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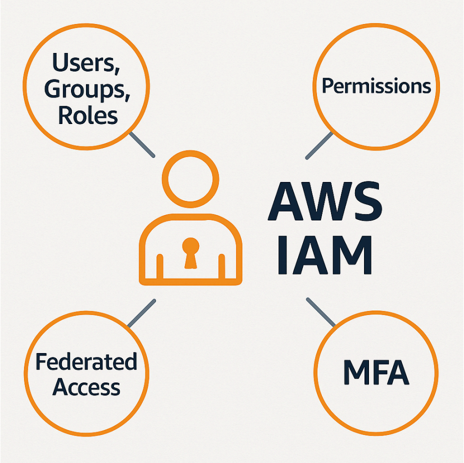
Powerful short notes on Amazon AWS IAM (Identity and Access Management)



What is AWS IAM?

- **AWS IAM** (Identity and Access Management) is a service that helps you securely control access to AWS resources.
- It allows you to create users, groups, and roles, and manage their permissions to access AWS services.

Key Concepts in AWS IAM

1. **Users**
   - A **user** is an entity that represents a person or application that needs access to AWS services.
   - Each user has its own credentials (username and password or access keys) to log in.
2. **Groups**
   - A **group** is a collection of users.
   - You can assign permissions to a group, and all users in the group will have those permissions.
3. **Roles**
   - A **role** is an identity in AWS that you can assign permissions to, but it is not tied to a specific user.
   - Roles are often used for applications or services to access resources, and you can switch between roles in your AWS account.
4. **Policies**

    - A **policy** is a document that defines the permissions for users, groups, or roles.
    - Policies define what actions are allowed or denied on which resources.
    - Policies are written in JSON format.
    - There are **managed policies** (AWS predefined) and **customer managed policies** (customized by users).

Types of Policies

1. **AWS Managed Policies**
    - Predefined policies provided by AWS.
    - These policies cover common use cases like access to S3, EC2, etc.
2. **Customer Managed Policies**
    - Custom policies created by you.
    - Useful for defining fine-grained permissions for specific tasks.

How IAM Works

- **Authentication**: IAM is used to verify who you are (e.g., username and password).
- **Authorization**: Once authenticated, IAM determines what actions you can perform (e.g., read/write to S3 bucket).
- **Access Control**: IAM helps you control access based on policies you assign to users, groups, or roles.

IAM Best Practices

1. **Use Multi-Factor Authentication (MFA)**
    - MFA adds an extra layer of security. Users need a second form of identification (like a phone app) to log in.
2. **Create Individual Users**
    - Don't share AWS root account credentials. Always create individual IAM users for everyone who needs access.
3. **Use Groups to Assign Permissions**
    - Instead of assigning permissions to individual users, use IAM groups to make managing permissions easier.
4. **Least Privilege Access**
    - Always assign the least amount of privilege necessary for users to perform their jobs. Don't give more access than needed.
5. **Rotate Credentials Regularly**
    - Regularly update passwords and access keys to enhance security.

IAM Roles in Detail

- **Assuming a Role**: Users or services can temporarily take on a role with specific permissions.
- **Use Case**: An EC2 instance might need access to S3 buckets. You can create an IAM role with access to S3, and then assign it to the EC2 instance.

IAM Access Keys

- **Access keys** are used for programmatic access to AWS services (e.g., using the AWS CLI or SDK).
- Each access key has a **Key ID** and **Secret Key**.
- Always keep the secret key safe. Never share it.

IAM Permissions Structure

- **Action**: Specifies what actions are allowed (e.g., s3:PutObject, ec2:StartInstances).
- **Resource**: Specifies the AWS resources on which actions can be performed (e.g., a specific S3 bucket or EC2 instance).
- **Effect**: Defines whether the action is allowed or denied (either Allow or Deny).
- **Condition**: Optional. Specifies conditions that must be met for the policy to apply (e.g., based on IP address).

How to Set Up IAM Users and Permissions

1. **Create a User**
   - Go to IAM in the AWS Console.
   - Click on **Users** and select **Add User**.
   - Provide a username and set the credentials (password or access key).
2. **Assign Permissions**
   - After creating a user, you can assign permissions directly or via groups.
   - You can select from AWS managed policies or create your own custom policies.
3. **Creating Groups**
   - Groups help you manage permissions for multiple users.
   - Create a group and assign IAM users to it. Then, assign permissions to the group.
4. **Create Roles for Services or Applications**
   - Create a role if you need services (like EC2, Lambda) to access AWS resources.
   - Specify which services can assume the role and which policies are attached.

IAM Trust Relationship

- **Trust policies** define which entities can assume a role.
- For example, an EC2 instance might be trusted to assume an IAM role that allows it to access an S3 bucket.

Conclusion

AWS IAM is a critical part of managing security in AWS. It helps you manage who can access your AWS resources and what actions they can perform. By understanding users, groups, roles, and policies, you can secure your AWS environment and follow best practices to keep it safe.

18 frequently asked IAM interview questions and answers

1. What is IAM, and how is it used in AWS?

IAM (Identity and Access Management) is a service in AWS that helps you manage access to AWS resources securely. It allows you to create and manage users, groups, roles, and permissions. IAM lets you control who can access what services and resources in your AWS environment. You can use IAM to grant or deny access to AWS services and resources, ensuring that only authorized users can access critical resources.

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2. What are Roles, Groups, Policies, and Users in IAM?

- **Users**: A user is an individual identity in AWS with specific credentials like username and password. Users are associated with permissions that allow them to perform specific tasks in AWS.
- **Groups**: A group is a collection of IAM users. You can assign policies to a group so that all members of the group inherit those permissions.
- **Roles**: A role is similar to a user but is meant to be assumed by AWS services or other IAM users. Roles don’t have credentials like users do and can be assumed temporarily.
- **Policies**: Policies are rules that define what actions a user, group, or role can perform on specific resources. Policies can grant permissions like read, write, delete, or access to specific resources.

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3. What is the difference between Roles and Policies?

- **Roles**: Roles are used to delegate access to AWS services or resources. They are assumed by users or services to temporarily inherit permissions.
- **Policies**: Policies define what permissions are allowed or denied. They specify the actions a user, role, or group can perform. Policies are attached to roles, users, or groups to control access.

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4. How do Roles and Policies work together in IAM?

Roles and policies work together to grant permissions. A **role** is created and assigned a **policy** that defines what actions are allowed when that role is assumed. When a user or service assumes the role, they inherit the permissions defined in the policy attached to that role.

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5. What is the difference between AWS-managed policies and user-managed inline policies? Explain with examples.

- **AWS-managed policies**: These are predefined policies created and maintained by AWS. They cover common use cases like Amazon S3 read-only access or full EC2 access. Example: AmazonS3ReadOnlyAccess grants read-only access to all Amazon S3 resources.
- **User-managed inline policies**: These are custom policies created by the user and attached directly to a specific user, group, or role. These are more flexible but must be managed manually. Example: A custom inline policy can grant a user access to only specific S3 buckets within a project.

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6. What is the Root User in IAM, and how is Multi-Factor Authentication (MFA) related to it?

- **Root User**: The root user is the original IAM user created when an AWS account is set up. It has full administrative privileges and access to all AWS services. It is very powerful, and AWS recommends using it only for account-level tasks (e.g., changing billing information).
- **MFA (Multi-Factor Authentication)**: MFA adds an extra layer of security. For the root user, MFA should be enabled to require both a password and a second factor (like a mobile device) to sign in, making it harder for unauthorized users to access the account.

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7. What is a Trust Policy in IAM?

A **trust policy** is a type of policy used to define which entities (users, roles, services) are allowed to assume a particular role. It's attached to the role and specifies who can take on that role.

Example: You could have a trust policy that allows an EC2 instance to assume an IAM role and interact with S3 buckets.

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8. Can an IAM user assume a role? If yes, how?

Yes, an IAM user can assume a role if they are granted permission through a policy. The user needs to have the sts:AssumeRole permission, which allows them to take on the permissions defined in the role. Once the user assumes the role, they can perform the actions allowed by the role's policy.

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9. How can you restrict a specific user or group from accessing a particular service in AWS?

You can use **IAM policies** to restrict access. For example, to restrict a user or group from accessing Amazon S3, you can create a policy that explicitly denies access to S3 resources. This policy can then be attached to the user or group.

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10. What are Permission Boundaries in IAM?

A **permission boundary** is a policy that sets the maximum permissions a user or role can have. Even if the user or role is granted broader permissions through other policies, the permission boundary will limit the access to a specific set of permissions.

Example: You can use a permission boundary to ensure a developer can only access a specific S3 bucket, even if they have broader permissions.

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11. What are Policy Versions in IAM?

Policy versions allow you to manage different versions of a policy. When you update a policy, AWS creates a new version of the policy while keeping the previous version intact. You can revert to an older version of the policy if necessary.

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12. What is the difference between resource-based policies and identity-based policies?

- **Resource-based policies**: These are attached directly to the resource (e.g., S3 bucket, Lambda function). They define who can access the resource and what actions they can perform.
- **Identity-based policies**: These are attached to users, groups, or roles. They define what actions the identity can perform on which resources.

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13. What is the purpose of the Condition element in IAM policies?

The **Condition** element in a policy allows you to specify conditions under which a policy is applied. For example, you can grant access only if the request is coming from a certain IP address or if it's using SSL. This helps to make the policies more granular and secure.

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14. How can you temporarily revoke permissions from a user or group?

You can temporarily revoke permissions by removing or disabling the IAM policies attached to the user or group. Alternatively, you can attach a deny policy that explicitly denies all access.

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15. What happens if a user is part of two groups with conflicting permissions?

When a user is part of two groups with conflicting permissions, the **explicit deny** always takes precedence over allow. If one policy allows an action and the other denies it, the deny will override the allow.

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16. How can you audit IAM usage in your AWS environment?

You can audit IAM usage using **AWS CloudTrail**, which records API calls and actions made by IAM users, groups, and roles. CloudTrail logs provide detailed information about who did what and when. You can also use AWS IAM Access Analyzer to identify any unintended access.

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17. What is a Service-Linked Role in IAM?

A **Service-Linked Role** is a role that is automatically created by an AWS service and is used by that service to perform actions on your behalf. For example, Amazon EC2 automatically creates a service-linked role to manage EC2 instances.

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18. How do roles function in IAM?

Roles in IAM function as a way to delegate access. They are assumed by users or services and grant the permissions defined in the role's policy. Roles allow you to provide temporary access to AWS resources, and once the role is assumed, the entity can perform the actions allowed by the attached policies.

5 real-world scenario-based IAM questions

1. Scenario: A company has multiple departments like HR, Finance, and Engineering. Each department needs different levels of access to AWS resources. How would you manage this?

Answer:
To manage access for multiple departments like HR, Finance, and Engineering, you would follow the principle of least privilege, ensuring that each department has only the access it needs and nothing more. This can be done effectively using **IAM groups** and **policies**.

1. **Create IAM Groups**:
   First, create an IAM group for each department. IAM groups allow you to manage permissions for multiple users at once, simplifying management and minimizing errors. For instance:
   - Create a group called **HR** for the HR department.
   - Create a group called **Finance** for the Finance department.
   - Create a group called **Engineering** for the Engineering department.
2. **Assign Policies to Groups**:
   Next, assign IAM policies to each group based on the department's needs. AWS provides **managed policies** for common use cases, or you can create **custom policies** for more fine-grained control. For example:
   - **HR Group**: Assign policies that grant read-only access to HR-related data, such as employee details stored in S3. You could also assign permissions to access Amazon WorkDocs or Amazon Chime if required.
   - **Finance Group**: Assign policies that allow access to financial data stored in Amazon S3, RDS, or any other database services used for financial management. Finance users might need full access to financial databases

    and limited access to compute resources.

  - **Engineering Group**: This group may require full access to EC2 instances for infrastructure management, full S3 access for storage, and access to other development tools like CodeCommit or CodeBuild.

3. **Attach Users to Groups**:
   Assign IAM users to the corresponding groups. Each user will inherit the permissions of the group they belong to, making it easier to manage large teams.

4. **Monitoring and Auditing**:
   To ensure that users adhere to their department's access requirements, use AWS **CloudTrail** to monitor actions performed by users in each group. You can also use **AWS Config** to check compliance with your internal policies.

By organizing access this way, you ensure that departments have access to only the resources they need, preventing unauthorized access to sensitive information from other departments.

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2. Scenario: You need to give a third-party contractor temporary access to your AWS resources to perform a specific task. How would you do this?

Answer:
Providing a third-party contractor with temporary access to AWS resources can be done securely using **IAM roles** and **STS (Security Token Service)**. This ensures that the contractor gets access only for a limited time and only to the specific resources they need.

Create an IAM Role:
Create a new **IAM role** that includes the specific permissions the contractor needs for the task. For example, if they need access to EC2 instances or an S3 bucket, create a role that grants them **read-only** or **full access** to these resources.
Example of a policy that grants EC2 and S3 access:

json
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```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": ["ec2:DescribeInstances", "s3:GetObject"],
            "Resource": "*"
        }
    ]
}
```

1.

Set Up a Trust Policy for the Role:
 The **trust policy** defines who can assume the role. In this case, you would allow the contractor to assume the role. You could use their AWS account or federate their identity using an identity provider (e.g., Google or Active Directory).
 Example trust policy for allowing a third-party account to assume the role:

 json
CopyEdit

```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::CONTRACTOR_ACCOUNT_ID:root"
            },
            "Action": "sts:AssumeRole"
        }
    ]
}
```

2.
3. **Use MFA for Additional Security**:
    It's a good practice to enable **MFA (Multi-Factor Authentication)** for an additional layer of security, ensuring that the contractor needs to authenticate via both a

password and a second factor (e.g., a mobile device) to assume the role.

4. **Define a Time Limit Using Session Duration**:
 Since the contractor only needs temporary access, you can specify a **session duration** when they assume the role. AWS allows setting a session duration (up to 12 hours). Once the session expires, the contractor will no longer have access to the resources.

5. **Revoke Access Once the Task is Completed**:
 After the contractor completes the task, revoke access by deleting the role or modifying the trust policy to remove the contractor's ability to assume the role.

Using these steps, you can securely grant temporary, limited access to a third-party contractor without exposing your AWS environment to unnecessary risks.

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3. Scenario: A user has access to several AWS resources, but they accidentally delete an important file from an S3 bucket. How can you prevent such accidental deletions?

Answer:
 To prevent accidental deletions, you should implement a combination of **versioning**, **MFA delete**, and **IAM policies** that explicitly deny the deletion of critical resources.

1. **Enable S3 Versioning**:
 Enabling **versioning** on S3 buckets ensures that every time an object is updated or deleted, previous versions are retained. This allows you to recover deleted objects. Even if a user deletes a file, they can restore it by reverting to a previous version.
 To enable versioning:

   - Go to the S3 console.

   - Select the bucket, then click **Properties**.

   - In the **Bucket Versioning** section, click **Enable**.

2. **Enable MFA Delete**:
 MFA Delete adds an extra layer of protection by requiring multi-factor authentication (MFA) before allowing deletion of objects in the bucket. This ensures that even if a user has permission to delete objects, they need a second factor (e.g., an MFA code from their mobile device) to proceed with the deletion.
 To enable MFA Delete, you must enable versioning first and then configure MFA Delete from the **S3 Management Console**.

Implement IAM Policies to Deny Deletion:
You can create a custom IAM policy that explicitly denies the `s3:DeleteObject` action for users who should not have deletion rights. For example:

json
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```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Deny",
            "Action": "s3:DeleteObject",
            "Resource": "arn:aws:s3:::my-bucket/*"
        }
    ]
}
```

3. Attach this policy to the users who should not have delete permissions.

4. **Use Bucket Policies**:
   In addition to IAM policies, you can implement **bucket policies** to control delete access. For example, you could add a bucket policy to deny delete actions from any user except a trusted administrator or specific role.

By combining these approaches, you can minimize the risk of accidental deletions and provide a safety net for critical data.

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4. Scenario: You need to give a user access to multiple AWS services, but you only want to grant read-only access. How would you do this?

Answer:
To grant **read-only** access to multiple AWS services, the best approach is to use an **AWS-managed read-only policy** or create a custom policy that grants only the necessary permissions.

1. **Use AWS Managed Policy**:
   AWS provides a **read-only managed policy** called `ReadOnlyAccess` that grants read-only permissions to all services in AWS. This policy allows users to list and view resources, but it doesn't allow them to make changes. Attach this policy to the user:
   - Go to the IAM console.
   - Select the user and click on **Add Permissions**.
   - Choose **Attach policies directly**, search for `ReadOnlyAccess`, and attach it.

Custom Read-Only Policy:
If you only want to grant read-only access to specific services (e.g., S3 and EC2), you can create a custom policy. For example:

json
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```json
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Action": [
                "s3:ListBucket",
                "s3:GetObject",
                "ec2:DescribeInstances"
            ],
            "Resource": "*"
        }
    ]
}
```

2. This policy grants permission to list S3 buckets, retrieve objects from S3, and describe EC2 instances but does not allow modifying or deleting any resources.

3. **Assign the Policy to the User**:
   After creating the custom policy, attach it to the user or group that requires read-only access. This ensures that the user can view resources but cannot modify them.

By using these methods, you ensure that users can only view the resources and data they need without the risk of accidental modifications or deletions.

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5. Scenario: You are working in a shared AWS account, and different teams require different levels of access to certain S3 buckets. How can you manage this?

Answer:
When working in a shared AWS account with multiple teams, you can manage access to **S3 buckets** using a combination of **IAM policies**, **bucket policies**, and **S3 Access Control Lists (ACLs)**.

IAM Policies for Team Access:
Create custom **IAM policies** for each team that specify which S3 buckets they can access and what actions they can perform. For example, the HR team might need full access to an HR S3 bucket, while the Finance team needs read-only access to a different bucket.
Example IAM policy for read-only access to a specific bucket:

json
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```json
{

    "Version": "2012-10-17",

    "Statement": [

        {

            "Effect": "Allow",

            "Action": ["s3:ListBucket", "s3:GetObject"],

            "Resource": "arn:aws:s3:::finance-bucket/*"

        }

    ]
}
```

1.

S3 Bucket Policies:
In addition to IAM policies, **S3 bucket policies** can be used to control access at the bucket level. Bucket policies allow you to specify who can access the bucket and what actions they can perform (e.g., allow or deny access based on specific conditions such as source IP address, MFA authentication, etc.).
Example of an S3 bucket policy that grants read-only access to a specific IAM user:

json
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```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Effect": "Allow",
            "Principal": {
                "AWS": "arn:aws:iam::123456789012:user/financeUser"
            },
            "Action": "s3:GetObject",
            "Resource": "arn:aws:s3:::finance-bucket/*"
        }
    ]
}
```

2.
3. **Access Control Lists (ACLs)**:
   S3 ACLs can be used to manage access at the individual object level. For instance, you can grant read access to an S3 object only to certain teams or users. However, ACLs should be used cautiously as they can complicate the access control model.

By using a combination of IAM policies, bucket policies, and ACLs, you can provide each team with the appropriate level of access to the S3 buckets, ensuring that sensitive data is protected and each team can access only what they need.