PROFESSIONAL TRAINING 1

entitled

USER MANAGEMENT IN AWS

Submitted in partial fulfillment of the requirements for the award of
Bachelor of Engineering degree in Computer Science and Engineering

by

MITHUN.U

Reg.No : 41110805

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SCHOOL OF COMPUTING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A++" by NAAC
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BONAFIDE CERTIFICATE

This is to certify that this Professional Training is the bonafide work of **U. MITHUN (Reg.No: 41110805)** who carried out the project entitled **USER MANAGEMENT IN AWS** under my supervision from June 2023 to October 2023.

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DECLARATION

I, **U. MITHUN (Reg.No: 41110805),** hereby declare that the Professional Training Report-I entitled **USER MANAGEMENT IN AWS** done by me under the guidance of **Dr. Mr. R. VIGNESH** is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Computer Science and Engineering.

DATE:

PLACE: **SIGNATURE OF THE CANDIDATE**

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TRAINING CERTIFICATE

ABSTRACT

Cloud computing paradigm is one of the most promising ones in recent times and has demonstrated a potential to revolutionize the way software development and usage handled in the information technology (IT) industry. Cloud computing not only provides the benefits agility but also enhances the scalability of the software framework. In this paper, we study Amazon Web Services(AWS) as a case study to provide an in Depth overview of various concepts and key features. More specifically, we study how management of user and user permissions is handled in the framework. This paper will provide a solid understanding of key features of AWS to cloud computing researches. Effective user management is a critical aspect of modern web applications and services. This abstract provides an overview of my project, which focuses on implementation a robust and scalable user management system using Amazon Web Services (AWS) to ensure security, flexibility, and ease of administration. We leverage AWS Identity and Access Management (IAM) for user authentication and authorization, AWS Cognito for user registration and authentication flows, and AWS Lambda functions to handle custom user-related processes. Amazon RDS or DynamoDB is used for user data storage, and AWS Amplify simplifies frontend integration User Management, AWS, Authentication, Authorization, Security, Scalability, AWS Identity and Access Management (IAM), AWS Cognito.

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INTRODUCTION

Identity and Access management

Due to an increasing popularity of various networking applications user data and its necessary computational capability has grown exponentially in recent times. Further, researchers have demonstrated a number of interesting use cases for network analytics that require cloud based computational capabilities Consequently, understanding the key aspects of cloud computing frameworks is essential for researchers working in networking and communications. AWS Identity and Access Management (IAM) is a web service that enables Amazon Web Services (AWS) customers to manage users and user permissions in AWS. The service is targeted at organizations with multiple users or systems in the cloud that use AWS products such as Amazon EC2, Amazon SimpleDB, and the AWS Management Console. With IAM, you can centrally manage users, security credentials such as access keys, and permissions that control which AWS resources users can access

User management in AWS (Amazon Web Services) is a critical aspect of cloud security and access control. AWS provides various services and tools to help you manage users and their permissions effectively. In this introduction, we'll explore the basics of user management in AWS. User management in AWS involves creating, configuring, and controlling access for individuals or entities (users or applications) who need to interact with AWS services and resources. This process is crucial for maintaining the security and compliance of your AWS environment. AWS provides a robust and flexible framework for user management, allowing you to customize access control to meet your organization's specific needs while maintaining a strong security posture in the cloud.

Benefits, Problems, Uses

Benefits: AWS identity and access management helps you securely control access to Amazon web Service and your account re-sources. IAM can also keep your account credentials private with IAM you can create multiple IAM users under the umbrella of your

AWS account or enable temporary access through identity federation with your corporate directory

Problems: Without IAM, however, you must either create multiple AWS accounts—each with its own billing and subscriptions to AWS products—or your employees must share the security credentials of a single AWS account. • In addition, without IAM, you cannot control the tasks a particular user or system can do and what AWS resources they might use. • This guide provides a conceptual overview of IAM, describes business use cases, and explains AWS permissions and policies

Uses: Using IAM to give user access to your AWS resources

Advantages of using IAM

Managing users in AWS (Amazon Web Services) has several advantages, especially when using AWS Identity and Access Management (IAM) to control and secure access to your AWS resources. Here are some key advantages of user management using AWS IAM:

Granular Access Control: AWS IAM allows you to define fine-grained permissions for each user, group, or role. You can control who has access to specific AWS services, resources, and actions, ensuring the principle of least privilege.

Secure Access: IAM supports multi-factor authentication (MFA), which adds an extra layer of security to user accounts. This helps protect sensitive resources from unauthorized access.

Identity Federation: You can integrate IAM with external identity providers (IdPs) such as Active Directory, LDAP, or SAML, enabling single sign-on (SSO) and simplifying user authentication and management.

Scalability: IAM is designed to scale with your AWS infrastructure. You can easily create, modify, or remove user accounts and permissions as your organization grows and evolves.

Audit Trail: IAM provides detailed logging and auditing capabilities. You can track who accessed what resources and when, which is crucial for compliance and security monitoring.

Policy-Based Access Control: IAM uses policies written in JSON to define permissions. This policy-based approach makes it easier to manage and update access control rules across your AWS environment.

Easy Integration with AWS Services: IAM seamlessly integrates with other AWS services, such as AWS Cloud Trail for logging and AWS Organizations for managing multiple AWS accounts.

Temporary Access: You can grant temporary access to users and services by creating temporary security credentials using AWS Identity Federation or by assuming roles in AWS IAM. This is useful for granting access to external users or applications for a limited time.

Least Privilege Principle: IAM encourages you to follow the principle of least privilege, meaning users and roles are only given the permissions necessary to perform their tasks, reducing the risk of accidental or intentional misuse of privileges.

Compliance: IAM helps you meet compliance requirements by enforcing access control and providing audit logs. This is particularly important in industries with strict regulatory requirements, such as healthcare (HIPAA) or finance (PCI DSS).

Cost Control: By using IAM to control who can access and modify AWS resources, you can help prevent unauthorized actions that could lead to unexpected costs, such as accidental resource termination or excessive resource provisioning.

Easy Revocation of Access: When a user or role no longer needs access to AWS resources, you can quickly revoke their permissions, reducing the risk of unauthorized access

Types of IAM

In AWS (Amazon Web Services), IAM (Identity and Access Management) provides a framework for managing user identities and their permissions to access AWS resources. There are several types of IAM entities and elements within AWS IAM:

Users: Users are individual AWS accounts created within your AWS organization. Each user can have their own set of permissions and access keys. Users are typically associated with real individuals or applications.

Groups: Groups are collections of IAM users. By associating IAM policies with groups, you can manage permissions for multiple users collectively. This simplifies access management, especially when many users have similar access requirements.

Roles: Roles are AWS identities that you can create and assign to AWS resources or federated users. Roles are often used for cross-account access or to grant temporary permissions to services or applications.

Policies: IAM policies are JSON documents that define permissions. They can be attached to users, groups, or roles. Policies specify what actions are allowed or denied on which resources.

Permissions Boundaries: Permissions boundaries are an advanced feature used to delegate permissions to other users or roles. They set the maximum permissions that a user or role can have. This is often used in situations where a team or organization wants to delegate control over IAM without granting too much power.

Resource Policies: Some AWS resources (e.g., S3 buckets, SQS queues) have their own resource policies that can be used to control access to those resources independently of IAM policies.

Federation: AWS supports federation, which allows you to grant users from other identity providers (e.g., Active Directory, Facebook, Google) temporary access to AWS resources without creating IAM users. You can use services like AWS Single Sign-On (SSO) or AWS Identity Federation to achieve this.

Multi-Factor Authentication (MFA): IAM supports MFA, which adds an extra layer of security by requiring users to provide two or more separate factors (typically something you know, like a password, and something you have, like a hardware token) for authentication.

Access Keys: IAM users can have access keys associated with their account. These keys are used for programmatic access to AWS services via APIs and command-line tools.

Instance Profiles: These are used to associate roles with EC2 instances. When an EC2 instance assumes a role through its instance profile, it can make AWS API requests on behalf of applications running on the instance.

Securing users in AWS

Securing user access in AWS (Amazon Web Services) using Identity and Access Management (IAM) is a critical aspect of maintaining the security of your cloud resources. AWS IAM provides a framework for managing and controlling access to AWS services and resources. Here are some best practices to enhance the security of user access in AWS IAM:

Use Least Privilege Principle: Assign the minimum permissions necessary to perform a user's job. Avoid giving users more permissions than they need.

Implement Strong Password Policies: Enforce strong password requirements for IAM users. Require periodic password rotation.

Enable Multi-Factor Authentication (MFA): Encourage or mandate the use of MFA for IAM users. MFA adds an extra layer of security by requiring something the user knows (password) and something the user has (MFA device).

Rotate Access Keys: If you're using access keys for programmatic access, regularly rotate them.
Use IAM Access Analyzer to identify unused keys and remove them.

Regularly Review Permissions: Conduct regular reviews of IAM policies to ensure they align with the principle of least privilege. Use AWS IAM Access Advisor to see what services and actions users are using and adjust their permissions accordingly.

Use IAM Roles: Instead of giving users long-term access keys, use IAM roles for services and applications running on EC2 instances, Lambda functions, etc. Roles are more secure and easier to manage.

Use AWS Organizations: Use AWS Organizations to manage and consolidate multiple AWS accounts.
Centralize IAM user and policy management.

Enable Cloud Trail: Enable AWS Cloud Trail to capture and log all API activity in your AWS account. Monitor Cloud Trail logs for suspicious activities.

Implement IAM Policies Carefully: Craft IAM policies that define precise permissions. Use IAM policy conditions to further restrict access based on various factors like IP ranges or time of day.

Monitor and Audit: Regularly review IAM access logs for unusual activities. Set up Cloud Watch alarms for specific events, like failed login attempts or unauthorized actions.

Implement Account Password Policies: Set up password policies that require IAM users to create strong, regularly updated passwords. Enable the password expiration feature.

Limit Root User Access: Avoid using the root user except for initial account setup. Use IAM users with administrative permissions instead.

Use AWS Secrets Manager and AWS Parameter Store: Store sensitive information, such as database passwords or API keys, securely using AWS Secrets Manager or AWS Parameter Store.

Regularly Train and Educate Users: Ensure that your IAM users are educated about security best practices and the potential risks of misusing permissions.

Automate Security Controls: Use AWS Configure and AWS Organizations to automate security controls and compliance checks.

Regularly Update and Patch Resources: Keep all your AWS resources, including EC2 instances and containers, up to date with security patches.

Aim and Scope of the present Investigation

Objective of the work

The objective for user management in AWS is to establish and maintain a secure and efficient system for managing user access to AWS resources and services. This includes ensuring that authorized users have the appropriate level of access while preventing unauthorized access or misuse of resources. Key objectives for user management in AWS

The primary objective for user management in AWS is to establish and maintain a secure and efficient access control system for the AWS resources and services within an organization. This involves creating, managing, and enforcing policies that define who can access what resources, under what conditions, and with what level of permissions. User management in AWS aims to ensure that only authorized individuals or systems can interact with AWS assets, safeguarding sensitive data and preventing unauthorized access or misuse. This process also facilitates the tracking and auditing of user actions, enabling organizations to maintain compliance with security standards and regulatory requirements. Ultimately, effective user management in AWS enhances operational efficiency, reduces security risks, and provides the foundation for a robust and scalable cloud infrastructure.

Access Control Implement fine-grained access controls to grant or restrict permissions for AWS resources based on the principle of least privilege. Ensure that users have access only to the resources and actions necessary for their roles and responsibilities. Identity

Management Create and manage user identities within AWS using services like AWS Identity and Access Management (IAM) to ensure that each user has a unique identity and appropriate permissions. Authentication Establish secure authentication methods for user access, such as multi-factor authentication (MFA), to enhance security and verify the identity of users. Authorization Define policies and roles to control user access to AWS resources. Ensure that users are authorized to perform only the actions required for their job functions. User Lifecycle Management Streamline the process of onboarding, off boarding, and updating user access as employees join, leave, or change roles within the organization. Automate user provisioning and de-provisioning to maintain security and compliance. Security Compliance Enforce security policies, compliance requirements, and audit trails to monitor and track user activity within AWS. Regularly review and audit user access to ensure compliance with organizational and regulatory standards. User Education Provide training and resources to educate users about AWS security best practices, including password management, data handling, and responsible use of resources. Monitoring and Alerting Implement monitoring and alerting mechanisms to detect and respond to suspicious or unauthorized user activity in real-time. Set up alerts for login attempts, policy violations, or unusual resource usage. Resource Tagging Encourage the use of resource tagging to categorize and label AWS resources. This helps in organizing resources and simplifies access management based on tags. Cost Optimization Consider cost implications when managing user access, and utilize AWS features like AWS Cost Explorer to analyze user-related costs and optimize resource utilization.
Disaster Recovery Develop and maintain a disaster recovery plan that includes user management procedures to ensure business continuity in case of unexpected events. Documentation and Documentation Maintain clear and up-to-date documentation of user access policies, procedures, and guidelines for user management within AWS.
Regular Auditing and Review Conduct periodic reviews and audits of user access rights, permissions, and activity to identify and address any potential security or compliance issues

Scope

User management in AWS refers to the process of creating, configuring, and managing user accounts that can access and use AWS resources and services. AWS provides several

services and tools to facilitate user management, and the scope for user management in AWS is quite extensive. Here are some key aspects of user management in AWS

Identity and Access Management (IAM) IAM is a core AWS service that enables you to manage access to AWS resources securely. You can create and manage IAM users, groups, roles, and policies. This allows you to grant or restrict permissions for various AWS resources and services to different users or groups. Multi-Factor Authentication (MFA) AWS supports MFA, which adds an extra layer of security to user accounts. By enabling MFA, you can require users to provide an additional authentication factor, such as a temporary code from a hardware token or a mobile app, in addition to their password.
Federation You can integrate AWS IAM with your existing identity systems, such as Active Directory or LDAP, using services like AWS Single Sign-On (SSO) or AWS Directory Service. This allows you to manage user access centrally and extend it to AWS resources. Password Policies AWS IAM allows you to set password policies that enforce security requirements like password complexity, expiration, and reuse prevention. Access Control You can control access to AWS resources at a granular level by defining IAM policies. These policies can be attached to users, groups, or roles, and they specify what actions are allowed or denied for specific resources.

Resource-Level Permissions AWS IAM supports resource-level permissions, which means you can grant users access only to specific instances, buckets, or other resources within AWS services like EC2, S3, or RDS. Audit Trails AWS CloudTrail provides a record of all actions taken in your AWS account, including user sign-ins and changes to IAM policies. This helps in auditing and compliance. User Lifecycle Management You can manage the entire lifecycle of IAM users, including creation, suspension, and deletion of accounts. AWS allows you to automate these processes using scripts or AWS Lambda functions. Third-Party Identity Providers AWS supports integration with third-party identity providers (IdPs) like Google, Facebook, or corporate IdPs using protocols such as SAML and OpenID Connect.
Role-Based Access Control (RBAC) AWS IAM allows you to implement RBAC by creating roles with specific permissions and then assigning those roles to users or groups as needed. Temporary Access AWS provides mechanisms to grant temporary access to users and applications, such as AWS Security Token Service (STS) and session policies. Compliance and Security AWS provides various compliance certifications and security

features to help you meet regulatory requirements and secure your user management processes.

Working

User management allows administrators to manage resources and organize users according to their needs and roles while maintaining the security of IT systems. Administrators need powerful user management capabilities that can allow them to group users and define flexible access policies. For end-users, many parts of user management are invisible. When users are exposed to user management—for example, when they use a login box to access an application—they expect the interaction to be simple and seamless. Login is a frequently-performed, critical operation, meaning that any delay or malfunction annoys users and hurts productivity. Many organizations recognize that on-premise IdP solutions are insufficient for the modern IT environment. Users increasingly rely on cloud services and access corporate systems remotely, often via personal devices, and traditional IdP cannot address these use cases.

Many organizations recognize that on-premise IdP solutions are insufficient for the modern IT environment. Users increasingly rely on cloud services and access corporate systems remotely, often via personal devices, and traditional IdP cannot address these use cases. Organizations must find a way to manage secure access for a distributed environment. At the same time, users demand the same simplicity of popular services like Google and Facebook in their work environment. These challenges are making user management more important and more complex than ever before.

EXPERIMENTAL OR MATERIALS AND METHODS; ALGORITHMSUSED

Types of modules used

In AWS, user management is primarily handled through AWS Identity and Access Management (IAM). IAM allows you to control access to AWS services and resources by creating and managing users, groups, roles, and policies. Here are the main types of modules or components used in user management in AWS

Users: AWS IAM users are individual entities that you create to represent the people, applications, or services that interact with your AWS resources. Each user can have their own set of permissions and access keys.

Groups: IAM groups are collections of IAM users. You can attach policies to groups, making it easier to manage permissions for multiple users with similar access needs. Instead of assigning permissions to individual users, you assign them to groups.

Roles: IAM roles are similar to users but are meant to be assumed by AWS services, resources, or users outside your AWS account. Roles are often used to delegate permissions to services like EC2 instances, Lambda functions, or for cross-account access.

Policies: Policies are JSON documents that define permissions. You can attach policies to users, groups, or roles to grant or restrict access to AWS resources. AWS provides managed policies or you can create custom policies to suit your specific requirements.

Access Keys: IAM users can have access keys (Access Key ID and Secret Access Key) that allow programmatic access to AWS services and resources. Access keys are typically used by developers and applications to make API calls.

Multi-Factor Authentication (MFA): IAM users can enable MFA to add an additional layer of security to their AWS accounts. MFA requires users to provide a second authentication factor, such as a time-based one-time password (TOTP), in addition to their password.

Identity Providers: AWS allows you to federate your IAM users with external identity providers (e.g., Active Directory, Facebook, Google) using services like Amazon Cognito, AWS Single Sign-On (SSO), or custom identity providers.

Resource Policies: Some AWS resources, such as Amazon S3 buckets and Lambda functions, have their own resource policies. These policies can be used to control who can

access the resource, even if the user does not have an associated IAM role or user.

Service Control Policies (SCPs): In AWS Organizations, you can use SCPs to set fine-grained permissions and controls on member accounts within an organization. SCPs help you manage access across multiple AWS accounts.

Python (boto3)

Python is a high-level, interpreted scripting language developed in the late 1980s by Guido van Rossum at the National Research Institute for Mathematics and Computer Science in the Netherlands. The initial version was published at the alt.sources newsgroup in 1991, and version 1.0 was released in 1994.
Python 2.0 was released in 2000, and the 2.x versions were the prevalent releases until December 2008. At that time, the development team made the decision to release version 3.0, which contained a few relatively small but significant changes that were not backward compatible with the 2.x versions. Python 2 and 3 are very similar, and some features of Python 3 have been back ported to Python 2. But in general, they remain not quite compatible.
Both Python 2 and 3 have continued to be maintained and developed, with periodic release updates for both. As of this writing, the most recent versions available are 2.7.15 and 3.6.5. However, an official End Of Life date of January 1, 2020 has been established for Python 2, after which time it will no longer be maintained. If you are a newcomer to Python, it is recommended that you focus on Python 3, as this tutorial will do.
Python is still maintained by a core development team at the Institute, and Guido is still in charge, having been given the title of BDFL (Benevolent Dictator For Life) by the Python community. The name Python, by the way, derives not from the snake, but from the British comedy troupe Monty Python's Flying Circus, of which Guido was, and presumably still is, a fan. It is common to find references to Monty Python sketches and movies scattered throughout the Python documentation.

Hardware and Software Requirements

User management in AWS (Amazon Web Services) typically involves using AWS Identity and Access Management (IAM) to create and manage users, groups, and permissions for your AWS resources. While IAM itself is a service provided by AWS, it runs on AWS infrastructure, and various hardware components are involved in its operation. Here are some of the hardware components and technologies used in user management in AWS:

- Data centers
- Servers
- Storage
- Networking Infrastructure
- Security hardware
- Monitoring and logging infrastructure
- Hardware security
- Content delivery
- Hardware security modules

Software requirement

Managing user access and permissions in AWS (Amazon Web Services) typically involves using a combination of AWS Identity and Access Management (IAM) and various AWS services. Here are some key software components and tools that are commonly used for user management in AWS

- AWS IAM
- AWS management console
- AWS command line interface(CLI)
- AWS identity federation
- AWS organization
- AWS single sign-on(SSO)
- AWS directory service
- Third-party identity and access management solutions
- Auditing and monitoring tools
- Custom Scripts and automations

Source code for creating an user

```
import boto3

iam = boto3.client('iam')

def create_iam_user(username):
    try:
        # Create a new IAM user
        iam.create_user(UserName=username)
        print(f"IAM user '{username}' created successfully.")
    except Exception as e:
        print(f"Error creating IAM user: {str(e)}")

def list_iam_users():
    try:
        # List IAM users
        response = iam.list_users()
        print("IAM Users:")
        for user in response['Users']:
            print(f"Username: {user['UserName']}")
    except Exception as e:
        print(f"Error listing IAM users: {str(e)}")

if __name__ == "__main__":
    while True:
        print("\n1. Create IAM User")
        print("2. List IAM Users")
        print("3. Exit")
        choice = input("Enter your choice (1/2/3): ")

        if choice == '1':
            username = input("Enter the username for the new IAM user: ")
            create_iam_user(username)
        elif choice == '2':
```

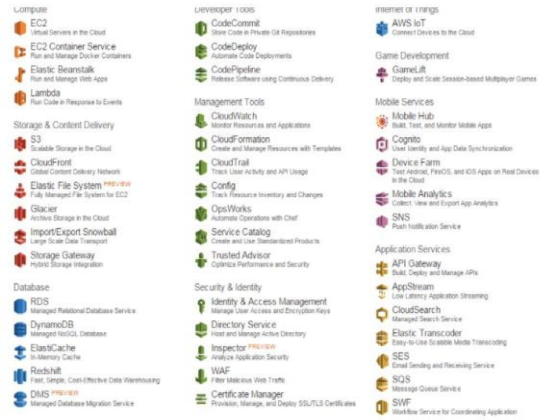
```
            list_iam_users()
        elif choice == '3':
            break
        else:
            print("Invalid choice. Please select a valid option (1/2/3).")
```

Source code for managing creating an user

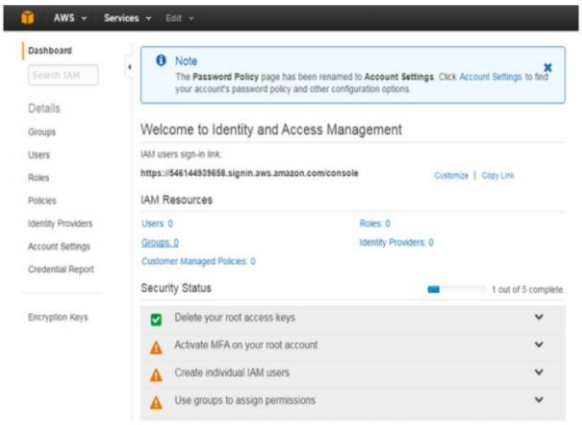
```
import boto3

# Replace these with your AWS credentials
aws_access_key_id = 'YOUR_ACCESS_KEY'
aws_secret_access_key = 'YOUR_SECRET_KEY'
aws_region = 'us-east-1'  # Replace with your desired AWS region

# Initialize the IAM client
iam = boto3.client('iam', region_name=aws_region,
                   aws_access_key_id=aws_access_key_id,
                   aws_secret_access_key=aws_secret_access_key)

# Create a new IAM user
def create_iam_user(username):
    try:
        response = iam.create_user(UserName=username)
        print(f"IAM User '{username}' created successfully")
    except Exception as e:
        print(f"Error creating IAM User: {e}")

# List IAM users
def list_iam_users():
    try:
        response = iam.list_users()
        print("List of IAM Users:")
```

```
        for user in response['Users']:
            print(f"- {user['UserName']}")
    except Exception as e:
        print(f"Error listing IAM Users: {e}")

# Delete an IAM user
def delete_iam_user(username):
    try:
        iam.delete_user(UserName=username)
        print(f"IAM User '{username}' deleted successfully")
    except Exception as e:
        print(f"Error deleting IAM User: {e}")

if __name__ == '__main__':
    username = 'example_user'

    # Create an IAM user
    create_iam_user(username)

    # List IAM users
    list_iam_users()

    # Delete the IAM user
    delete_iam_user(username)
```

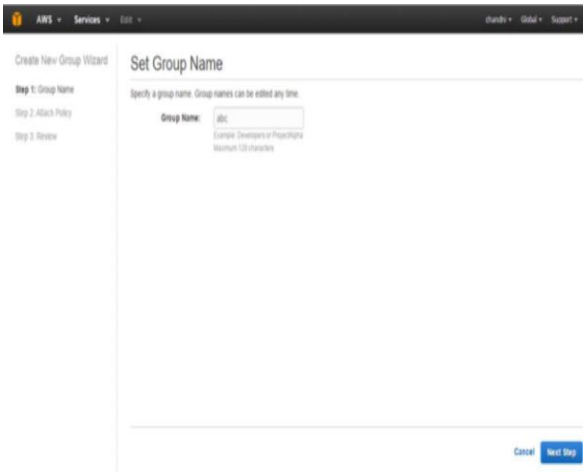
Figure



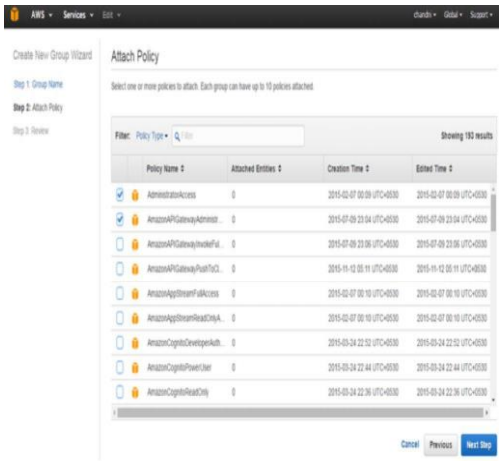
Homepage



Identity and Access management



Set group name



Attach policies

Conclusion

In conclusion, robust user management in AWS is an indispensable element of cloud infrastructure governance. AWS Identity and Access Management (IAM) serves as the linchpin for controlling access to resources, allowing organizations to grant precise permissions to users and entities while adhering to the principle of least privilege. Whether managing users, groups, or roles, AWS offers a versatile toolkit to tailor access controls to specific needs, bolstering security and compliance. The flexibility of integrating with external identity providers enables seamless authentication and authorization, promoting efficiency

in user onboarding. Furthermore, diligent monitoring through AWS services like CloudTrail and automation using tools like AWS Lambda are essential for maintaining a secure environment. Continuous vigilance, policy review, and alignment with industry best practices are fundamental to achieving the delicate balance between accessibility and security in AWS user management.

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• "Architecting for Scale" by Lee Atchison (Includes AWS-related insights on scaling applications).

• "AWS Lambda: A Guide to Serverless Microservices" by Matthew Fuller •