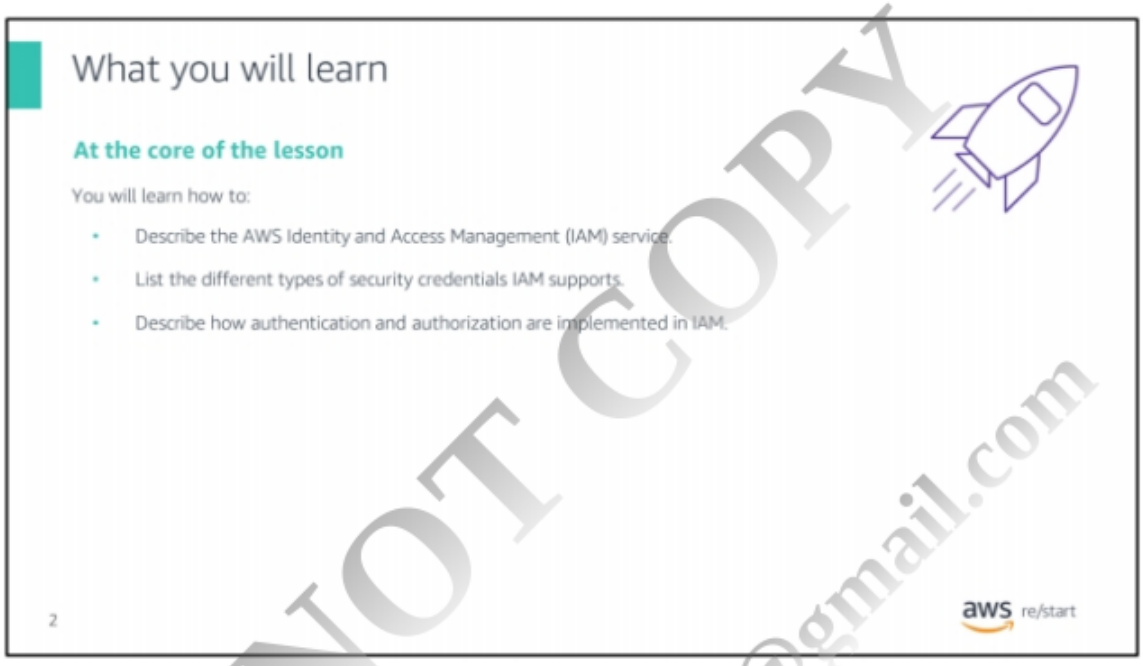
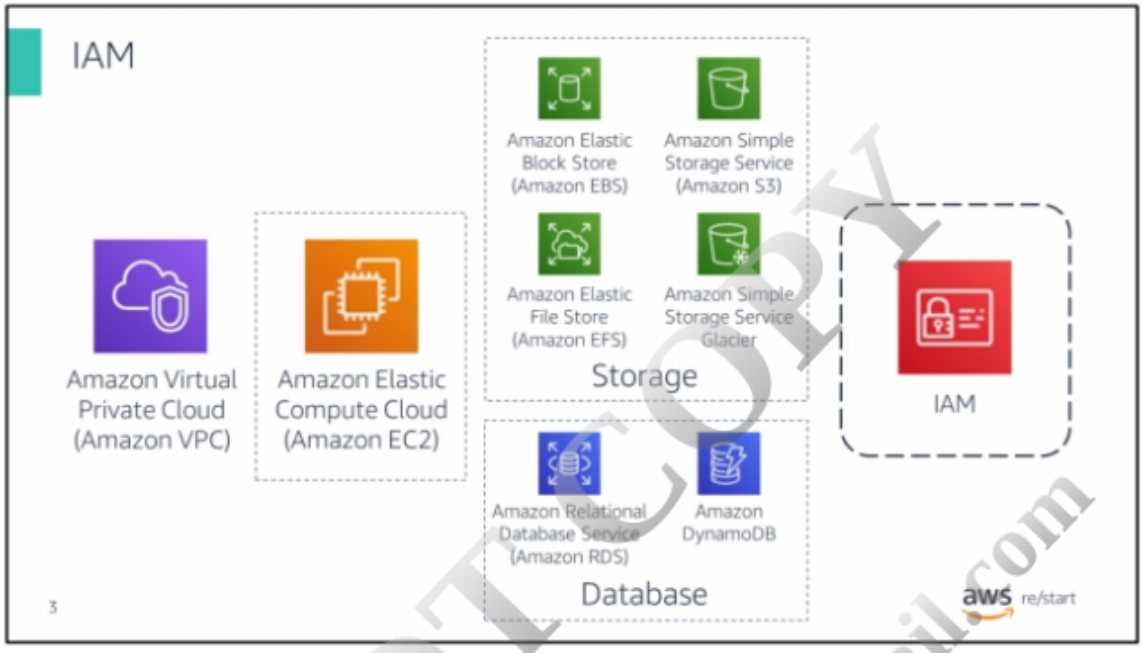
This module introduces AWS Identity and Access Management (IAM).

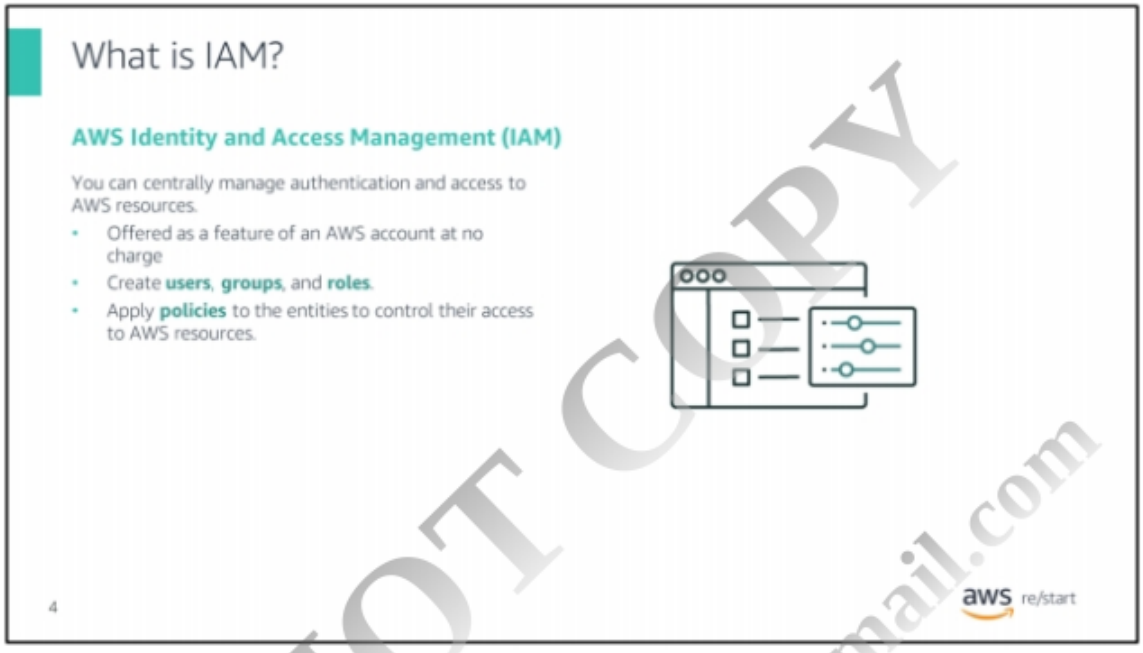


In this module, you will learn about AWS Identity and Access Management (IAM) users, groups, and roles. You will also learn about the different types of security credentials.



AWS Identity and Access Management (IAM) enables you to manage access to to AWS services and resources securely. Using IAM, you can create and manage AWS users and groups (to support authentication), and use permissions to allow and deny their access to AWS resources (to support authorization).

IAM uses access control concepts that you already know—such as users, groups, and permissions—so that you can specify which users can access specific services.



AWS Identity and Access Management (IAM) is a service that helps securely control access to AWS resources.

Authentication

Use IAM to configure *authentication*, which is the first step, because this controls *who* can access AWS resources. IAM is used for user authentication, and it is also used by applications and other AWS services for access.

Authorization

IAM is used to configure *authorization*, based on the user. Authorization determines *which* resources users can access and *what* they can do to or with those resources. Authorization is defined through the use of policies. A *policy* is an object in AWS that, when associated with an identity or resource, defines their permissions.

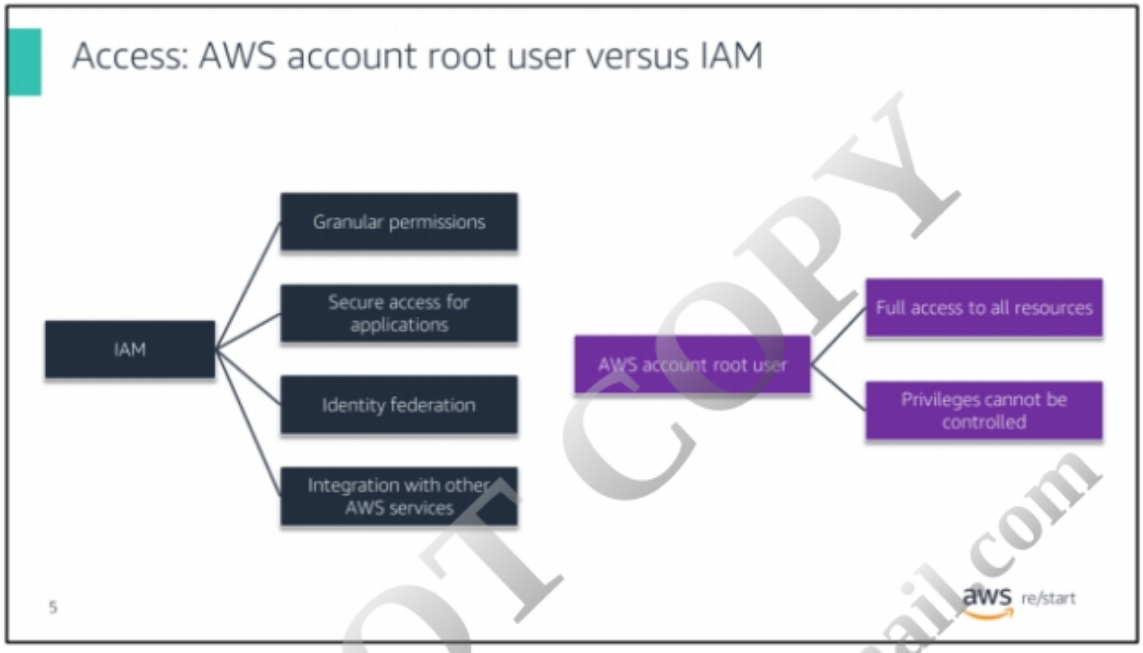
IAM reduces the need to share passwords or access keys when granting access rights to other people or systems. It also makes it easy to enable or disable a user's access.

Use IAM as the tool to centrally manage access regarding who can launch, configure, manage, and terminate the resources. It provides granular control over access permissions for users, systems, or other applications that might make programmatic calls to other AWS resources.

Use IAM to perform the following tasks:

- Manage the resources that can be accessed and the actions that can be performed on the resources. For example, who has permissions to terminate Amazon Elastic Compute Cloud (Amazon EC2) instances?

- Define required credentials based on context, such as:
    - Who can access which AWS service?
    - What is the user or system allowed to do with the service?



AWS account root user

When you first create an AWS account, you begin with a single sign-in identity. This entity has complete access to all AWS services and resources in the account and is called the *AWS account root user*. The account root user is accessed by signing in with the email address and password that you used to create the account.

AWS account root users have full access to all resources in the account. You cannot control the permissions of the AWS account root user credentials. Therefore, AWS strongly recommends that you not use AWS account root user credentials for day-to-day interactions with AWS.

IAM

Use IAM to create additional users and assign permissions to these users, following the principle of least privilege. With IAM, you can securely control access to AWS services and resources for users in your AWS account. For example, if you require administrator-level permissions, you can

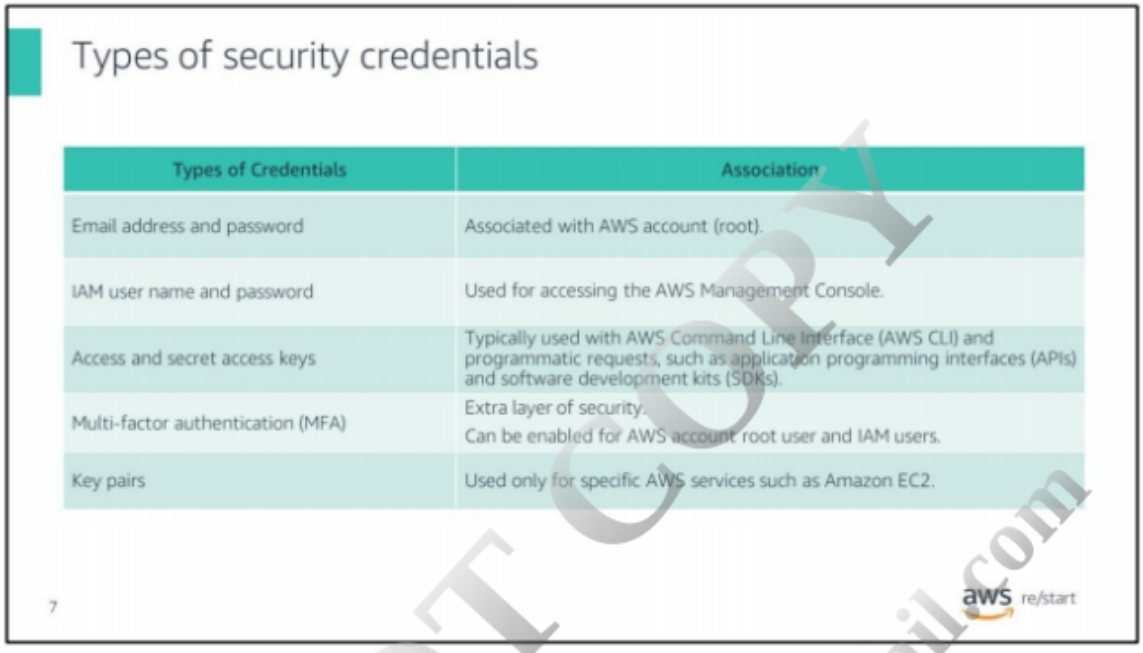
1. Create an IAM user.
2. Grant that user full access.
3. Use those credentials to interact with AWS.

Later, if you need to revoke or modify your permissions, you can delete or modify any policies that are associated with that IAM user.

Additionally, if you have multiple users that require access to your AWS account, you can create unique credentials for each user, and define who has access to which resources. In other words, you don't need to share credentials. For example, you can create IAM users with read-only access to resources in your AWS account and distribute those credentials to users who require read access.

The principle of least privilege is an important concept in computer security: determine what users (and roles) need to do and then craft policies that allow them to perform only those tasks.

When you create IAM policies, follow the standard security practice of granting least privilege. That is, grant only the permissions required to perform a task. Start with a minimum set of permissions and grant additional permissions as necessary. Doing so is more secure than starting with permissions that are too lenient and then trying to tighten them later.

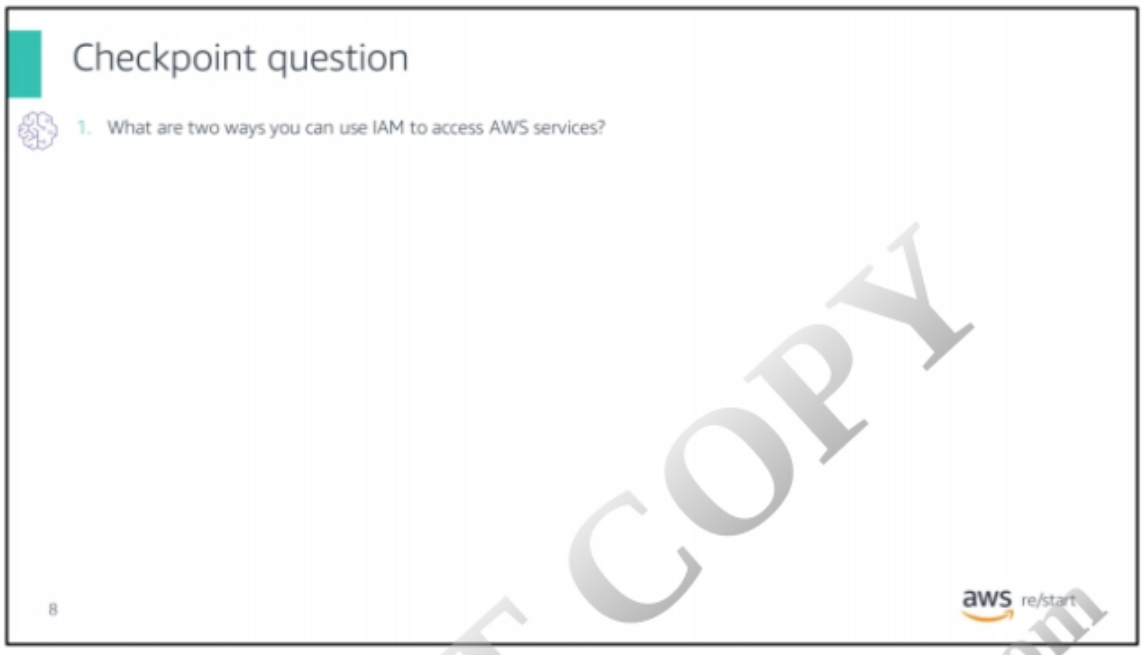


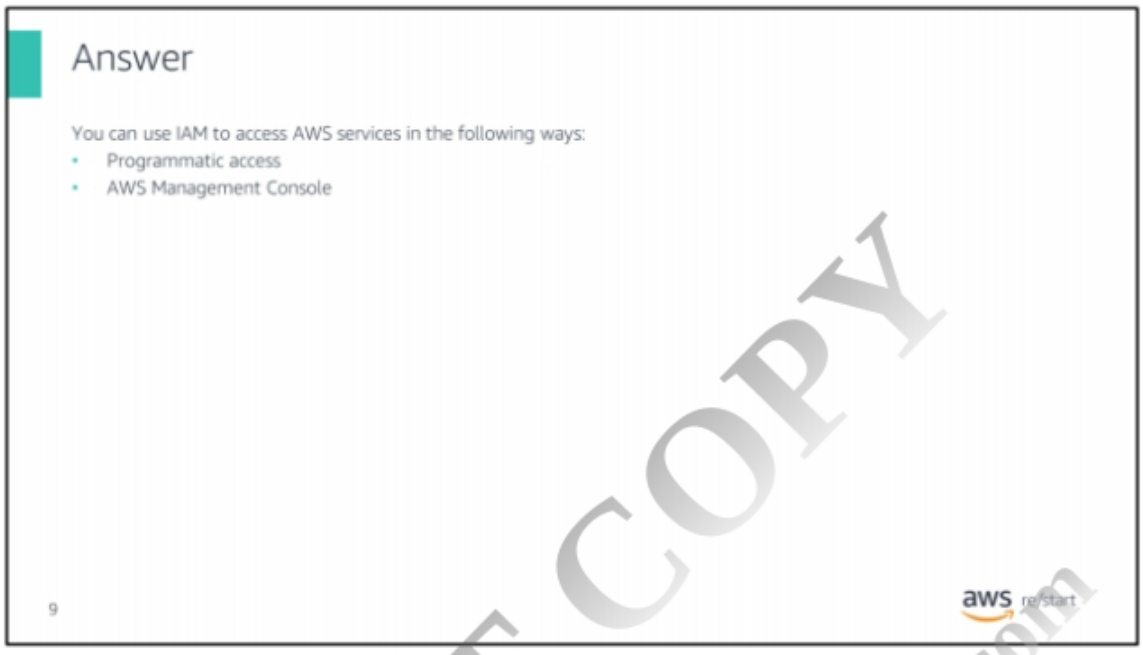
Here is a summary of the different types of AWS security credentials.

Each AWS account has an assigned account root user. This account root user has an assigned email address for the purposes of account recovery and communication. However, AWS recommends that you do not use the account root user for everyday tasks, even administrative ones. Instead, follow the best practice of using the account root user only to create an IAM user first. Then, securely lock away the account root user credentials. Use them only when you must perform the few account and service management tasks that cannot be accomplished in other ways.

As mentioned earlier, the IAM user name and password security credentials are used to access the AWS Management Console, which is also known as the console. Access keys can be used for programmatic access when they are generated for a user.

For added security, AWS recommends that you apply multi-factor authentication (MFA) on the AWS account root user and on any defined IAM users.

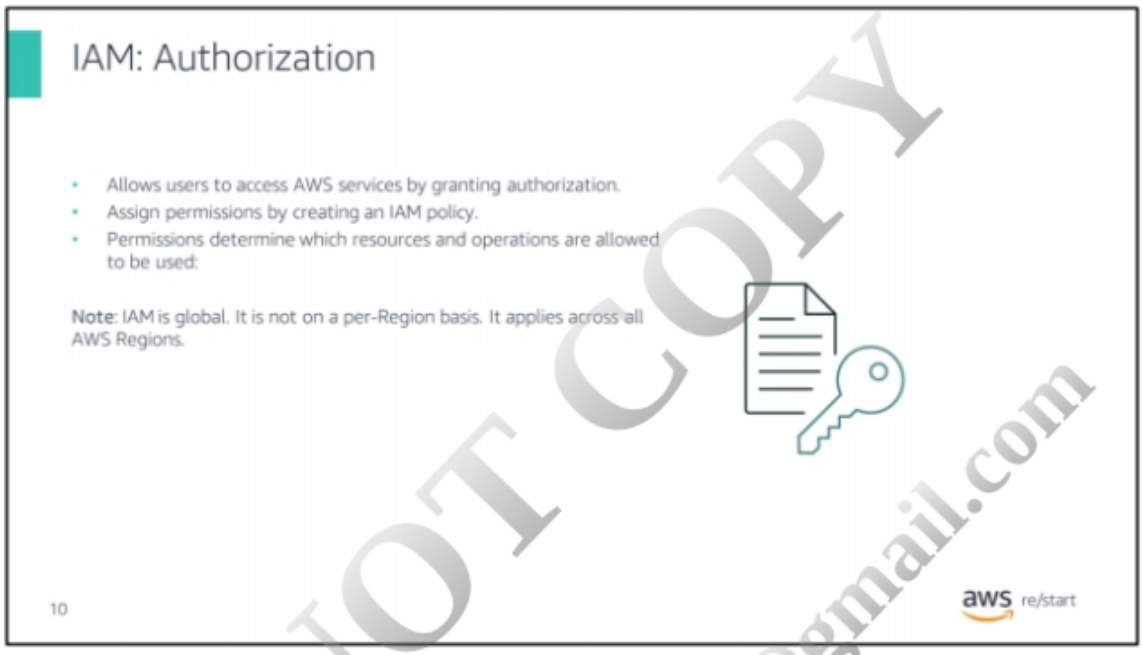




You can assign users two different types of access: Programmatic access and AWS Management Console access.

Bonus question
Which two types of keys are necessary to enable users with programmatic access?

Answer
An access key ID and secret access key are necessary to provide access to AWS services.



After a user has been authenticated, they must then be authorized to access an AWS service.

To assign permissions to a user, group, or role, you must create an IAM policy. A policy is a document that explicitly lists permissions. There are no default permissions. All actions are denied by default (implicit deny) unless they are explicitly allowed. Any actions that you did not explicitly allow are denied. Any actions that you explicitly deny are always denied.

IAM is global. It is not on a per-Region basis. It applies across all AWS Regions.

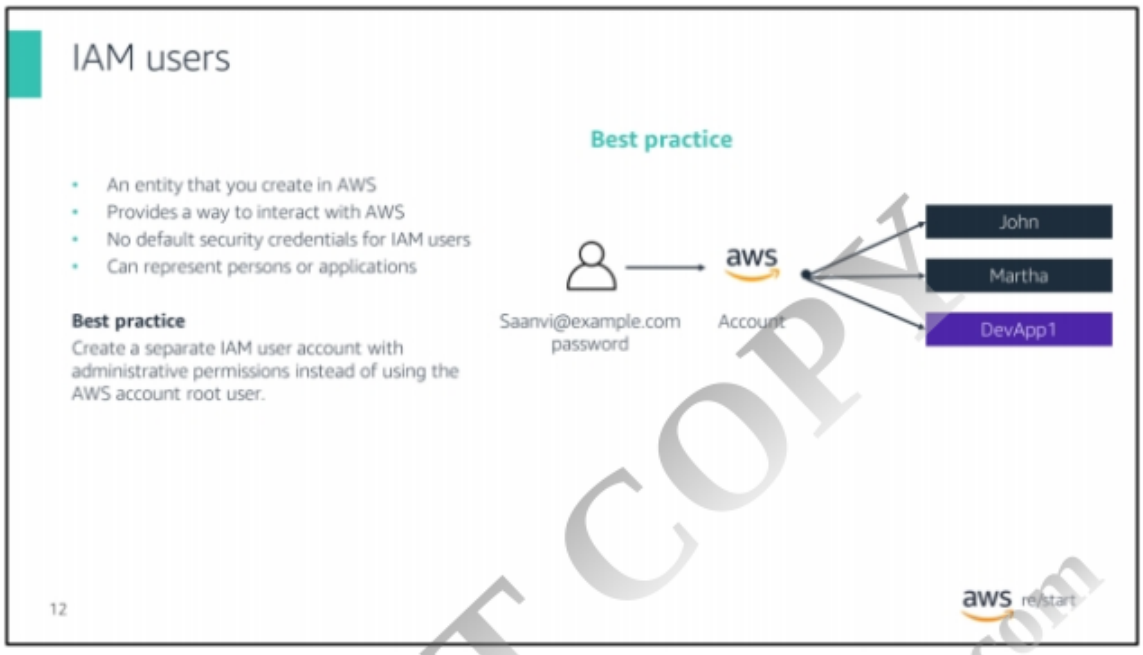
You can access AWS services and resources by using the following tools:

- AWS Management Console
- AWS Command Line Interface (AWS CLI)
- Software development kits (SDKs) and application programming interfaces (APIs) from a variety of supported environments

For increased security, AWS recommends enabling MFA. With MFA, users and systems must be authenticated before they can access AWS services and resources. Two options are provided for authentication devices: hardware devices and virtual MFA-compliant applications (Google Authenticator or Authy two-factor authentication). Short Message Service (SMS) is another authentication alternative where you use your mobile device that can receive SMS messages to receive a code.

The AWS Security Token Service (AWS STS) is a web service that also enables you to request temporary, limited-permission credentials for IAM users or for users that you authenticate.

For more information, refer to Using multi-factor authentication (MFA) in AWS in the *AWS Identity and Access Management User Guide*.

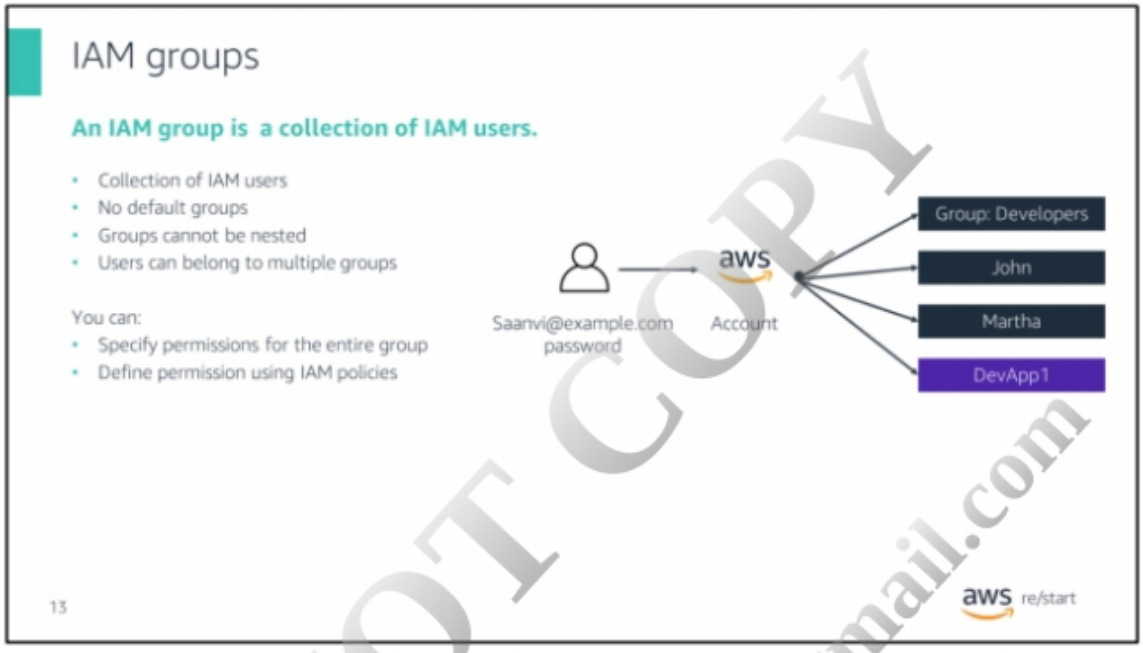


An IAM **user** is an entity that you create in AWS that provides a way to interact with AWS. An IAM user primarily gives individuals identities that they can use to sign in to the console and make requests to AWS services.

Newly created IAM users have no default credentials that they can use to authenticate themselves and access AWS resources. First, assign security credentials to users for authentication. Then, attach permissions that authorize the users to perform any AWS actions or to access any AWS resources. The credentials that you create for users are what they use to uniquely identify themselves to AWS.

An IAM user is only an identity with associated permissions. You might create an IAM user to represent an application that must have credentials to make requests to AWS. An application might have its own identity in your account and its own set of permissions in the same way that processes have their own identities and permissions in an operating system, such as Microsoft Windows or Linux.

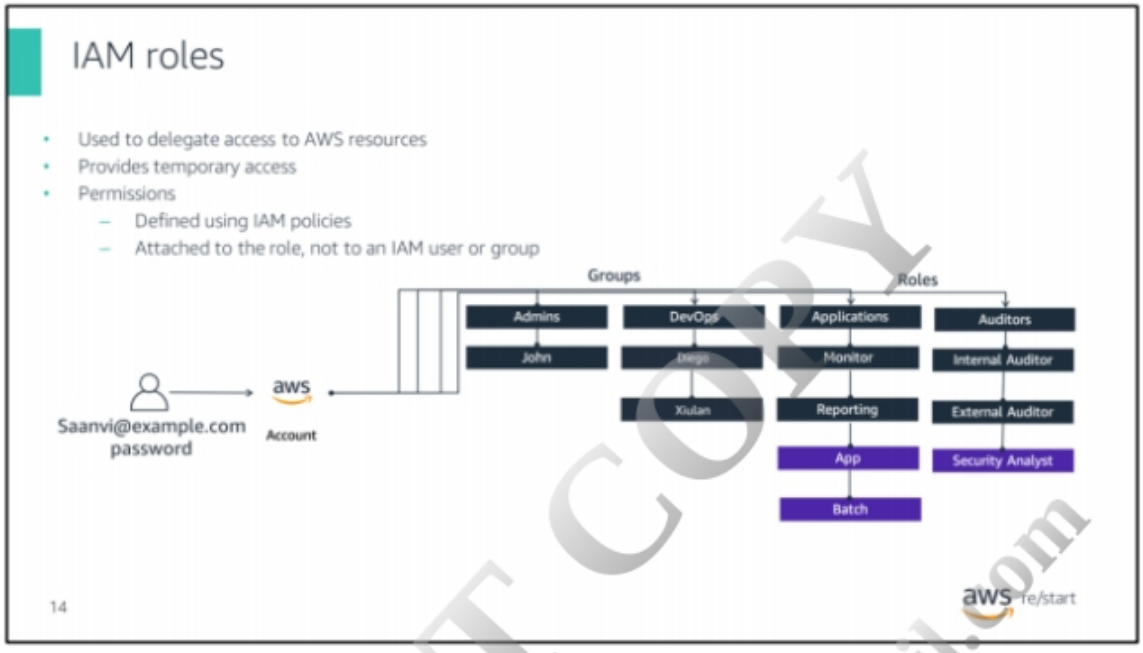
A best practice is to create a separate IAM user account with administrative permission instead of using the account root user.



A **group** is a collection of IAM users. Groups enable you to specify permissions for a collection of users, which can make it easier to manage the permissions for those users. For example, you could have a group named **Developers** and give that group the types of permissions that developers typically need. Any user in that group automatically has the permissions that are assigned to the group. If a new user joins your organization and should have developer permissions, add that user to the Developers group. Doing so automatically gives these users the appropriate permissions. Similarly, if a person changes jobs in your organization, instead of editing that user's permissions, you can remove the user from the earlier group and add them to the new group.

Important characteristics of groups:

- A group can contain many users, and a user can belong to multiple groups.
- Groups cannot be nested. They can contain only users, not other groups.
- No default group exists that automatically includes all users in the AWS account. If you want to have a default group, you must create it and assign each new user to it.



A **role** is a tool for giving temporary access to AWS resources in your AWS account. Permissions are not attached to an IAM user or group. Instead, at runtime, applications or AWS services can programmatically assume a role. When a role is assumed, AWS returns temporary security credentials that the user or application can use to make programmatic requests to AWS. Consequently, you do not need to share long-term security credentials—for example, by creating an IAM user—for each entity that requires access to a resource.

Use cases

A use case for using roles is with federated users. A federated user does not have a permanent identity in an AWS account the way that an IAM user does. To assign permissions to a federated user, you can create a role entity.

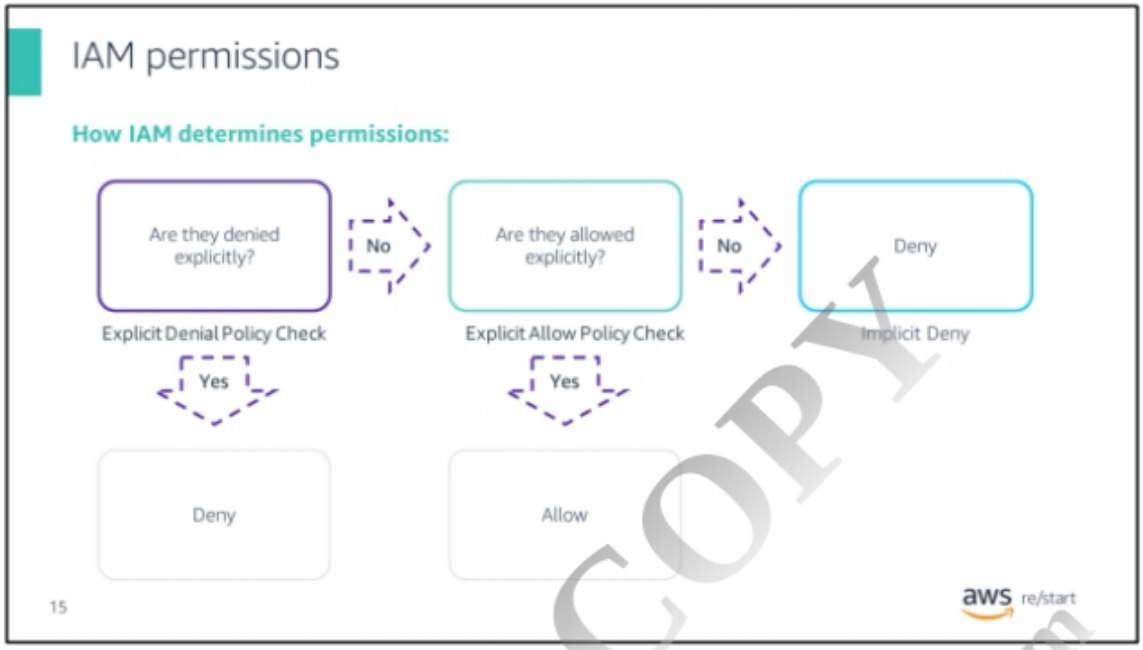
Creating roles

You create a role in the AWS account that contains the resources that you want to allow access to. When you create the role, specify two policies:

- The **trust** policy specifies who is allowed to assume the role, such as the trusted entity or principal.

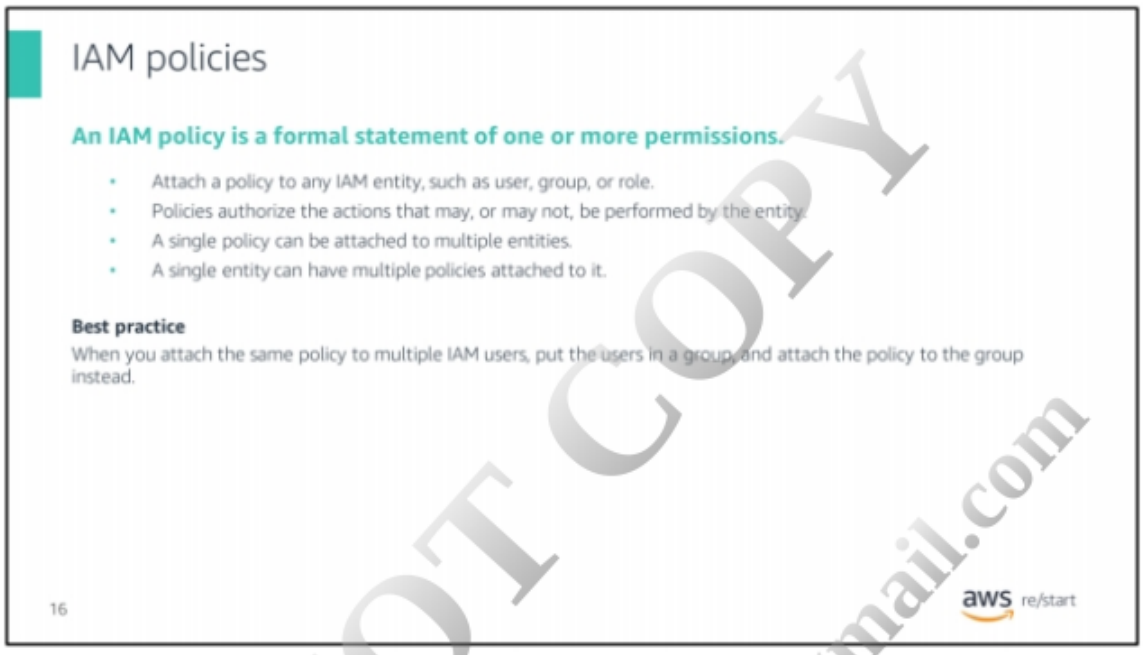
- The **access** (or **permissions**) policy defines what actions and resources the principal is allowed access to. The principal can be any of the following –
    - AWS account
    - AWS service (such as Amazon Elastic Compute Cloud, or Amazon EC2)
    - Security Assertion Markup Language (SAML) provider
    - Identity provider (IdP) that can include Login with Amazon, Facebook, or Google.

  The principal can also be an IAM user, group, or role from other AWS accounts, including ones that are not owned by you.



Using policies, you can fine-tune permissions that are granted to IAM users, groups, and roles. Because policies are stored in JavaScript Object Notation (JSON) format, you can use them with a version control system. It is a best practice to define least privileged access to each user, group, or role. That way, you can customize access to specific resources by using an *authorization* policy.

When you determine whether permissions are allowed, IAM first checks for an **explicit denial policy**. If one does not exist, it then checks for an **explicit allow policy**. If an explicit deny or an explicit allow policy does not exist, IAM reverts to the default: **implicit deny**.



An IAM policy is a formal statement of one or more permissions. Policies can be attached to any IAM entity, which includes a user, group, role, or resource. For example, you can attach a policy to your AWS resources to block all requests that do not come from an approved internet protocol (IP) address range. Policies specify what actions are allowed, which resources to allow the actions on, and what the effect will be when the user requests access to the resources.

The order that the policies are evaluated in has no effect on the outcome of the evaluation. All policies are evaluated, and the result is always that the request is either allowed or denied. When there is a conflict, the most restrictive policy wins.

Types of IAM policies

- **Identity-based policies** are permissions policies that you can attach to a principal or identity, such as an IAM user, role, or group. These policies control what actions that identity can perform, on which resources, and under what conditions. Identity-based policies can be further categorized as –

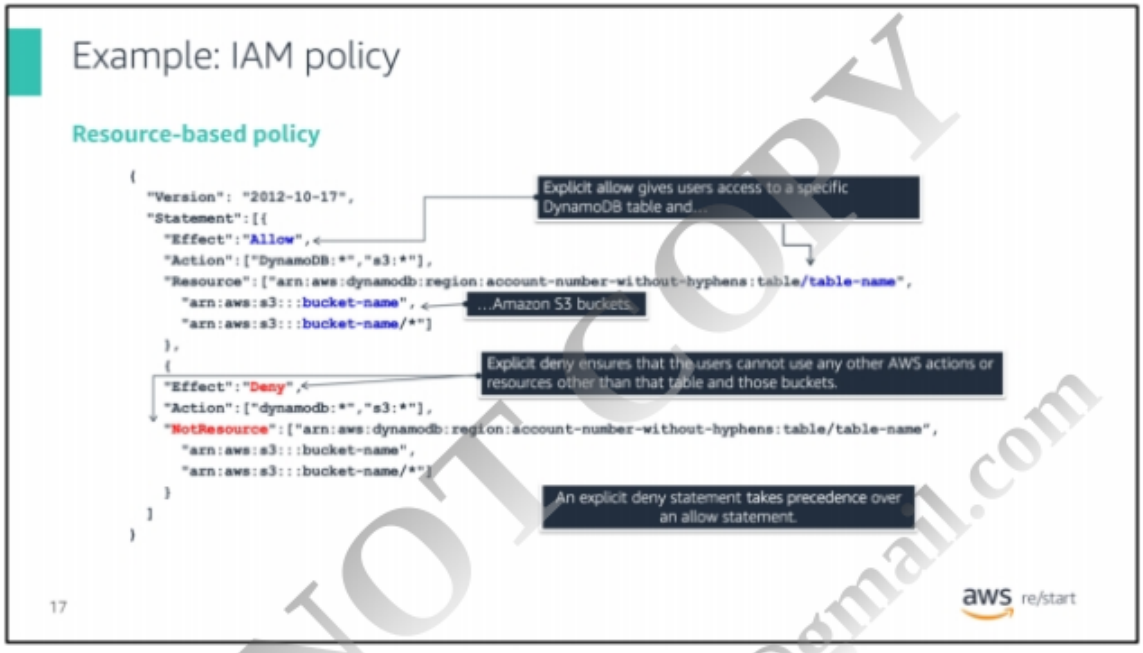
    - Managed policies: Standalone identity-based policies that you can attach to multiple users, groups, and roles in your AWS account

    - Inline policies: Policies that you create and manage and that are

embedded directly into a single user group or role

- **Resource-based policies** are JSON policy documents that you attach to a resource, such as an Amazon Simple Storage Service (Amazon S3) bucket. These policies control what actions a specified principal can perform on that resource and under what conditions. Resource-based policies are inline policies. There are not managed resource-based policies. For more information, refer to Policies and permissions in IAM in the *AWS Identity and Access Management User Guide*.

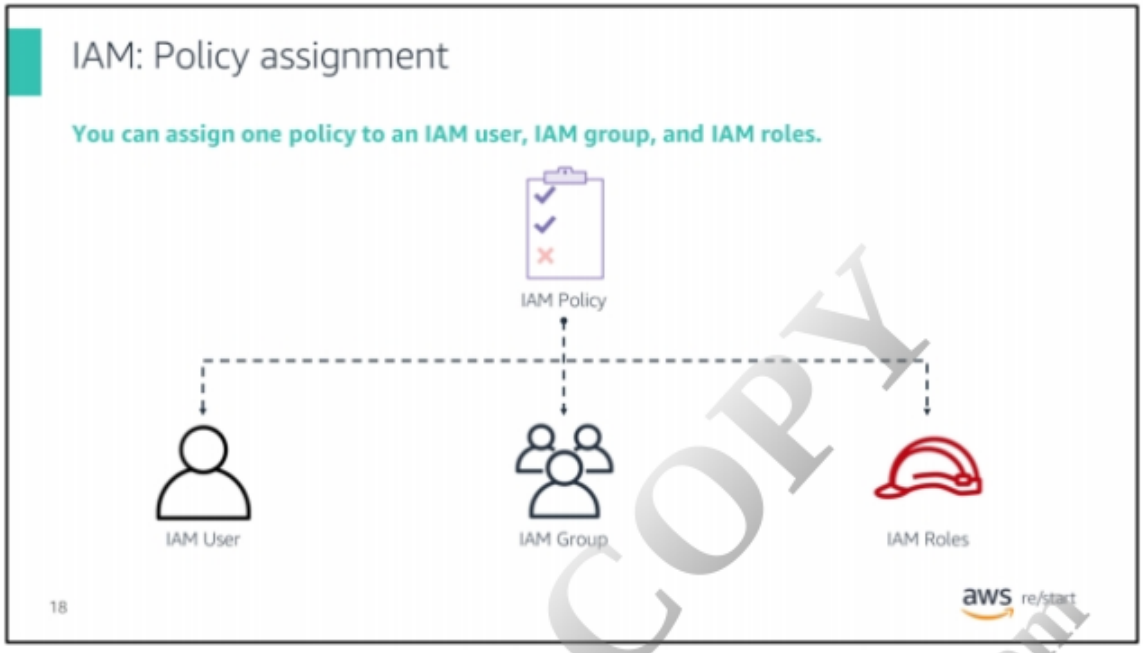
When you attach the same policy to multiple IAM users, put the users in a group and attach the policy to the group instead. Additionally, you can use the IAM policy simulator to test and troubleshoot IAM and resource-based policies. To learn more about the IAM policy simulator, refer to Testing IAM policies with the IAM policy simulator in the *AWS Identity and Access Management User Guide*.



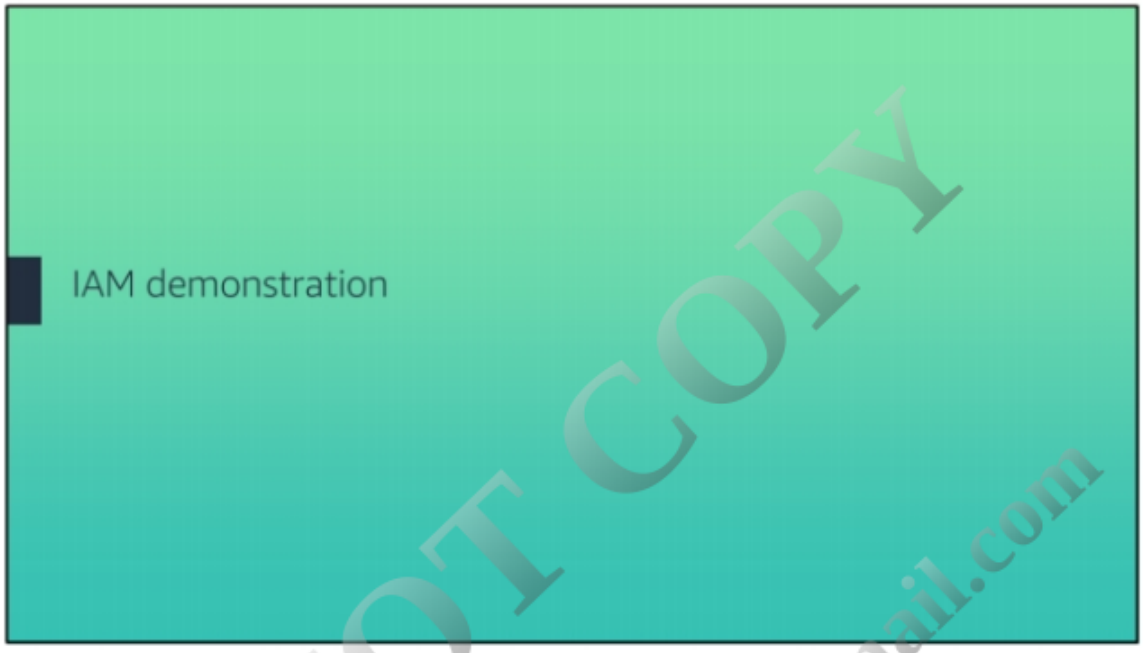
The example policy gives users access to only the following resources:

- Amazon DynamoDB table whose name is represented by *`table-name`*.
- Corporate Amazon S3 bucket for the AWS account, whose name is represented by *`bucket-name`* and all the objects that it contains.

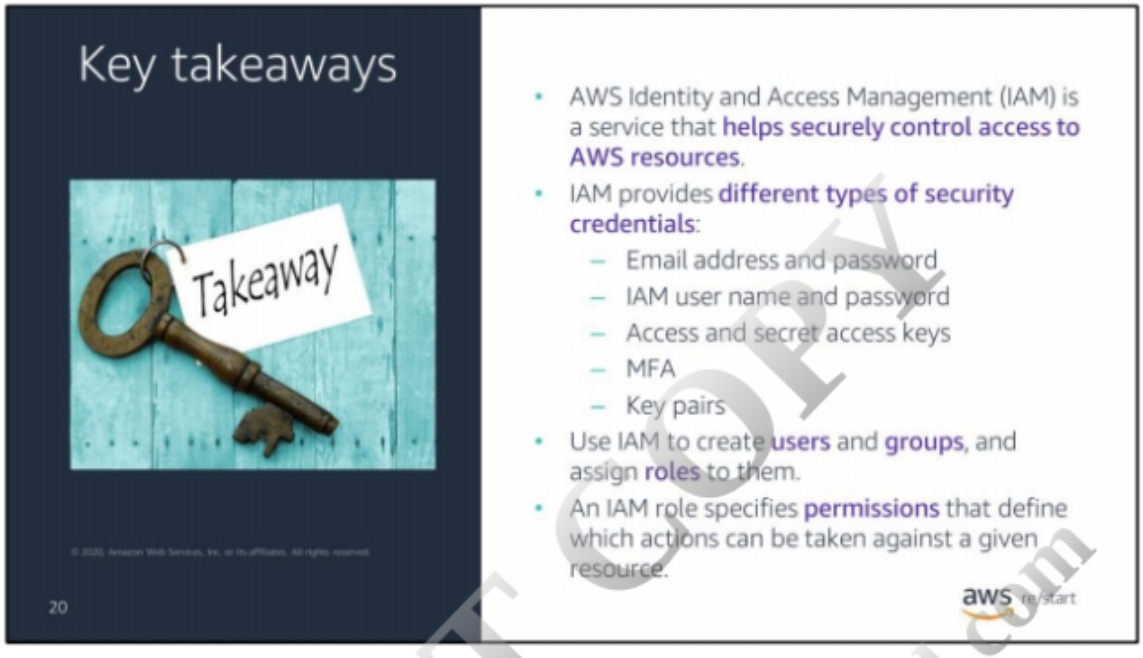
The policy includes an explicit deny **("Effect":"Deny")** element with the **`NotResource`** element. This explicit deny helps to ensure that users cannot perform any AWS actions or use resources except those that were specified in the policy (even if permissions were granted in another policy). An explicit deny statement takes precedence over an allow statement.



You can assign the same policy to an IAM user, IAM group, and IAM roles. This allows for reuse and reduces the need to recreate the same policy for different identities.



Now, take a moment to review the IAM console video demonstration, which is in Canvas.



Key takeaways from this lesson include:

- AWS Identity and Access Management (IAM) is a service that helps securely control access to AWS resources.
- IAM provides different types of security credentials:
  - Email address and password
  - IAM user name and password
  - Access and secret access keys
  - MFA
  - Key pairs
- Use IAM to create users and groups, and assign roles to them.
- An IAM role specifies permissions that define what actions can be taken against a given resource.