person, application, or service to authenticate to AWS.
- An **IAM group** is a simple way to attach the same policies to multiple users.
- An **IAM role** can have permissions policies attached to it, and can be used to delegate temporary access to users or applications.

# Recorded demo: IAM



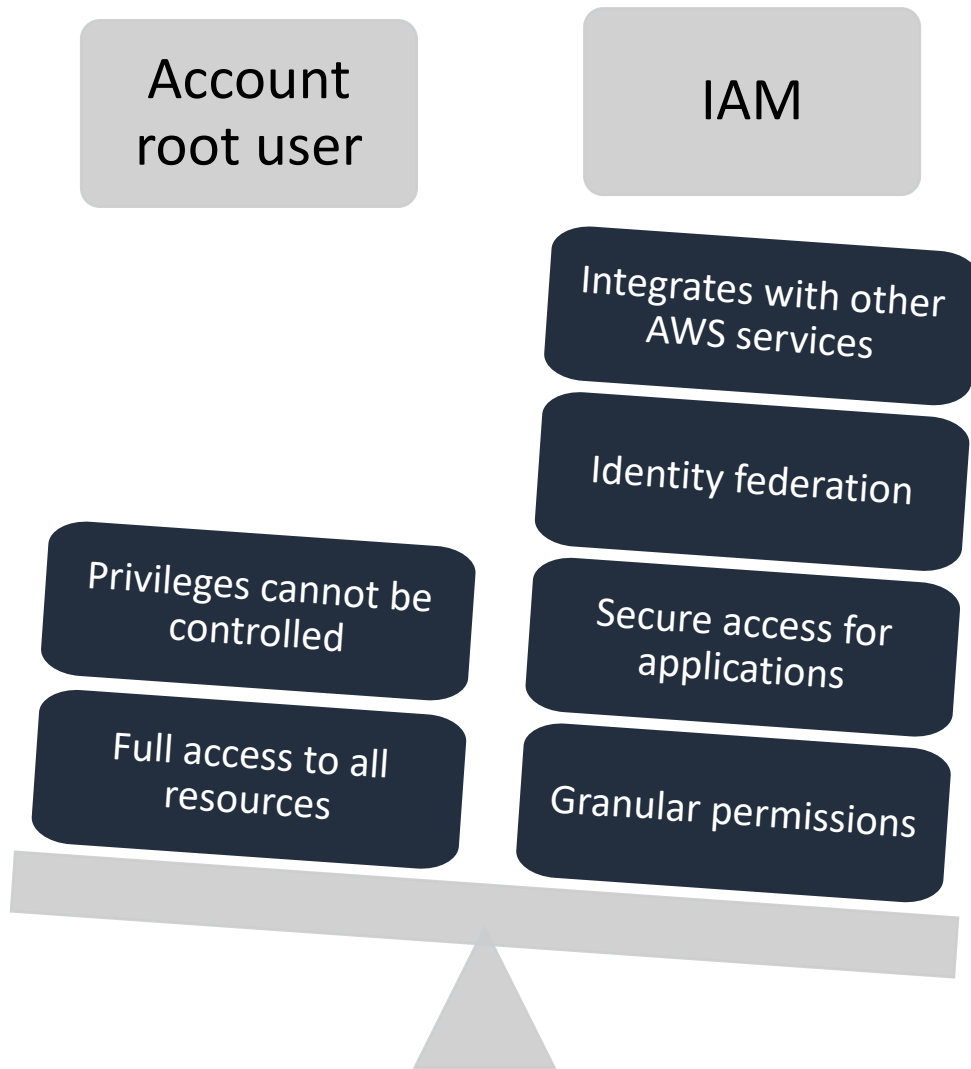
## Set up demo

AWS Identity and Access  
Management (IAM)

Module 4: AWS Cloud Security

# Section 3: Securing a new AWS account

# AWS account root user access versus IAM access



- **Best practice:** Do not use the AWS account root user except when necessary.
  - Access to the **account root user** requires logging in with the *email address* (and password) that you used to create the account.
- Example actions that can only be done with the account root user:
  - Update the account root user password
  - Change the AWS Support plan
  - Restore an IAM user's permissions
  - Change account settings (for example, contact information, allowed Regions)

## Step 1: Stop using the account root user as soon as possible.

- The account root user has unrestricted access to all your resources.
- To stop using the account root user:
  1. While you are logged in as the account root user, **create an IAM user** for yourself. Save the access keys if needed.
  2. Create an IAM group, give it full administrator permissions, and add the IAM user to the group.
  3. Disable and **remove your account root user access keys**, if they exist.
  4. **Enable a password policy** for users.
  5. Sign in with your new IAM user credentials.
  6. Store your account root user credentials in a secure place.



## Step 2: Enable multi-factor authentication (MFA).

- Require MFA for your **account root user** and for **all IAM users**.
- You can also use MFA to control access to AWS service APIs.
- Options for retrieving the MFA token –
  - Virtual MFA-compliant applications:
    - Google Authenticator.
    - Authy Authenticator (Windows phone app).
  - U2F security key devices:
    - For example, YubiKey.
  - Hardware MFA options:
    - Key fob or display card offered by [Gemalto](#).



MFA token

## Step 3: Use AWS CloudTrail.

- CloudTrail tracks user activity on your account.
  - Logs all API requests to resources in all supported services your account.
  - **Basic AWS CloudTrail event history is enabled by default** and is free.
    - It contains all management event data on latest 90 days of account activity.
- To access CloudTrail –
  1. Log in to the **AWS Management Console** and choose the **CloudTrail** service.
  2. Click **Event history** to view, filter, and search the last 90 days of events.
- **To enable logs beyond 90 days and enable specified event alerting, create a trail.**
  1. From the CloudTrail Console trails page, click **Create trail**.
  2. Give it a name, apply it to all Regions, and create a new Amazon S3 bucket for log storage.
  3. Configure access restrictions on the S3 bucket (for example, only admin users should have access).

## Step 4: Enable a billing report, such as the AWS Cost and Usage Report.

- Billing reports provide information about your use of AWS resources and estimated costs for that use.
- AWS delivers the reports to an Amazon S3 bucket that you specify.
  - Report is updated at least once per day.
- The **AWS Cost and Usage Report** tracks your AWS usage and provides estimated charges associated with your AWS account, either by the hour or by the day.

# Section 3 key takeaways



Best practices to secure an AWS account:

- **Secure** logins with multi-factor authentication (MFA).
- **Delete** account root user **access keys**.
- **Create** individual **IAM users** and grant permissions according to the principle of least privilege.
- **Use groups** to assign permissions to IAM users.
- **Configure** a **strong password policy**.
- **Delegate** using **roles** instead of sharing credentials.
- **Monitor** account activity by using AWS CloudTrail.

# Lab 1: Introduction to IAM

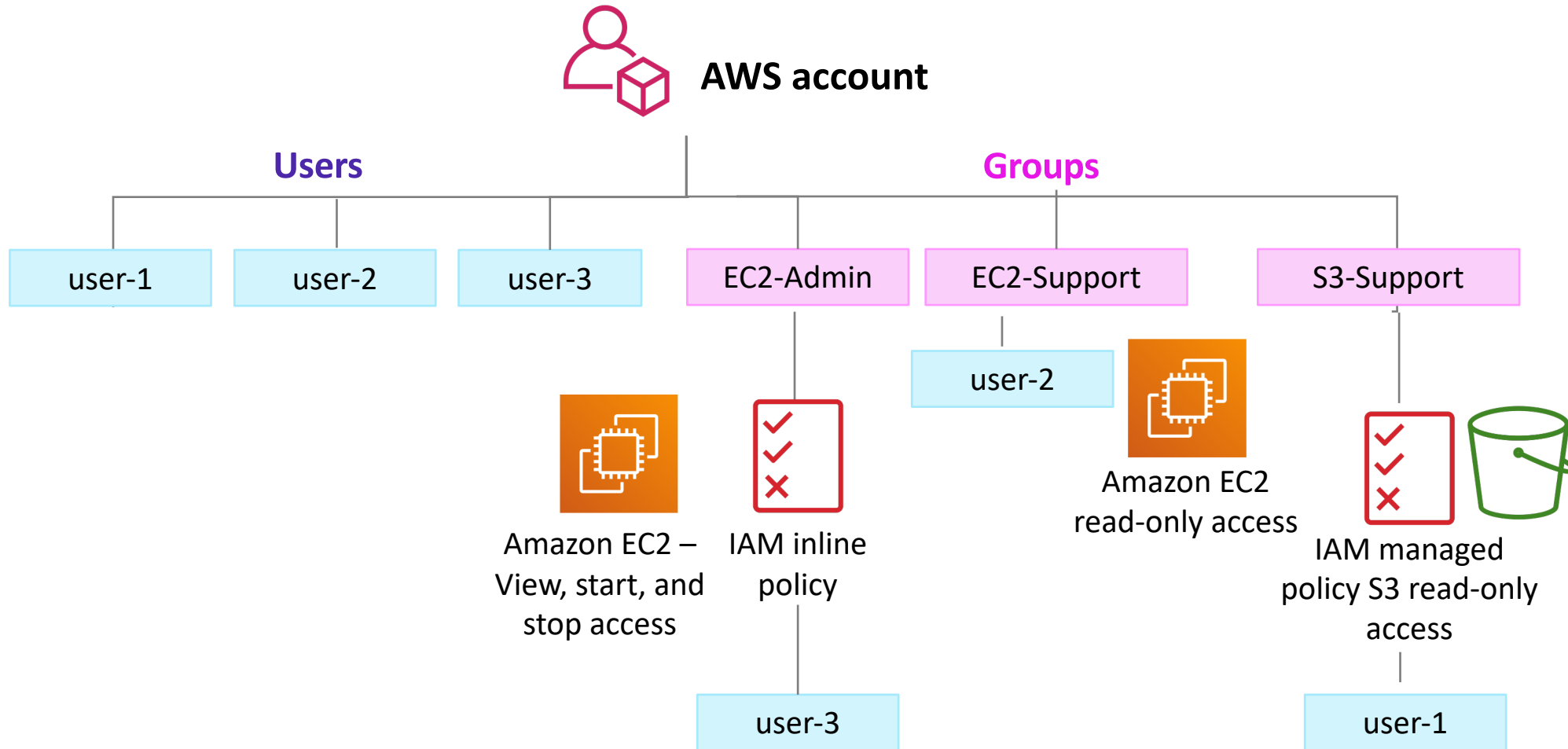


- Task 1: Explore the Users and Groups.
- Task 2: Add Users to Groups.
- Task 3: Sign-In and Test Users.



AWS Identity and Access Management (IAM)

# Lab 1: Final product





~ 40 minutes



# Begin Lab 1: Introduction to AWS IAM



# Lab debrief: Key takeaways



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# Section 4: Securing accounts

- **AWS Organizations** enables you to consolidate multiple AWS accounts so that you centrally manage them.



**AWS Organizations**

- **Security features** of AWS Organizations:
  - **Group AWS accounts into organizational units (OUs)** and attach different access policies to each OU.
  - **Integration and support for IAM**
    - Permissions to a user are the intersection of what is allowed by AWS Organizations and what is granted by IAM in that account.
  - **Use service control policies** to establish control over the AWS services and API actions that each AWS account can access

- **Service control policies (SCPs)** offer centralized control over accounts.
  - Limit permissions that are available in an account that is part of an organization.
- Ensures that accounts comply with access control guidelines.
- SCPs are *similar* to IAM permissions policies –
  - They use similar syntax.
  - However, an SCP never grants permissions.
  - Instead, SCPs **specify the maximum permissions** for an organization.

## AWS Key Management Service (AWS KMS) features:

- Enables you to **create and manage encryption keys**
- Enables you to control the use of encryption across AWS services and in your applications.
- Integrates with AWS CloudTrail to log all key usage.
- Uses hardware security modules (HSMs) that are validated by Federal Information Processing Standards (FIPS) 140-2 to protect keys



AWS Key Management  
Service (AWS KMS)

## 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** 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

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# Section 5: Securing data on AWS

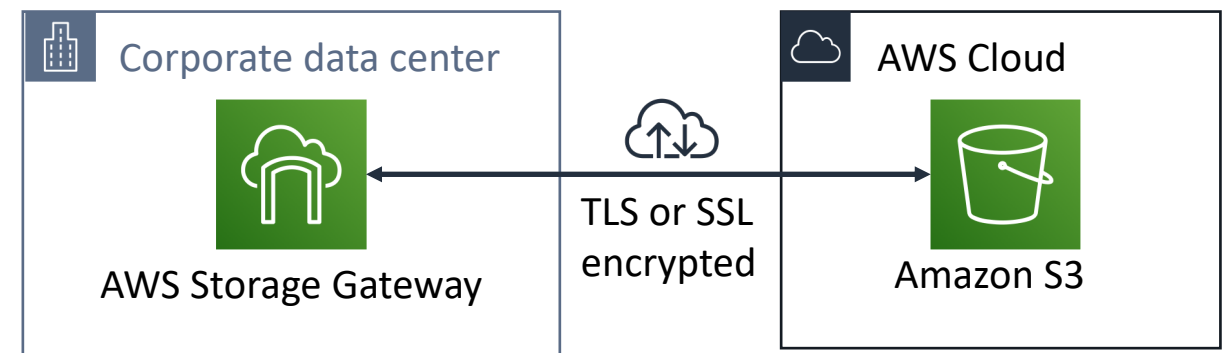
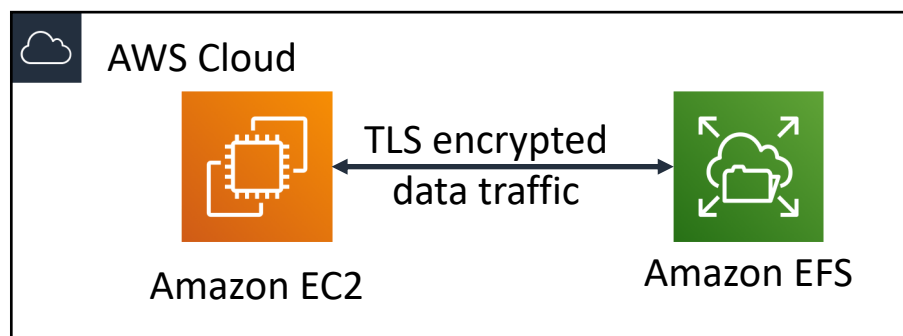


- **Encryption** encodes data with a **secret key**, which makes it unreadable
  - Only those who have the secret key can decode the data
  - **AWS KMS** can manage your secret keys
- AWS supports encryption of **data at rest**
  - Data at rest = Data stored physically (on disk or on tape)
  - You can encrypt data stored in any service that is supported by AWS KMS, including:
    - Amazon S3
    - Amazon EBS
    - Amazon Elastic File System (Amazon EFS)
    - Amazon RDS managed databases



# Encryption of data *in transit*

- Encryption of **data in transit** (data moving across a network)
  - **Transport Layer Security (TLS)**—formerly SSL—is an open standard protocol
  - **AWS Certificate Manager** provides a way to manage, deploy, and renew TLS or SSL certificates
- Secure HTTP (HTTPS) creates a secure tunnel
  - Uses TLS or SSL for the bidirectional exchange of data
- **AWS services support data in transit encryption.**
  - Two examples:



- Newly created S3 buckets and objects are **private** and **protected** by default.
- When use cases require sharing data objects on Amazon S3 –
  - It is essential to manage and control the data access.
  - Follow the **permissions that follow the principle of least privilege** and consider using Amazon S3 encryption.
- Tools and options for controlling access to S3 data include –
  - [Amazon S3 Block Public Access](#) feature: Simple to use.
  - IAM policies: A good option when the user can authenticate using IAM.
  - [Bucket policies](#)
  - [Access control lists](#) (ACLs): A legacy access control mechanism.
  - [AWS Trusted Advisor](#) bucket permission check: A free feature.

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# Section 6: Working to ensure compliance

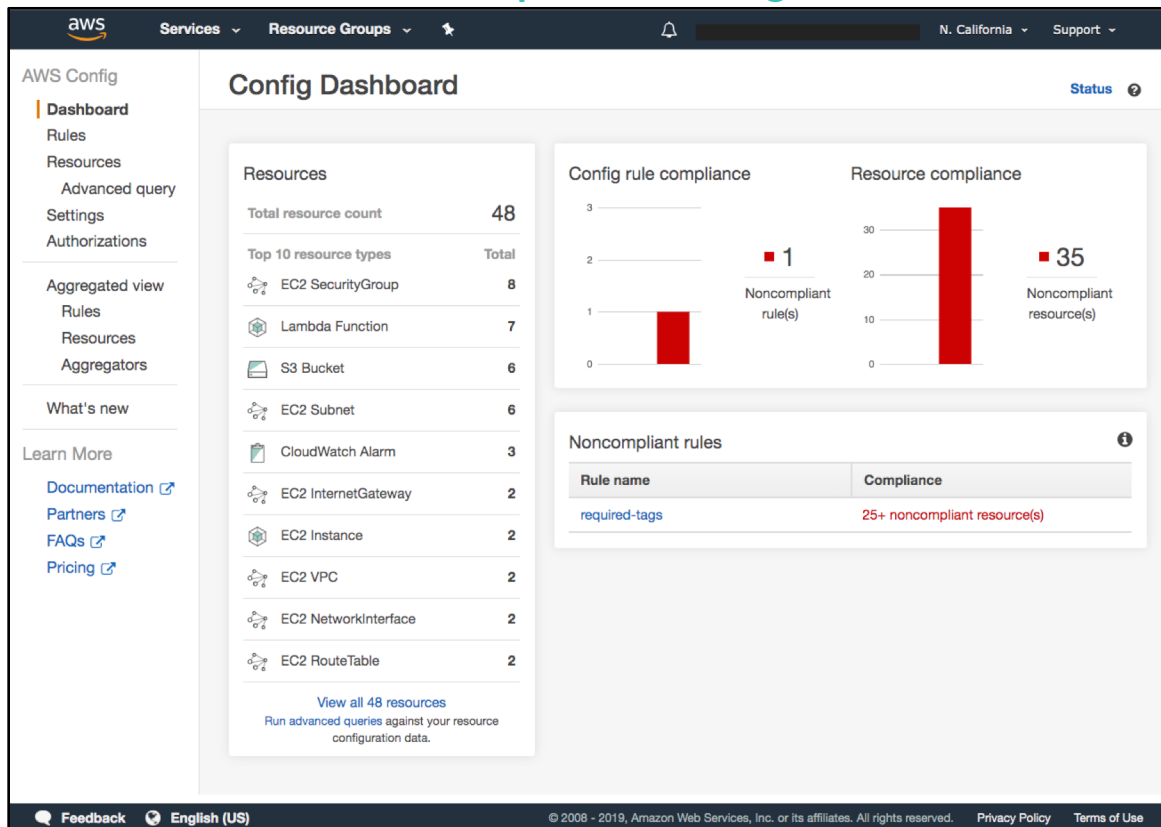
- Customers are subject to many different security and compliance regulations and requirements.
- **AWS engages with certifying bodies and independent auditors to provide customers with detailed information about the policies, processes, and controls that are established and operated by AWS.**
- Compliance programs can be broadly categorized –
  - **Certifications and attestations**
    - Assessed by a third-party, independent auditor
    - Examples: **ISO** 27001, 27017, 27018, and ISO/IEC 9001
  - **Laws, regulations, and privacy**
    - AWS provides security features and legal agreements to support compliance
    - Examples: EU **General Data Protection Regulation (GDPR)**, HIPAA
  - **Alignments and frameworks**
    - Industry- or function-specific security or compliance requirements
    - Examples: Center for Internet Security (CIS), EU-US Privacy Shield certified





AWS Config

## Example AWS Config Dashboard view



- Assess, audit, and evaluate the configurations of AWS resources.
- Use for continuous monitoring of configurations.
- Automatically evaluate *recorded* configurations versus *desired* configurations.
- Review configuration changes.
- View detailed configuration histories.
- Simplify compliance auditing and security analysis.



AWS Artifact

- **Is a resource for compliance-related information**
- Provide access to security and compliance reports, and select online agreements
- Can access example downloads:
  - AWS ISO certifications
  - Payment Card Industry (PCI) and Service Organization Control (SOC) reports
- Access AWS Artifact directly from the AWS Management Console
  - Under **Security, Identify & Compliance**, click **Artifact**.

# Section 6 key takeaways



- **AWS security compliance programs** provide information about the policies, processes, and controls that are established and operated by AWS.
- **AWS Config** is used to assess, audit, and evaluate the configurations of AWS resources.
- **AWS Artifact** provides access to security and compliance reports.



Module 4: AWS Cloud Security

# Module wrap-up

In summary, in this module you learned how to:

- Recognize the shared responsibility model
- Identify the responsibility of the customer and AWS
- Recognize IAM users, groups, and roles
- Describe different types of security credentials in IAM
- Identify the steps to securing a new AWS account
- Explore IAM users and groups
- Recognize how to secure AWS data
- Recognize AWS compliance programs

# Complete the knowledge check



# Sample exam question

Which of the following is AWS's responsibility under the AWS shared responsibility model?

- A. Configuring third-party applications
- B. Maintaining physical hardware
- C. Securing application access and data
- D. Managing custom Amazon Machine Images (AMIs)

- [AWS Cloud Security](#) home page
- [AWS Security Resources](#)
- [AWS Security Blog](#)
- [Security Bulletins](#)
- [Vulnerability and Penetration testing](#)
- AWS Well-Architected Framework – [Security pillar](#)
- AWS documentation - [IAM Best Practices](#)

# Thank you

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