

Project Title:

IAM ROLES AND SECURE ACCESS AUTOMATION ON AWS

Students Name: Onyinye Susan Nwosu

Institution: TechCrush HQ

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Instructors: Temiloluwa Komolafe

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1. Introduction

This project focuses on automating and managing AWS Identity and Access Management (IAM) roles and subnet configurations using the AWS Command Line Interface (CLI). The goal was to implement secure user and group access control while managing subnets within a Virtual Private Cloud (VPC) environment.

The project simulates a real-world enterprise setup where different administrative groups, Database Administrators (DBAdmins) and Web Administrators (WebAdmins) require distinct permissions and network resources. Each group was given custom IAM policies to control their level of access, ensuring a separation of duties and enhanced security.

By completing this project, I learned how to:

- Use the AWS CLI for creating and managing IAM users, groups, and policies.
- Configure subnets within a specific VPC and assign tags for project identification.
- Apply security best practices by implementing least privilege access.
- Troubleshoot permission and resource errors during the setup process.

This hands-on project bridges theoretical knowledge of AWS IAM and VPC networking with practical, command-line-based execution—essential skills for any cloud or cybersecurity professional.

2. Project Objectives

The objectives of this project were to:

- i. Create two IAM groups: DBAdmins and WebAdmins to represent different administrative roles.
 - ii. Create and configure IAM users (TestDBUser and TestWebUser) and assign them to their appropriate groups.
 - iii. Create custom IAM policies granting read-only access to specific AWS resources for each group.
 - iv. Create and configure two subnets (WebSubnet and DBSubnet) within a chosen VPC using AWS CLI.
 - v. Verify the network and IAM configurations through the test users and their respective AWS profiles.
 - vi. Identify and troubleshoot any command syntax or permission errors encountered during execution.
 - vii. Document every process, including challenges, corrections, and final outcomes.
- These objectives helped ensure a structured approach to learning and applying both IAM access control and VPC subnet management using real AWS commands.

3. Tools and Environment Setup

Tool/Service	Description	Purpose in the Project
AWS CLI	Command-line tool for managing AWS services.	Used to create, configure, and verify IAM and subnet resources.
AWS Management Console	Web interface for AWS services	Used occasionally for verification and monitoring.
IAM (Identity and Access Management)	AWS service for access control.	Used for creating users, groups, and custom policies.
Amazon VPC	Service for creating isolated virtual networks.	Used to create and manage subnets (WebSubnet and DBSubnet).
JSON Files	Used for defining IAM policy documents.	Contained access permissions for both groups.
AWS Profiles	Named CLI configurations.	Used to differentiate between user sessions (testdb, testweb).

Configuration Item	Details
Operating System	Linux (Kali)
AWS Region	Us-east-1
VPC ID Used	vpc-04aba4c2c6e73693b
CIDR Blocks	172.31.0.0/16, 10.0.0.0/16
Subnets	WebSubnet, DBSubnet
Availability Zones	Us-east-1a, us-east-1b
IAM Users	TestDBUser, TestWebUser
IAM Groups	DBAdmins, WebAdmins
Policy Files	DBAdminsReadOnlyPolicy.json, WebAdminsReadOnlyPolicy.json

Expected Outcomes

By the end of the project, the following outcomes were expected:

- Two properly configured IAM groups with attached custom policies.
- Two IAM users, each restricted to specific administrative tasks within AWS.
- Two subnets successfully created within the chosen VPC, tagged correctly.
- Validation of user permissions through AWS CLI commands.
- Full documentation of all steps, including troubleshooting details, lessons learned, and outcomes.

4. Methodology / Step-by-Step Implementation

4.1 AWS CLI installation & initial configuration

What I did (summary)

- Installed AWS CLI on the Kali VM and verified the installation.
- Configured AWS CLI with programmatic credentials (Access Key ID and Secret Access Key) using a named profile for testing.
- Confirmed the CLI connection to AWS using the security token service to get caller identity.

Why

I needed a working, authenticated CLI environment to run all automation steps consistently from the terminal.

What happened / outputs to record

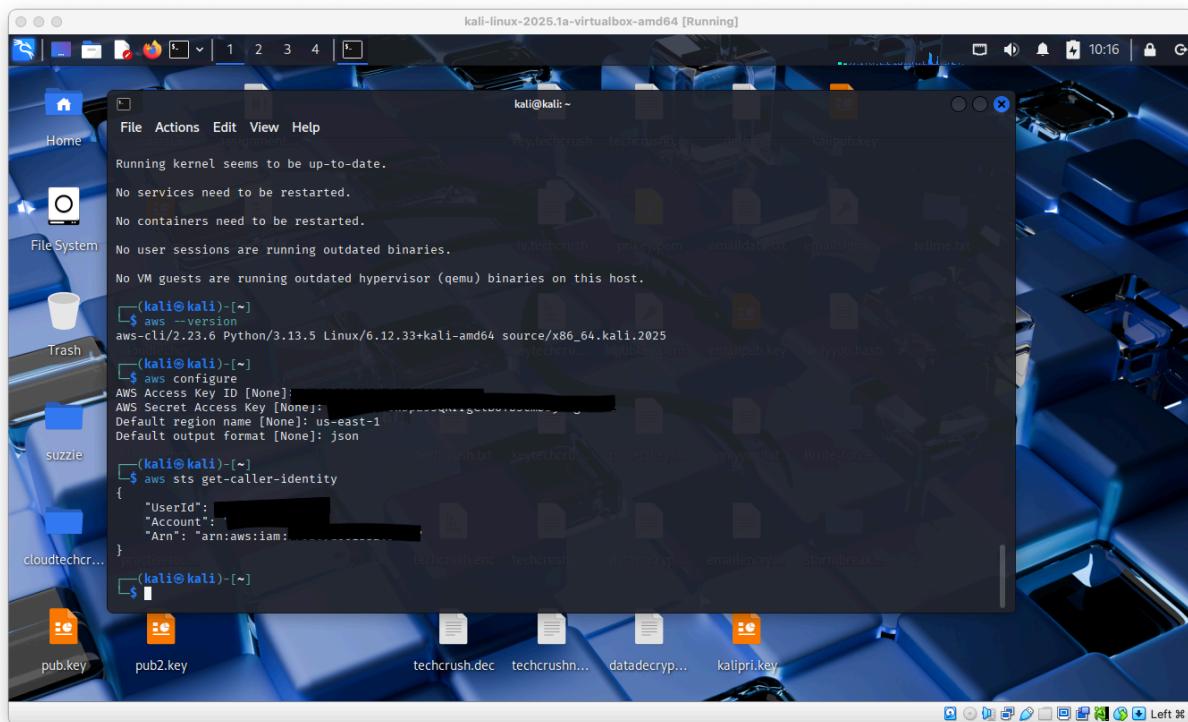
- aws --version confirmed installation.

- aws configure (using the saved Access Key ID / Secret Access Key) created the testdb profile.
- aws sts get-caller-identity returned the account ID and ARN — proving CLI authentication.

Challenges & fixes

- First credential entry failed (typing mistake); solution: regenerated keys in the AWS console and reconfigured the CLI with the correct keys.

terminal showing aws --version & output showing configured profiles & aws sts get-caller-identity.



```

kali@kali:~$ aws --version
aws-cli/2.23.6 Python/3.13.5 Linux/6.12.33+kali-amd64 source/x86_64.kali.2025
kali@kali:~$ aws configure
AWS Access Key ID [None]:
AWS Secret Access Key [None]:
Default region name [None]: us-east-1
Default output format [None]: json
kali@kali:~$ aws sts get-caller-identity
{
    "UserId": "AIDAQWZPQHJL567890",
    "Account": "123456789012",
    "Arn": "arn:aws:iam:123456789012:root"
}
kali@kali:~$ 

```

4.2 VPC creation and verification

What i did (summary)

- Created a dedicated VPC for the project (named IAM-Automation-VPC) and recorded its VPC ID.
- Verified available VPCs to ensure we targeted the correct one throughout the project.

Why

A dedicated VPC isolates the project network and ensures clean addressing for project subnets.

What happened / outputs to record

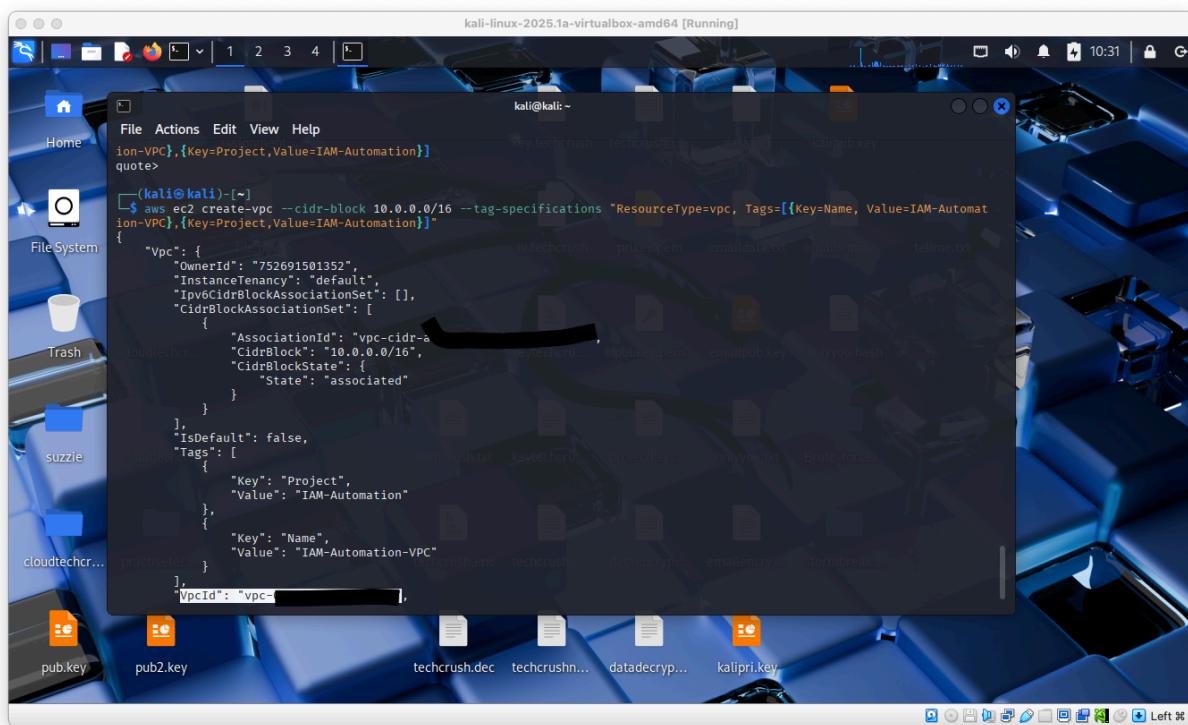
- VPC created with CIDR **10.0.0.0/16**.

- The VPC ID (the working, final one) was identified and used for all further network steps.

Challenges & fixes

- During earlier steps we referenced the wrong VPC ID and flung into CIDR/subnet errors. Solution: described VPCs and picked the correct VPC ID (the one with [10.0.0.0/16](#)) and used that consistently thereafter.
- Note: At one point the account showed a second VPC (default or previous), but we used only the final working VPC in the report.

AWS Console (or CLI output) showing the VPC name, ID and [10.0.0.0/16](#) CIDR & terminal output confirming VpcId.



```

kali@kali:~$ aws ec2 create-vpc --cidr-block 10.0.0.0/16 --tag-specifications "ResourceType=vpc, Tags=[{Key=Name, Value=IAM-Automation}]"
{
    "Vpc": {
        "OwnerId": "752691501352",
        "InstanceTenancy": "default",
        "Ipv6CidrBlockAssociationSet": [],
        "CidrBlockAssociationSet": [
            {
                "AssociationId": "vpc-cidr-a",
                "CidrBlock": "10.0.0.0/16",
                "CidrBlockState": {
                    "State": "associated"
                }
            }
        ],
        "IsDefault": false,
        "Tags": [
            {
                "Key": "Project",
                "Value": "IAM-Automation"
            },
            {
                "Key": "Name",
                "Value": "IAM-Automation-VPC"
            }
        ],
        "VpcId": "vpc-"
    }
}

```

4.3 Subnet creation (WebSubnet and DBSubnet)

What I did (summary)

- Created two subnets inside the project VPC:
 - WebSubnet — intended CIDR [10.0.1.0/24](#) in an AZ near us (us-east-1a or the account's available AZ).
 - DBSubnet — intended CIDR [10.0.2.0/24](#) in another AZ (us-east-1b).
- Verified the subnets were present and correctly tagged with Name=WebSubnet and Name=DBSubnet.

Why

Separate subnets isolate web-facing and database resources; tags make resource grouping and cleanup simple.

What happened / outputs to record

- WebSubnet created successfully and tagged as WebSubnet.
 - DBSubnet creation had multiple attempts:
 - We initially hit “invalid subnet range” / overlap errors when CIDR or VPC ID mismatched; this led to a cleanup cycle removing transient/incorrect subnets and recreating the correct ones.
 - Final state: both WebSubnet and DBSubnet present and visible in the VPC.

Challenges & fixes (detailed)

Problem 1: Backslash-style, multi-line shell syntax sometimes failed when pasted in Kali led to command parse errors.

Fix: We switched to single-line CLI invocations when necessary and, later, used the CLI's simplest tag/string quoting that worked on Kali. (In the final doc we avoid repeating the exact broken multiline forms.)

Problem 2: CIDR overlap / invalid range errors.

Fix: Verified the VPC CIDR ([10.0.0.0/16](#)) and checked existing subnets; chose unique /24 blocks that fit ([10.0.1.0/24](#) and [10.0.2.0/24](#)).

Problem 3: Some created subnets persisted from earlier attempts and confused results.

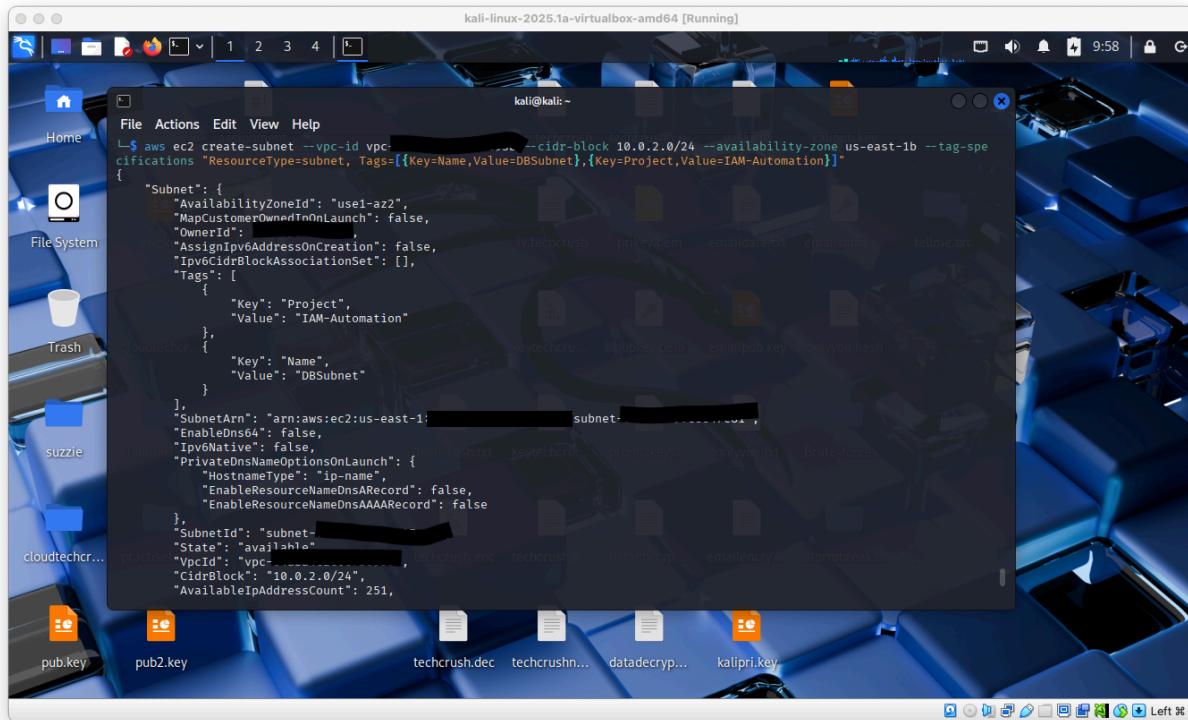
Fix: Systematically deleted all subnets on the VPC, then recreated WebSubnet and DBSubnet cleanly, verifying after each deletion/create cycle.

CLI output (describe-subnets) showing both subnets and their IDs.

Web Subnet created

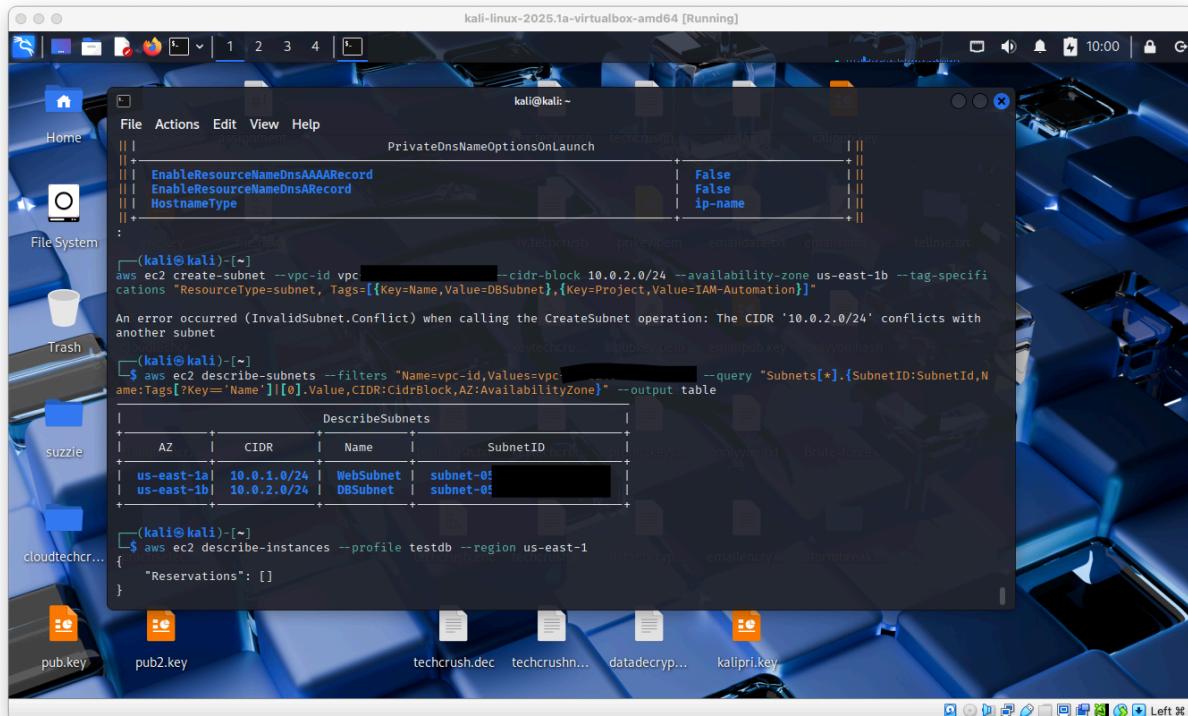
```
kali@kali:~$ aws ec2 create-subnet --vpc-id vpc-XXXXXXXXXX --cidr-block 10.0.1.0/24 --availability-zone us-east-1a --tag-specifications "ResourceType=subnet, Tags=[{Key=Name,Value=WebSubnet},{Key=Project,Value=IAM-Automation}]"
{
    "Subnet": {
        "AvailabilityZoneId": "use1-az1",
        "MapCustomerOwnedIpOnLaunch": false,
        "OwnerId": "aws",
        "AssignIpv6AddressOnCreation": false,
        "Ipv6CidrBlockAssociationSet": [],
        "Tags": [
            {
                "Key": "Project",
                "Value": "IAM-Automation"
            },
            {
                "Key": "Name",
                "Value": "WebSubnet"
            }
        ],
        "SubnetArn": "arn:aws:ec2:us-east-1:bnet/subnet-XXXXXXXXXX",
        "EnableDns64": false,
        "Ipv6Native": false,
        "PrivateDnsNameOptionsOnLaunch": {
            "HostnameType": "ip-name",
            "EnableResourceNameDnsARecord": false,
            "EnableResourceNameDnsAAAARecord": false
        },
        "SubnetId": "subnet-XXXXXXXXXX",
        "State": "available",
        "VpcId": "vpc-XXXXXXXXXX",
        "CidrBlock": "10.0.1.0/24",
        "OwnerId": "aws"
    }
}
```

DB Subnet created



```
kali@kali:~$ aws ec2 create-subnet --vpc-id vpc-XXXXXX --cidr-block 10.0.2.0/24 --availability-zone us-east-1b --tag-specifications "ResourceType=subnet, Tags=[{Key=Name,Value=DBSubnet},{Key=Project,Value=IAM-Automation}]"
{
    "Subnet": {
        "AvailabilityZoneId": "use1-az2",
        "MapCustomerOwnedIpOnLaunch": false,
        "OwnerId": "123456789012",
        "AssignIpv6AddressOnCreation": false,
        "Ipv6CidrBlockAssociationSet": [],
        "Tags": [
            {
                "Key": "Project",
                "Value": "IAM-Automation"
            },
            {
                "Key": "Name",
                "Value": "DBSubnet"
            }
        ],
        "SubnetArn": "arn:aws:ec2:us-east-1:123456789012:subnet-XXXXXX",
        "EnabledDns64": false,
        "Ipv6Native": false,
        "PrivateDnsNameOptionsOnLaunch": {
            "HostNameType": "ip-name",
            "EnableResourceNameDnsARecord": false,
            "EnableResourceNameDnsAAAARecord": false
        },
        "SubnetId": "subnet-XXXXXX",
        "State": "available",
        "VpcId": "vpc-XXXXXX",
        "CidrBlock": "10.0.2.0/24",
        "AvailableIpAddressCount": 251,
    }
}
```

Console subnets view showing both WebSubnet and DBSubnet with CIDRs and AZs.



```
kali@kali:~$ aws ec2 create-subnet --vpc-id vpc-XXXXXX --cidr-block 10.0.2.0/24 --availability-zone us-east-1b --tag-specifications "ResourceType=subnet, Tags=[{Key=Name,Value=DBSubnet},{Key=Project,Value=IAM-Automation}]"
An error occurred (InvalidSubnetConflict) when calling the CreateSubnet operation: The CIDR '10.0.2.0/24' conflicts with another subnet

(kali@kali)[~]$ aws ec2 describe-subnets --filters "Name=vpc-id,Values=vpc-XXXXXX" --query "Subnets[*].{SubnetId:SubnetId,Name:Name,CidrBlock:CidrBlock,AZ:AvailabilityZone}" --output table
+-----+-----+-----+-----+
| AZ   | CIDR | Name | SubnetID |
+-----+-----+-----+-----+
| us-east-1a | 10.0.1.0/24 | WebSubnet | subnet-0E |
| us-east-1b | 10.0.2.0/24 | DBSubnet | subnet-0F |
+-----+-----+-----+-----+
```

4.4 IAM groups creation

What I did (summary)

- Created two IAM groups: DBAdmins and WebAdmins.

Why

Groups provide role-based permission assignment and make it easy to manage multiple users.

What happened / outputs to record

- Group creation confirmed in CLI and visible in IAM console.

Challenges & fixes

- None critical here — group creation was straightforward.

CLI output for creating groups.

The screenshot shows a terminal window on a Kali Linux desktop environment. The terminal displays the command-line interface for creating IAM groups using the AWS CLI. The user has run the command `aws iam create-group --group-name WebAdmins` and `aws iam create-group --group-name DBAdmins`. The terminal output shows the JSON response for each group creation, including the group name, path, group ID, ARN, and creation date. A file browser window is also visible in the background, showing a file named `data.sig`.

```
(kali㉿kali)-[~] $ aws iam create-group --group-name WebAdmins
{
    "Group": {
        "Path": "/",
        "GroupName": "WebAdmins",
        "GroupId": "AIGPQHJLWVZK5D6XGK3R",
        "Arn": "arn:aws:iam::123456789012:group/WebAdmins",
        "CreateDate": "2025-10-30T08:21:05+00:00"
    }
}
(kali㉿kali)-[~] $ aws iam create-group --group-name DBAdmins
{
    "Group": {
        "Path": "/",
        "GroupName": "DBAdmins",
        "GroupId": "AIGPQHJLWVZK5D6XGK3R",
        "Arn": "arn:aws:iam::123456789012:group/DBAdmins",
        "CreateDate": "2025-10-30T08:21:21+00:00"
    }
}
```

4.5 IAM policies, exact JSONs used

These are the exact policy JSONs we used. Save each into the named file and create the policy from that file.

DBAdminsReadOnlyPolicy.json

(this is the working DB read-only policy I used)

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Effect": "Allow",  
      "Action": [  
        "ec2:DescribeSubnets",  
        "ec2:DescribeVpcs",  
        "ec2:DescribeInstances",  
        "ec2:DescribeSecurityGroups",  
        "ec2:GetSubnet*",  
        "ec2:GetVpc*"  
      ],  
      "Resource": "*"  
    }  
  ]  
}
```

WebAdminsReadOnlyPolicy.json

(this is the working Web read-only policy I used)

```
{  
  "Version": "2012-10-17",  
  "Statement": [  
    {  
      "Effect": "Allow",  
      "Action": [  
        "ec2:Describe*",  
        "ec2:Get*"  
      ],  
      "Resource": "*"  
    }  
  ]  
}
```

Why

These policy documents restrict each group to read-only EC2/VPC operations, preventing deletions or modifications.

What happened / outputs to record

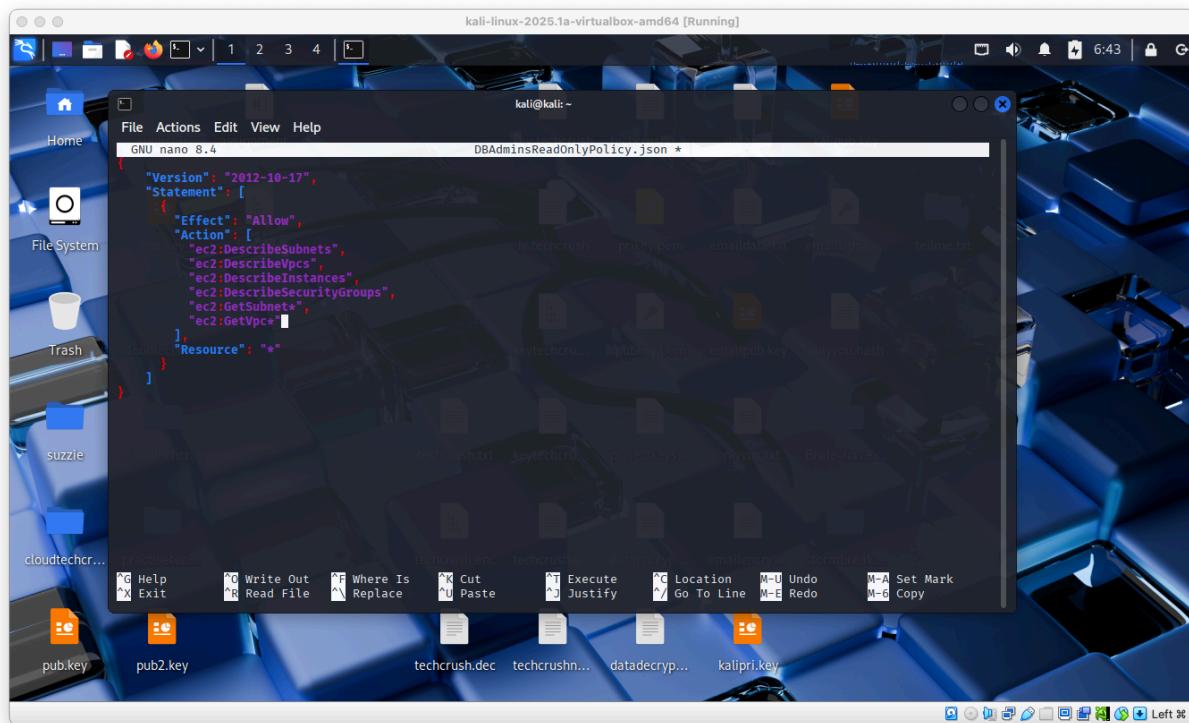
- Policies were created in IAM and returned Policy ARNs.
- Initial error: we once attached an incorrect JSON (or attempted to attach a file directly) — that caused the WebAdmins test to fail until corrected.

Challenges & fixes

Problem: Incorrect attach attempt (attached JSON path instead of an ARN).

Fix: Created the policy resource from the JSON file and attached the returned ARN to the group; detached any wrongly attached resource when needed.

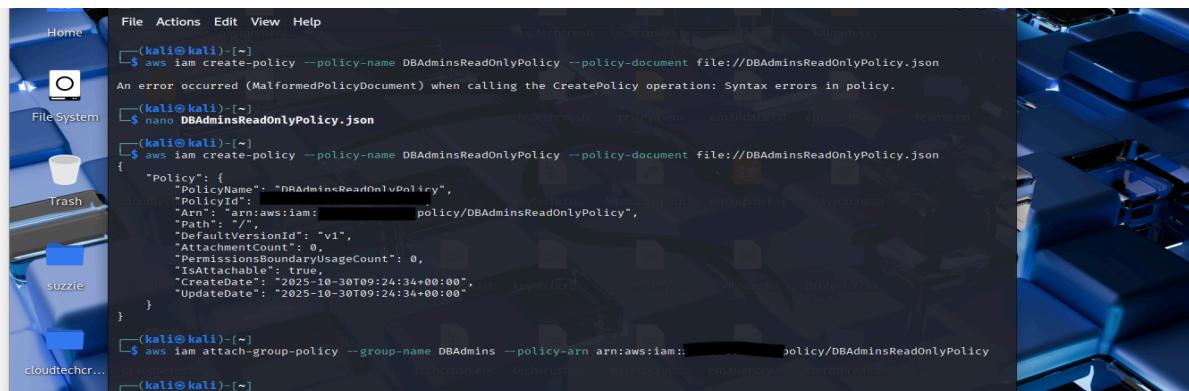
The DBAdmins JSON file contents in terminal



A screenshot of a Kali Linux desktop environment. A terminal window titled "DBAdminsReadonlyPolicy.Json *" is open, displaying the following JSON code:

```
Version: "2012-10-17",
Statement: [
    {
        Effect: "Allow",
        Action: [
            "ec2:DescribeSubnets",
            "ec2:DescribeVpcs",
            "ec2:DescribeInstances",
            "ec2:DescribeSecurityGroups",
            "ec2:GetSubnets",
            "ec2:GetVpc*"
        ],
        Resource: "*"
    }
]
```

DBAdmins Policy created & attached on AWS & policy attached to its group.



A screenshot of a Kali Linux desktop environment. A terminal window shows the following AWS CLI commands being run:

```
$ aws iam create-policy --policy-name DBAdminsReadOnlyPolicy --policy-document file:///DBAdminsReadOnlyPolicy.json
An error occurred (MalformedPolicyDocument) when calling the CreatePolicy operation: Syntax errors in policy.
$ nano DBAdminsReadOnlyPolicy.json
$ aws iam create-policy --policy-name DBAdminsReadOnlyPolicy --policy-document file:///DBAdminsReadOnlyPolicy.json
{
    "Policy": {
        "PolicyName": "DBAdminsReadOnlyPolicy",
        "PolicyId": "arn:aws:iam::policy/DBAdminsReadOnlyPolicy",
        "Arn": "arn:aws:iam::policy/DBAdminsReadOnlyPolicy",
        "Path": "/",
        "DefaultVersionId": "v1",
        "AttachmentCount": 0,
        "MaxAllowedVersionUsageCount": 0,
        "IsAttachable": true,
        "CreateDate": "2025-10-30T09:24:34+00:00",
        "UpdateDate": "2025-10-30T09:24:34+00:00"
    }
}
$ aws iam attach-group-policy --group-name DBAdmins --policy-arn arn:aws:iam::policy/DBAdminsReadOnlyPolicy
```

The WEBAdmins JSON file contents in terminal

The screenshot shows a terminal window titled "kali@kali: ~" running the command "GNU nano 8.4". The file content is a JSON document representing an AWS IAM policy:

```
{ "Version": "2012-10-17", "Statement": [ { "Effect": "Allow", "Action": [ "ec2:Describe*", "ec2:Get*" ], "Resource": "*" } ] }
```

The terminal window has a dark blue background with a grid pattern. The desktop environment includes icons for Home, File System, Trash, suzze, and cloudtechcr... on the left, and various files like .keytechcr..., .pubkey.pem, .emaildata.txt, .emailsigning..., tellme.txt, .keytechcr..., .pubkey.pem, .emailpub.key, .onlyyou.hash, .onlyyou.txt, and .Brute-force... on the desktop.

WEBAdmins Policy created & attached on AWS & policy attached to its group.

The screenshot shows a Kali Linux desktop environment with a terminal window open. The terminal session starts with the command `aws iam create-policy --policy-name WebAdminsReadOnlyPolicy --policy-document file://WebAdminsReadOnlyPolicy.json`. This command fails with the error message "Error parsing parameter '--policy-document': Unable to load paramfile file://WebAdminsReadOnlyPolicy.json: [Errno 2] No such file or directory: 'WebAdminsReadOnlyPolicy.json'". To resolve this, the user nano-edited the policy document file, which contained the following JSON:

```
{ "Policy": { "PolicyName": "WebAdminsReadOnlyPolicy", "PolicyId": "arn:aws:iam::[REDACTED]:policy/WebAdminsReadOnlyPolicy", "Arn": "arn:aws:iam::[REDACTED]:policy/WebAdminsReadOnlyPolicy", "Path": "/", "DefaultVersionId": "v1", "AttachmentCount": 0, "PermissionsBoundaryUsageCount": 0, "IsAttachable": true, "CreateDate": "2025-10-30T14:39:27+00:00", "UpdateDate": "2025-10-30T14:39:27+00:00" } }
```

After saving the edited file, the user attached the policy to the "WebAdmins" group using the command `aws iam attach-group-policy --group-name WebAdmins --policy-arn arn:aws:iam:[REDACTED]:policy/WebAdminsReadOnlyPolicy`. Finally, the user checked the EC2 subnets for the "testweb" profile in the "us-east-1" region using the command `aws ec2 describe-subnets --profile testweb --region us-east-1 --output table`.

4.6 Adding test users and assigning to groups

What I did (summary)

Created two users: TestDBUser and TestWebUser.

Added TestDBUser to DBAdmins, and TestWebUser to WebAdmins.

Why

To validate group-based permissions with real credentials.

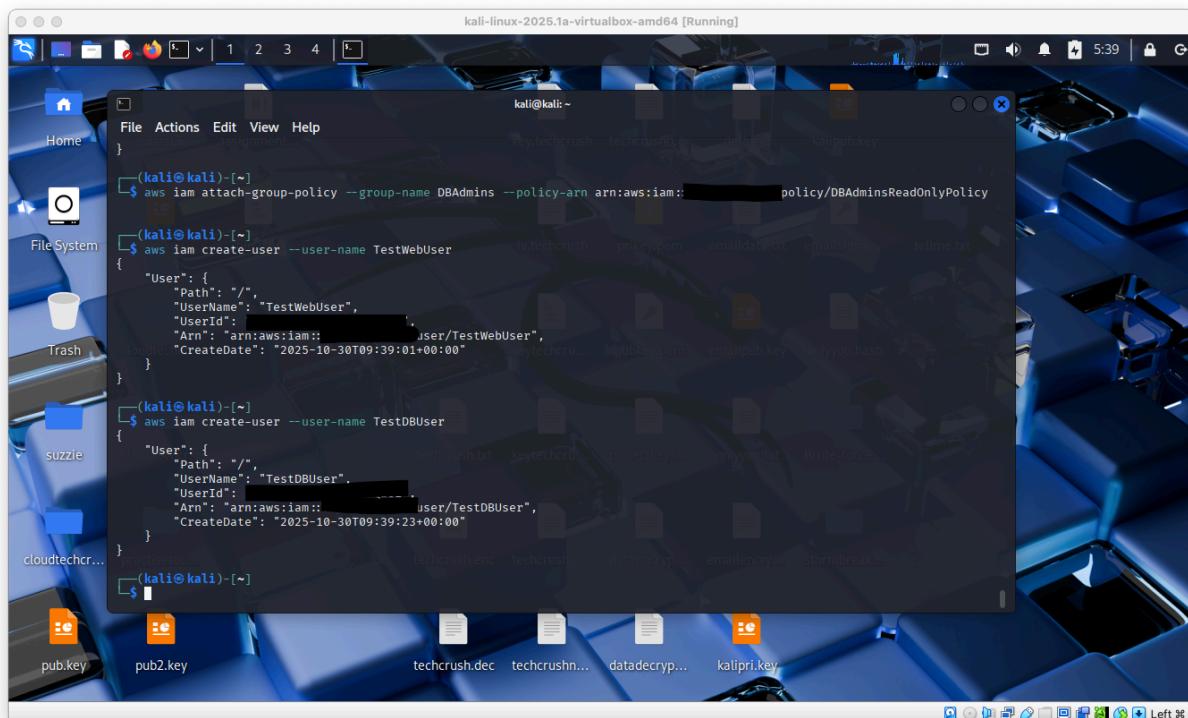
What happened / outputs to record

- Users created and visible in IAM.
- Each user added to its group successfully.

Challenges & fixes

- No major errors on create; just be sure to copy the User ARN for records.

Both test users created



```
(kali㉿kali)-[~]
$ aws iam attach-group-policy --group-name DBAdmins --policy-arn arn:aws:iam::aws:policy/DBAdminsReadOnlyPolicy
(kali㉿kali)-[~]
$ aws iam create-user --user-name TestWebUser
{
    "User": {
        "Path": "/",
        "UserName": "TestWebUser",
        "UserId": "AUGLJGKQHJLWVZPQXWYD",
        "Arn": "arn:aws:iam::user/TestWebUser",
        "CreateDate": "2025-10-30T09:39:01+00:00"
    }
}
(kali㉿kali)-[~]
$ aws iam create-user --user-name TestDBUser
{
    "User": {
        "Path": "/",
        "UserName": "TestDBUser",
        "UserId": "AUGLJGKQHJLWVZPQXWYD",
        "Arn": "arn:aws:iam::user/TestDBUser",
        "CreateDate": "2025-10-30T09:39:23+00:00"
    }
}
(kali㉿kali)-[~]
```

Both test users added to group & access key creation for TestDBUser



```
(kali㉿kali)-[~]
$ aws iam add-user-to-group --user-name TestWebUser --group-name WebAdmins
(kali㉿kali)-[~]
$ aws iam add-user-to-group --user-name TestDBUser --group-name DBAdmins
(kali㉿kali)-[~]
$ aws iam create-access-key --user-name TestDBUser
{
    "AccessKey": {
        "AccessKeyId": "AKIAJGKQHJLWVZPQXWYD",
        "CreateDate": "2025-10-30T09:40:01+00:00",
        "Status": "Active",
        "User": "TestDBUser"
    }
}
```

Access keys created & configure for TestDBUser

```
kali@kali:~$ aws iam create-access-key --user-name TestDBUser
{
    "AccessKey": {
        "UserName": "TestDBUser",
        "AccessKeyId": "XXXXXXXXXX",
        "Status": "Active",
        "SecretAccessKey": "XXXXXXXXXXXXXX",
        "CreateDate": "2025-10-30T10:02:13+00:00"
    }
}

(kali㉿kali)-[~]
└─$ aws configure --profile testdb
AWS Access Key ID [None]:
AWS Secret Access Key [None]: us-east-1
Default region name [None]: ``

(kali㉿kali)-[~]
└─$ aws configure --profile testdb
AWS Access Key ID [None]:
AWS Secret Access Key [None]: XXXXXXXXXXXXXXXXXXXXXXXX
Default region name [None]: us-east-1
Default output format [None]: json

(kali㉿kali)-[~]
```

Access keys created & configure for TestWEBUser

```
kali@kali:~$ aws iam list-attached-group-policies --group-name WebAdmins
{
    "AttachedPolicies": []
}

(kali@kali:~)
└─$ aws ec2 describe-subnets --profile testweb --region us-east-1 --output table
The config profile (testweb) could not be found

(kali@kali:~)
└─$ aws iam create-access-key --user-name TestWebUser
{
    "AccessKey": {
        "UserName": "TestWebUser",
        "AccessKeyId": "XXXXXXXXXX",
        "Status": "Active",
        "SecretAccessKey": "XXXXXXXXXXXXXX",
        "CreateDate": "2025-10-30T14:16:52+00:00"
    }
}

(kali@kali:~)
└─$ aws configure --profile testweb
AWS Access Key ID [None]:
AWS Secret Access Key [None]: 3
Default region name [None]: us-east-1
Default output format [None]: json
```

4.7 Creating access keys and configuring test CLI profiles

What I did (summary)

- Created Access Key ID + Secret Access Key for each test user.

- Configured two named CLI profiles (testdb and testweb) to test permissions from the CLI.

Why

Profiles let us simulate each user's permissions via the CLI without using the main admin account.

What happened / outputs to record

- Each create-access-key returned an AccessKeyId and SecretAccessKey.
- I used those to configure CLI profiles (one profile per user).
- At one point we aborted aws configure while entering keys — Ctrl+C cancels without saving; we re-ran configuration with correct values.

Challenges & fixes

- We accidentally made an access key we didn't want — we listed keys and deleted the unwanted key.
- Reminder: never paste keys into chat or save them in public places.

Access key output error



```
(kali㉿kali)-[~]
└─$ aws configure --profile testdb
AWS Access Key ID [None]:
AWS Secret Access Key [None]: us-east-1
Default region name [None]: ^C

(kali㉿kali)-[~]
└─$ aws configure --profile testdb
AWS Access Key ID [None]:
AWS Secret Access Key [None]:
```

4.8 Permission verification (what I tested and the results)

What I tested (summary)

For each test profile, we ran read actions and attempted a write/delete action to ensure read-only enforcement.

DBAdmins (testdb) checks

- Read: described subnets and VPCs — success (DBSubnet visible to testdb).
- Write: attempted to delete DBSubnet — denied (AccessDenied / UnauthorizedOperation).

Result: DBAdmins policy enforced correctly

WebAdmins (testweb) checks

- Read: initially failed because the wrong policy had been attached; after fixing and reattaching the correct WebAdminsReadOnlyPolicy, testweb could describe subnets and VPCs (WebSubnet visible).
- Write: attempted to delete WebSubnet — denied.

Result: WebAdmins policy enforced correctly after repair.

Challenges & fixes

- **Propagation delay:** IAM policy changes sometimes took a minute to propagate — we waited and retried.
- **Wrong policy attached first:** Detached, recreated and attached correct policy ARN. Testdb & TestWeb describe-subnets showing DBSubnet & WEBSubnet

The screenshot shows a Kali Linux desktop environment with a terminal window open. The terminal displays the following AWS CLI commands and their outputs:

```
aws configure --profile testdb
aws ec2 describe-subnets --profile testdb --query "Subnets[*].{SubnetID:SubnetId,Name:Tags[?Key=='Name'][@].Value,CIDR:CidrBlock,AZ:AvailabilityZone}" --output table
```

The output table shows the following subnet information:

AZ	CIDR	Name	SubnetID
us-east-1a	172.31.80.0/20	None	subnet-00000000
us-east-1a	10.0.1.0/24	WebSubnet	subnet-00000001
us-east-1f	172.31.64.0/20	None	subnet-00000002
us-east-1b	10.0.2.0/24	DBSubnet	subnet-00000003
us-east-1c	172.31.16.0/20	None	subnet-00000004
us-east-1e	172.31.48.0/20	None	subnet-00000005
us-east-1d	172.31.32.0/20	None	subnet-00000006

Testdb attempt to delete subnet and AccessDenied output.

The screenshot shows a Kali Linux desktop environment with a terminal window open. The terminal displays the following AWS CLI command and its error output:

```
aws ec2 delete-subnet --subnet-id subnet-00000001 --profile testdb --region us-east-1
```

The output shows an `AccessDenied` error:

```
An error occurred (UnauthorizedOperation) when calling the DeleteSubnet operation: You are not authorized to perform this operation. User: arn:aws:iam::123456789012:root [user/TestDBUser] is not authorized to perform: ec2:DeleteSubnet on resource: arn:aws:ec2:us-east-1:123456789012:subnet/subnet-00000001 because no identity-based policy allows the ec2:DeleteSubnet action. Encoded authorization failure message: ...
```

Testweb attempt to delete subnet and AccessDenied output.

The screenshot shows a terminal window on a Kali Linux desktop environment. The terminal is running nano to edit a file named WebAdminsReadOnlyPolicy.json. The user runs an AWS command to describe subnets, which outputs a table:

AZ	CIDR	Name	SubnetID
us-east-1a	10.0.1.0/24	WebSubnet	subnet-1
us-east-1b	10.0.2.0/24	DBSubnet	subnet-4

Then, the user runs another AWS command to delete the subnet with ID subnet-1, but receives an AccessDenied error message:

```
An error occurred (UnauthorizedOperation) when calling the DeleteSubnet operation: You are not authorized to perform this operation. User: arn:aws:iam::[REDACTED]:user/TestWebUser is not authorized to perform: ec2:DeleteSubnet on resource: arn:aws:ec2:us-east-1:[REDACTED]:subnet-[REDACTED] because no identity-based policy allows the ec2:DeleteSubnet action. Encoded authorization failure message: [REDACTED]
```

4.10 Final outcome & state

What the final environment included

- One working VPC: IAM-Automation-VPC (CIDR **10.0.0.0/16**) — use the final VPC ID in the report attachments.
- Two subnets:
 - WebSubnet — e.g., **10.0.1.0/24**, AZ: us-east-1a (replace with your chosen AZ if different).
 - DBSubnet — e.g., **10.0.2.0/24**, AZ: us-east-1b.
- IAM groups: DBAdmins, WebAdmins.
- IAM users: TestDBUser, TestWebUser assigned to their groups.
- Policies: DBAdminsReadOnlyPolicy and WebAdminsReadOnlyPolicy attached to respective groups.
- Verified behavior: read-only allowed; delete/modify forbidden for both test profiles.

5.0 Challenges and Solutions

During the implementation of the IAM Roles and Secure Access Automation Project, several challenges were encountered. Below is a summary of the main issues and how each was resolved:

Challenge	Description	Solution Implemented	Outcome
AWS CLI command syntax issues	Some AWS CLI commands failed due to incorrect syntax, especially when using quotation marks (' vs "), backslashes, and wrong line continuation symbols.	Adjusted command formatting to a single line using proper quotation marks. Verified correct syntax from working commands.	Commands executed successfully after correction.
Subnet creation conflicts	Attempts to create subnets with overlapping CIDR ranges resulted in “Invalid subnet range” errors.	Verified the main VPC CIDR and adjusted subnet ranges to avoid overlap (e.g., using 10.0.1.0/24 for WebSubnet and 10.0.2.0/24 for DBSubnet).	Both subnets created successfully and verified under the same VPC.
Multiple VPC confusion	AWS showed more than one VPC ID, causing difficulty in identifying the correct one used for the project.	Described and filtered all VPCs using <code>aws ec2 describe-vpcs</code> to confirm the correct project VPC by its tags and CIDR.	Correct VPC identified and reused consistently throughout setup.
Policy JSON errors	The IAM policy for DBAdmins initially failed due to syntax errors in the JSON document.	Recreated the JSON file using the correct format and indentation verified with <code>aws iam create-policy</code> .	Policy created successfully and attached to the intended IAM group.

Access key misconfiguration	A wrong access key was created for the test user, leading to wrong identity verification results.	Revoked the incorrect key and generated a new one. Updated AWS CLI profile credentials for the correct user.	Test user authenticated successfully with correct permissions.
Permissions validation errors	Some test users couldn't see or access subnet details due to missing role assignments.	Reattached IAM policies to groups and re-validated using separate profiles for testdb and testweb.	Permissions matched as intended DBAdmins had read-only access to DB resources, WebAdmins could manage web subnet.

6.0 Conclusion and Recommendations

The IAM Roles and Secure Access Automation Project was successfully completed using AWS infrastructure instead of Azure, while maintaining the original project objectives.

All configurations, including VPC setup, subnet segmentation, IAM group and policy creation, user configuration, and permission testing — were automated and verified. The project demonstrated a clear understanding of identity and access management, subnet segmentation, and secure access control principles within a cloud environment.

Key Takeaways:

- Proper tagging and documentation help prevent confusion when managing multiple cloud resources.
- Testing permissions with separate user profiles ensures that role-based access control works as intended.
- Using AWS CLI provides automation flexibility but requires careful attention to syntax.

Recommendations:

1. Always document VPC and subnet CIDRs during creation to prevent overlap or misconfiguration.

- 2.** Store IAM policy files in a version-controlled directory (e.g., GitHub) for reuse and CI/CD integration.
- 3.** Implement cleanup scripts (`aws iam delete-*`, `aws ec2 delete-*`) as part of automation pipelines for future scalability.
- 4.** Use environment-specific profiles in the AWS CLI to separate development, testing, and production credentials.

7.0 References

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8.0 Appendices

1. AWS account created

The screenshot shows the AWS IAM Dashboard. On the left, there's a sidebar with 'Identity and Access Management (IAM)' selected. Under 'Access management', it lists User groups, Users, Roles, Policies, Identity providers, Account settings, and Root access management. Under 'Access reports', it lists Access Analyzer and Resource analysis. A blue banner at the top right says 'New access analyzers available' and 'Access Analyzer now analyzes internal access patterns to your critical resources within a single account or across your entire organization'. Below this, the 'IAM Dashboard' section has a 'Security recommendations' box with two items: 'Add MFA for root user' and 'Root user has no active access keys'. To the right, the 'AWS Account' section displays the Account ID (redacted), Account Alias 'Create', and the 'Sign-in URL for IAM users in this account' (redacted). At the bottom right is a 'Quick Links' box with 'My security credentials'.

2. awscli installed

```
[kali㉿kali)-~] $ ping google.com
PING google.com (142.250.75.238) 56(84) bytes of data.
64 bytes from par10s41-in-f14.1e100.net (142.250.75.238): icmp_seq=1 ttl=255 time=161 ms
64 bytes from par10s41-in-f14.1e100.net (142.250.75.238): icmp_seq=2 ttl=255 time=216 ms
^C
--- google.com ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1001ms
rtt min/avg/max/mdev = 160.722/188.544/216.367/27.822 ms

[kali㉿kali)-~] $ sudo apt update & sudo apt install awscli -y
[sudo] password for kali:
Get:1 http://kali.download/kali kali-rolling InRelease [34.0 kB]
Get:2 http://kali.download/kali kali-rolling/main amd64 Packages [20.9 MB]
Get:3 http://kali.download/kali kali-rolling/main amd64 Contents [deb] [52.2 MB]
Ign:4 https://download.docker.com/linux/debian bookworm InRelease
Get:5 http://kali.download/kali kali-rolling/contrib amd64 Packages [114 kB]
Get:6 http://kali.download/kali kali-rolling/contrib amd64 Contents [deb] [252 kB]
Get:7 http://kali.download/kali kali-rolling/non-free amd64 Packages [188 kB]
Get:8 http://kali.download/kali kali-rolling/non-free amd64 Contents [deb] [896 kB]
Ign:9 https://download.docker.com/linux/debian bookworm InRelease
Ign:10 https://download.docker.com/linux/debian bookworm InRelease
Err:11 https://download.docker.com/linux/debian bookworm InRelease
  Could not wait for server fd - select ([1: Resource temporarily unavailable]) [IP: 108.157.78.123 443]
Fetched 74.6 MB in 2min 8s (582 kB/s)
1356 packages can be upgraded. Run 'apt list --upgradable' to see them.
Warning: Failed to fetch https://download.docker.com/linux/debian/dists/bookworm/InRelease Could not wait for server fd -
  select ([1: Resource temporarily unavailable]) [IP: 108.157.78.123 443]
Warning: Some index files failed to download. They have been ignored, or old ones used instead.
The following packages were automatically installed and are no longer required:
  isc-dhcp-common libutempter0          python3-dunamai           python3-pyviewerd
Uninstalling these packages may break your system.
Do you want to continue? [Y/n] y
python3-pyviewerd
```

3. AWS CLI successfully configured

```
[kali㉿kali)-~] $ aws --version
aws-cli/2.23.6 Python/3.13.5 Linux/6.12.33+kali-amd64 source/x86_64.kali.2025

[kali㉿kali)-~] $ aws configure
AWS Access Key ID [None]:
AWS Secret Access Key [None]:
Default region name [None]: us-east-1
Default output format [None]: json
```