AWS Cloud Security Builder Lab Project Report

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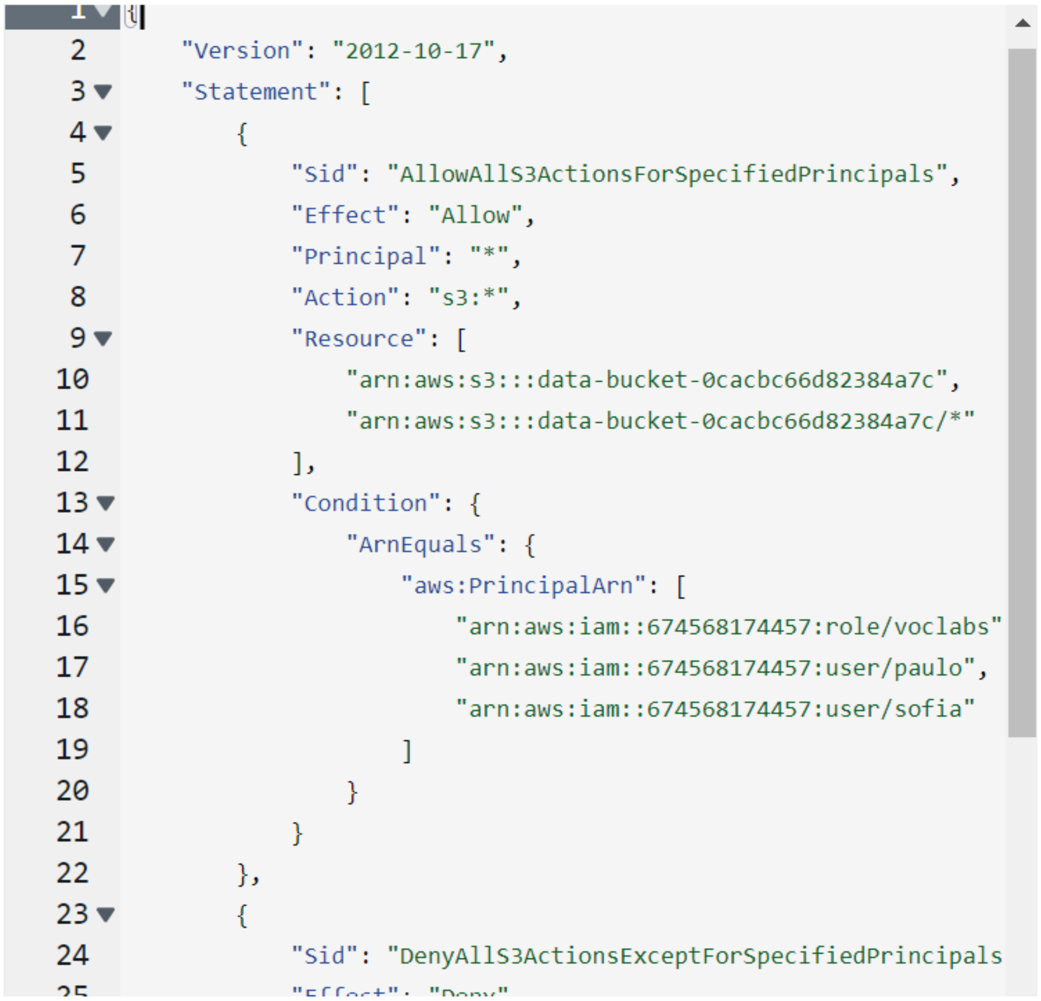
Section: A

Task 1:

Task 1.1: Create a bucket, apply a bucket policy, and test access

We create a new bucket by the name of data-bucket, upload a text file to the bucket and modify the bucket policy according to the specifications.



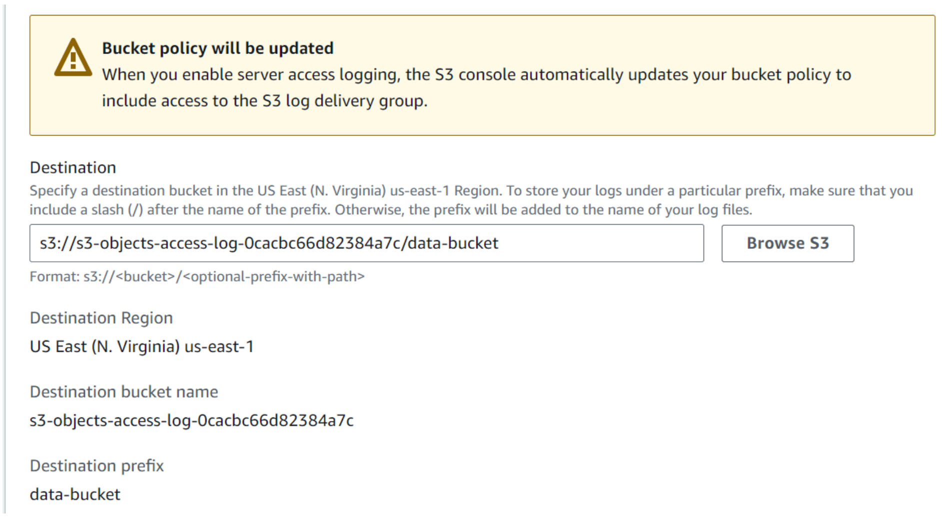
```
{
    "Version": "2012-10-17",
    "Statement": [
        {
            "Sid": "AllowAllS3ActionsForSpecifiedPrincipals",
            "Effect": "Allow",
            "Principal": "*",
            "Action": "s3:*",
            "Resource": [
                "arn:aws:s3:::data-bucket-0cacbc66d82384a7c",
                "arn:aws:s3:::data-bucket-0cacbc66d82384a7c/*"
            ],
            "Condition": {
                "ArnEquals": {
                    "aws:PrincipalArn": [
                        "arn:aws:iam::674568174457:role/voclabs"
                        "arn:aws:iam::674568174457:user/paulo",
                        "arn:aws:iam::674568174457:user/sofia"
                    ]
                }
            }
        },
        {
            "Sid": "DenyAllS3ActionsExceptForSpecifiedPrincipals
            "Effect": "Deny"
```

Bucket policy for allow and deny

We now test access from Paulo and Mary users and the access levels are indeed according to the specifications.

Task 1.2: Enable versioning and object-level logging on a bucket

After enabling versioning from the properties tab in the bucket menu, we enable server access logging to the logging bucket already created by the environment and confirm the bucket policy change.



Bucket policy will be updated
When you enable server access logging, the S3 console automatically updates your bucket policy to include access to the S3 log delivery group.

Destination
Specify a destination bucket in the US East (N. Virginia) us-east-1 Region. To store your logs under a particular prefix, make sure that you include a slash (/) after the name of the prefix. Otherwise, the prefix will be added to the name of your log files.

s3://s3-objects-access-log-0cacbc66d82384a7c/data-bucket

Format: s3://<bucket>/<optional-prefix-with-path>

Destination Region
US East (N. Virginia) us-east-1

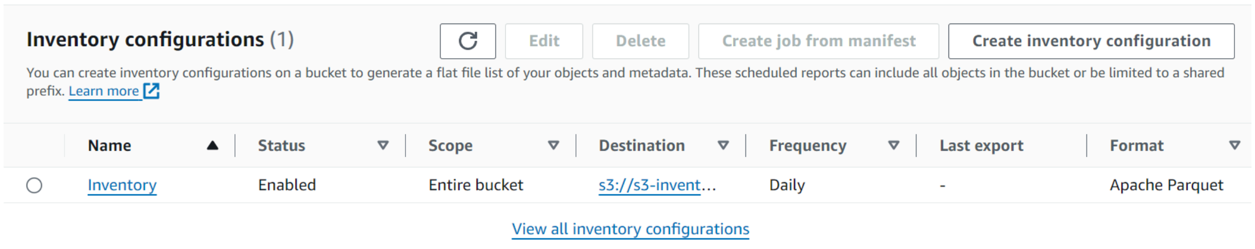
Destination bucket name
s3-objects-access-log-0cacbc66d82384a7c

Destination prefix
data-bucket

Access logging to the pre-created bucket

Task 1.3: Implement the S3 Inventory feature on a bucket

Implement the inventory configuration management setting under the management tab of the data bucket, and direct output to inventory bucket.



Inventory configurations (1)

You can create inventory configurations on a bucket to generate a flat file list of your objects and metadata. These scheduled reports can include all objects in the bucket or be limited to a shared prefix. Learn more

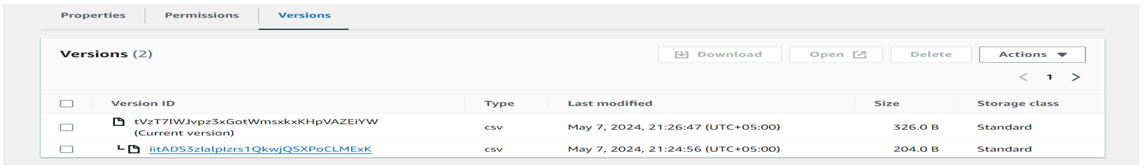
	Name	Status	Scope	Destination	Frequency	Last export	Format
○	Inventory	Enabled	Entire bucket	s3://s3-invent...	Daily	-	Apache Parquet

View all inventory configurations

inventory management configuration

Task 1.4: Confirm that versioning works as intended

Create the file customers.csv on the computer and log in as Paulo user. Upload the file customers.csv to data-bucket as Paulo user, change it on your computer and upload again to see that there are multiple versions of the file in the bucket.



Versions (2)

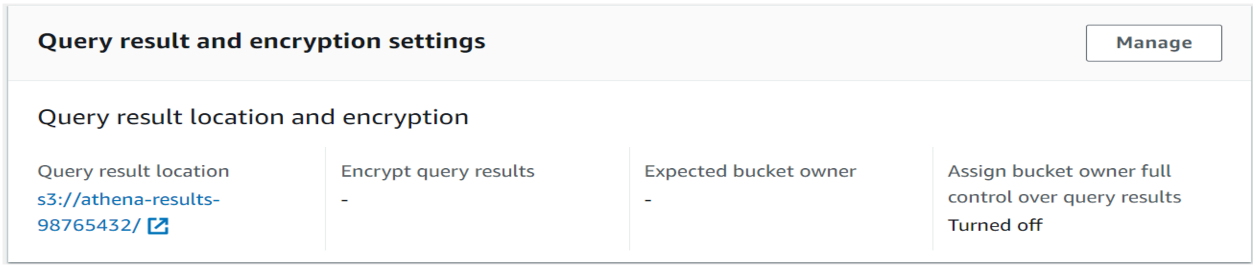
Version ID	Type	Last modified	Size	Storage class
tVzT7lWJvpz3xGotWmsxkxKHpVAZEiYW (Current version)	csv	May 7, 2024, 21:26:47 (UTC+05:00)	326.0 B	Standard
iitADS3zlalplzrs1QkwjQSXPoCLMExK	csv	May 7, 2024, 21:24:56 (UTC+05:00)	204.0 B	Standard

Multiple versions

Open both versions of the file to generate log data and log out of the Paulo user. Log in to the Mary user and try to access data-bucket, which fails due to permissions.

Task 1.5: Confirm object-level logging and query the access logs by using Athena

Confirm the log data by accessing one of the objects in the objects access bucket. Create a bucket by the name of athena-results-98765432 and configure this as the result destination from the athena console


Query result and encryption settings

Query result location and encryption

Query result location	Encrypt query results	Expected bucket owner	Assign bucket owner full control over query results
s3://athena-results-98765432/	-	-	Turned off

Result destination for athena

Paste the provided query into the editor and run it, while observing the results. It generates a new table. Upon previewing the contents of the new table, run the other provided query in the editor and observe the IAM user access results

Task 1.6: Review the S3 Inventory report by using S3 Select

Under the management section of the data-bucket, locate inventory management configuration and select the s3-inventory link.

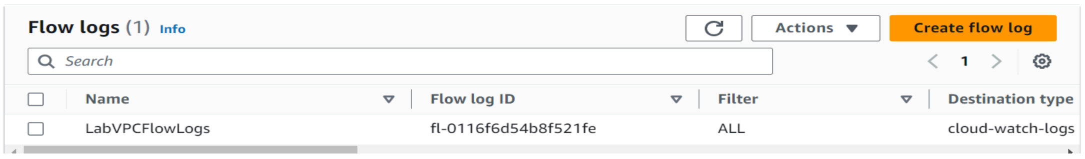
Task 2:

Task 2.1: Review LabVPC and its associated resources

Go to the VPC console and review the LabVPC instance along with its configurations and subnets. Go to the IAM and review the VPCFlowLogsRole and its policy. Afterwards, go to EC2 and observe the details for WebServer.

Task 2.2: Create a VPC flow log

Select LabVPC and create a new flow log according to the specifications.

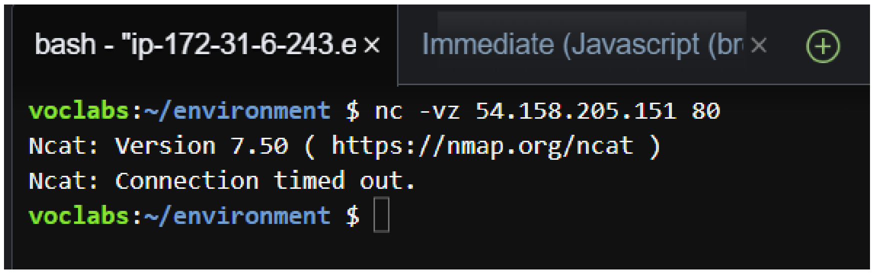


Name	Flow log ID	Filter	Destination type
LabVPCFlowLogs	fl-0116f6d54b8f521fe	ALL	cloud-watch-logs

New flow log

Task 2.3: Access the WebServer instance from the internet and review VPC flow logs in CloudWatch

Confirm that the WebServer instance's public IP address page does not load. Now, test access through Cloud9 IDE and run a command to check public access



```
voclabs:~/environment $ nc -vz 54.158.205.151 80
Ncat: Version 7.50 ( https://nmap.org/ncat )
Ncat: Connection timed out.
voclabs:~/environment $
```

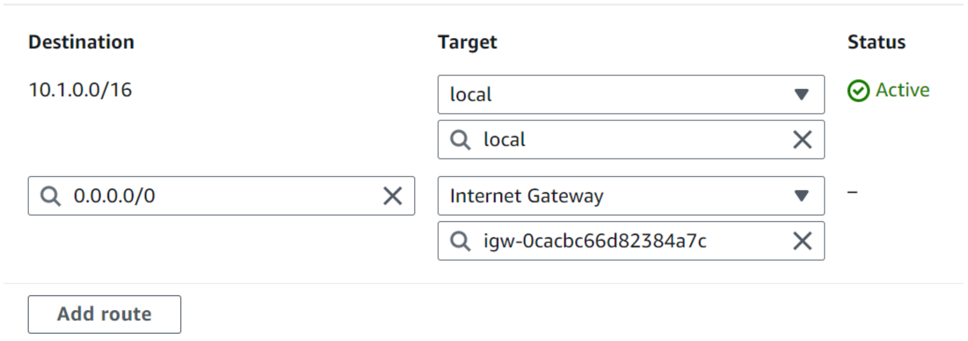
Cloud9Instance command to check access

Repeating this step with port 22 also gives the same result

Inexplicable error: cannot reach log destination. Can't fix because cannot delete flow log.

Task 2.4: Configure route table and security group settings

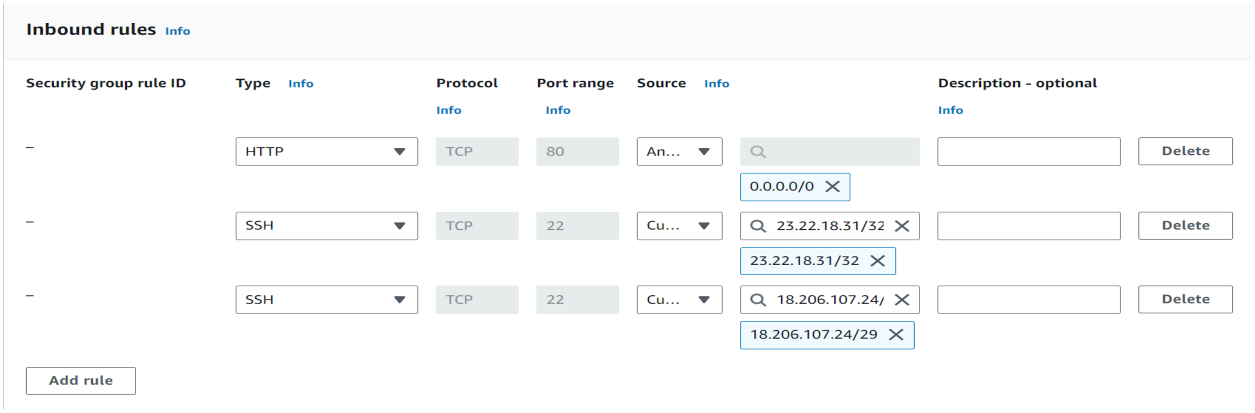
Go to VPC subnets and select WebServerSubnet and edit the route table to add the specified entry.



Destination	Target	Status
10.1.0.0/16	local / local	Active
0.0.0.0/0	Internet Gateway / igw-0cacbc66d82384a7c	–

Adding a new route

Test accessing the public ip address again, which fails again as it is supposed to. Find the Security Group for the WebServer instance and edit the inbound rules as per the specifications. Add an HTTP rule for port 80 access and SSH rule as well. The pubic ipv4 address of the Cloud 9 instance is 23.22.18.31 which is the source, while the destination is the WebServer Security group. Additionally, configure EC2 instance connect as well.



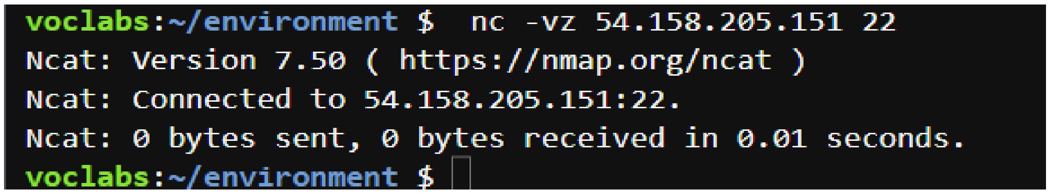
Inbound rules Info

Security group rule ID	Type	Protocol	Port range	Source		Description - optional	
–	HTTP	TCP	80	An...	0.0.0.0/0		Delete
–	SSH	TCP	22	Cu...	23.22.18.31/32		Delete
–	SSH	TCP	22	Cu...	18.206.107.24/29		Delete

Add rule

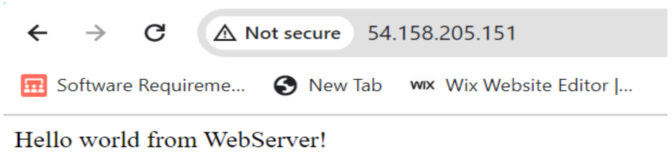
Added inbound rules

Now, we use the nc command to once again test public ip address connectivity from port 22 and it is a success.



```
voclabs:~/environment $  nc -vz 54.158.205.151 22
Ncat: Version 7.50 ( https://nmap.org/ncat )
Ncat: Connected to 54.158.205.151:22.
Ncat: 0 bytes sent, 0 bytes received in 0.01 seconds.
voclabs:~/environment $ 
```

Test from web browser for HTTP over port 80

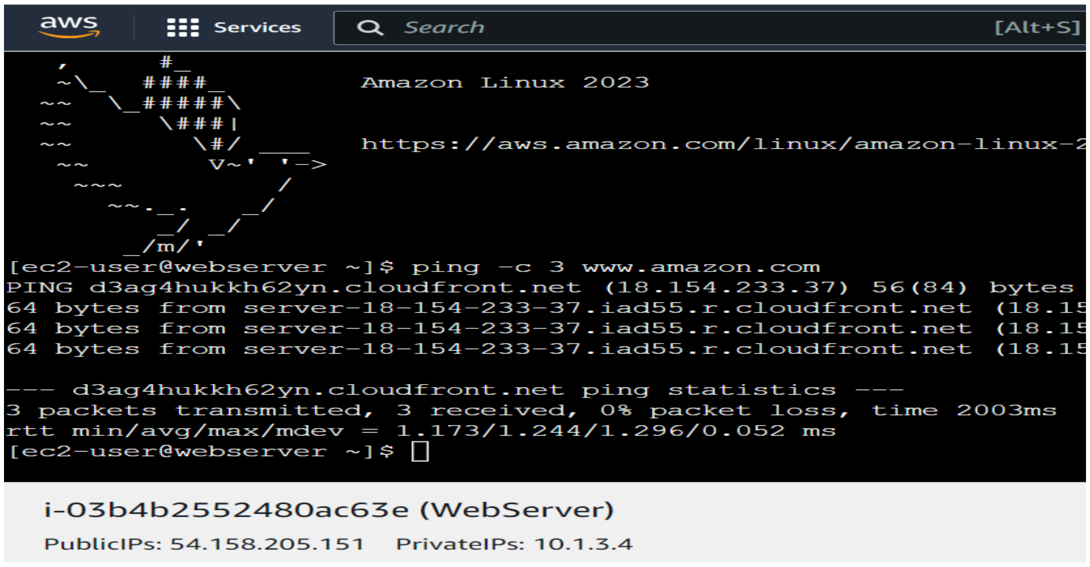


Not secure 54.158.205.151

Software Requireme... New Tab Wix Website Editor |...

Hello world from WebServer!

Test from Instance Connect



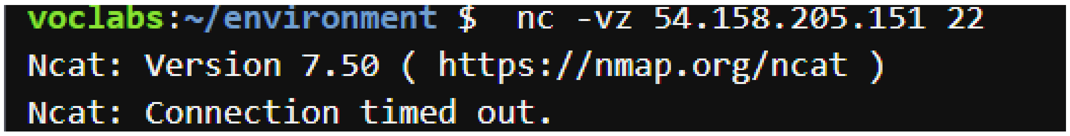
```
        ,     #_
        ~\_  ####_        Amazon Linux 2023
       ~~  \_#####\
       ~~     \###|
       ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2
        ~~       V~' '->
         ~~~         /
           ~~._.   _/
              _/ _/
            _/m/'
[ec2-user@webserver ~]$ ping -c 3 www.amazon.com
PING d3ag4hukkh62yn.cloudfront.net (18.154.233.37) 56(84) bytes
64 bytes from server-18-154-233-37.iad55.r.cloudfront.net (18.15
64 bytes from server-18-154-233-37.iad55.r.cloudfront.net (18.15
64 bytes from server-18-154-233-37.iad55.r.cloudfront.net (18.15

--- d3ag4hukkh62yn.cloudfront.net ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 1.173/1.244/1.296/0.052 ms
[ec2-user@webserver ~]$ 
```

i-03b4b2552480ac63e (WebServer)

PublicIPs: 54.158.205.151 PrivateIPs: 10.1.3.4

Task 2.5: Secure the WebServerSubnet with a network ACL

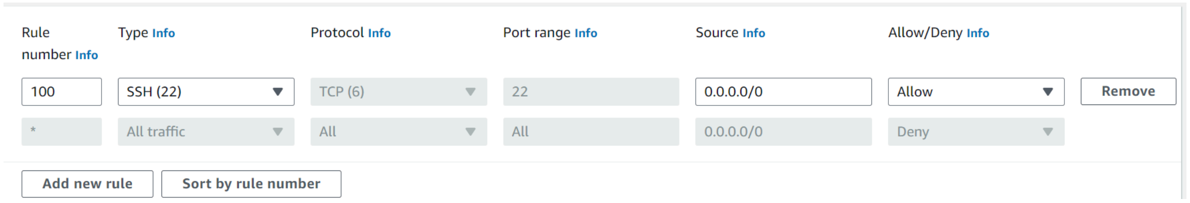
Navigating to the network ACL related to the WebServerSubnet. Modify the rule 100 from allow to deny and test access over port 22, which fails as expected. Network ACL overrides Security group inbound rules.



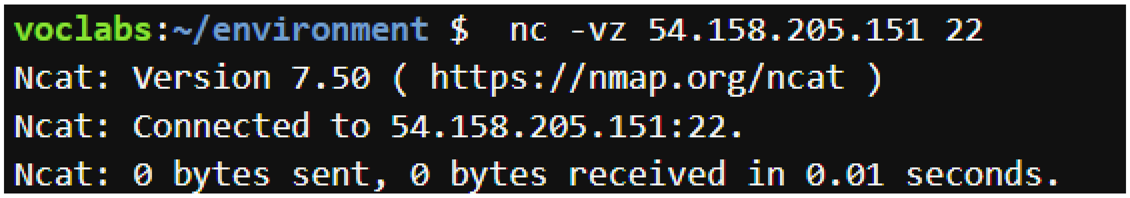
```
voclabs:~/environment $  nc -vz 54.158.205.151 22
Ncat: Version 7.50 ( https://nmap.org/ncat )
Ncat: Connection timed out.
```

Denied due to deny rule

Change the rule again to allow only port 22 access and test again.



Rule number	Type	Protocol	Port range	Source	Allow/Deny
100	SSH (22)	TCP (6)	22	0.0.0.0/0	Allow
*	All traffic	All	All	0.0.0.0/0	Deny



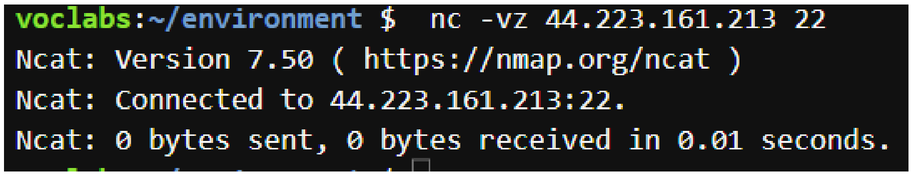
```
voclabs:~/environment $  nc -vz 54.158.205.151 22
Ncat: Version 7.50 ( https://nmap.org/ncat )
Ncat: Connected to 54.158.205.151:22.
Ncat: 0 bytes sent, 0 bytes received in 0.01 seconds.
```

Successful because port 22 allowed only

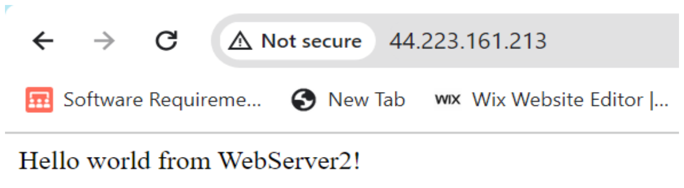
Similarly, add a new rule with number 90 that allows HTTP traffic from anywhere. The web browser access now works as well.

Task 2.6: Review NetworkFirewallVPC and its associated resources

Overview the configurations of FirewallVPC including the network ACL default rule. Now view the WebServer2 instance details and confirm access through port 80 and 22. It is successful.

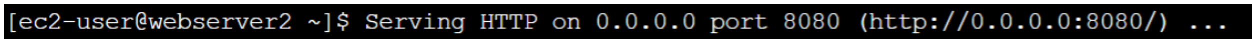


```
voclabs:~/environment $  nc -vz 44.223.161.213 22
Ncat: Version 7.50 ( https://nmap.org/ncat )
Ncat: Connected to 44.223.161.213:22.
Ncat: 0 bytes sent, 0 bytes received in 0.01 seconds.
```



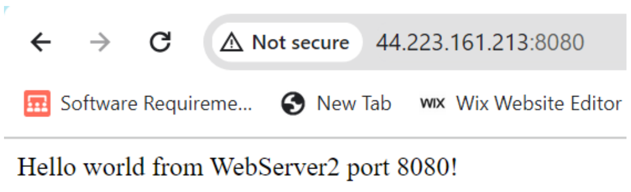
Hello world from WebServer2!

Now, use Instance Connect and run a command.



```
[ec2-user@webserver2 ~]$ Serving HTTP on 0.0.0.0 port 8080 (http://0.0.0.0:8080/) ...
```

Now, on the web browser test connection over 8080 port. It is also successful



Not secure 44.223.161.213:8080

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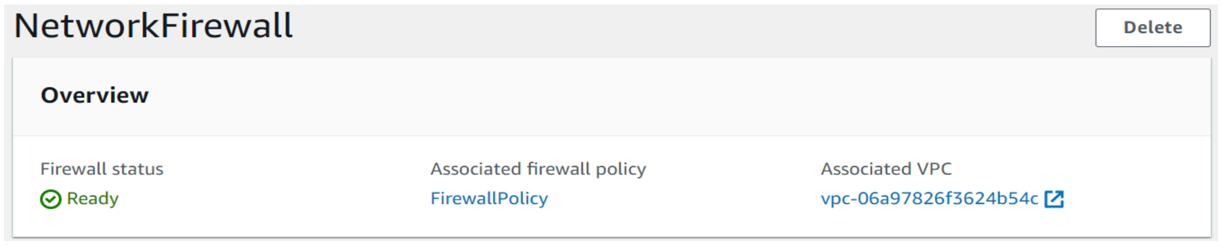
Hello world from WebServer2 port 8080!

Task 2.7: Create a network firewall

Navigate to the VPC console and create a firewall according to the specifications.



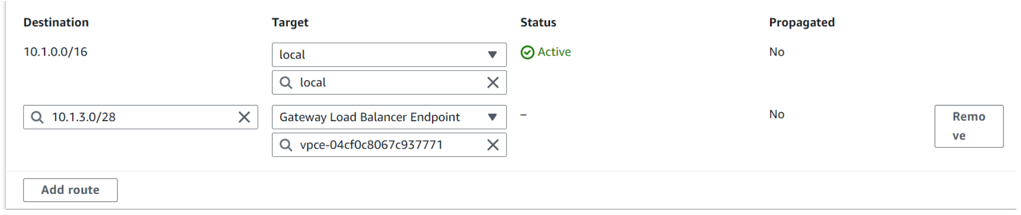
NetworkFirewall

Overview

Firewall status	Associated firewall policy	Associated VPC
Ready	FirewallPolicy	vpc-06a97826f3624b54c

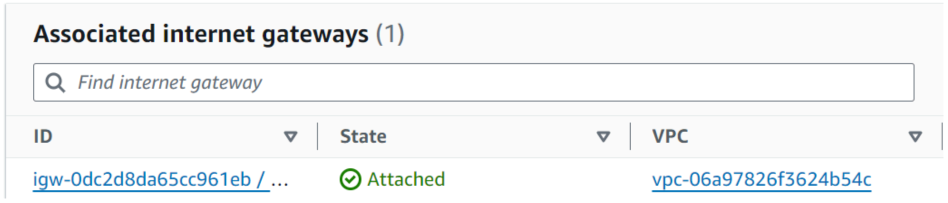
Task 2.8: Create route tables

Creating a new route table under NetworkFirewallVPC and edit it to add a new route that points to WebServer2.



Destination	Target	Status	Propagated
10.1.0.0/16	local	Active	No
10.1.3.0/28	Gateway Load Balancer Endpoint vpce-04cf0c8067c937771	-	No

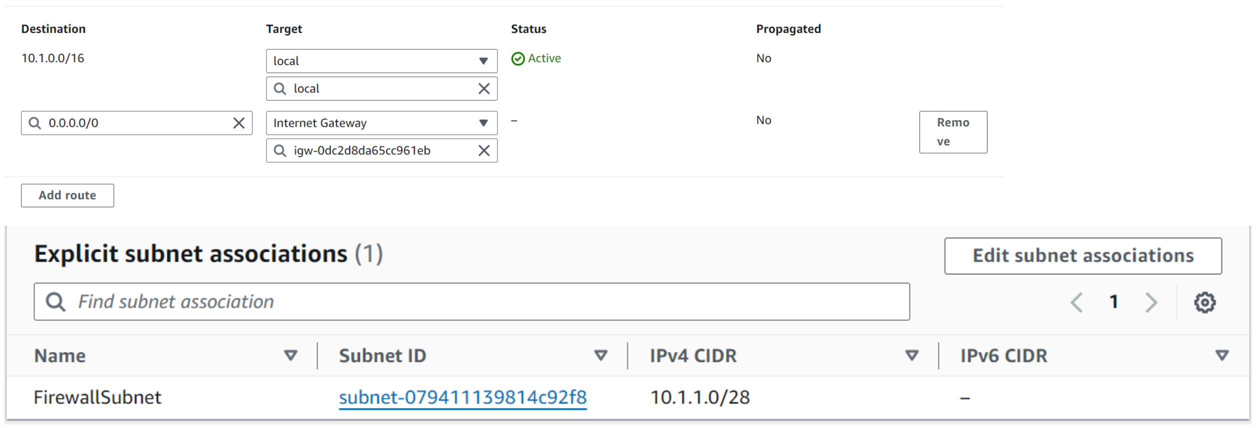
Add an Edge Association so that the table is connected to NetworkFirewallIG



Associated internet gateways (1)

ID	State	VPC
igw-0dc2d8da65cc961eb / ...	Attached	vpc-06a97826f3624b54c

Creating another route table, associate it with FirewallSubnet and add a route to point traffic towards NetworkFirewallIG.

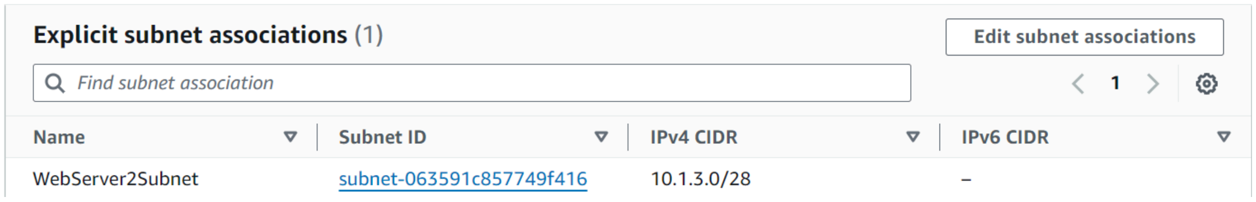


Destination	Target	Status	Propagated	
10.1.0.0/16	local / local	Active	No	
0.0.0.0/0	Internet Gateway / igw-0dc2d8da65cc961eb	–	No	Remove

Explicit subnet associations (1)

Name	Subnet ID	IPv4 CIDR	IPv6 CIDR
FirewallSubnet	subnet-079411139814c92f8	10.1.1.0/28	–

Create another route table for WebServer2 subnet under NetworkFirewallVPC

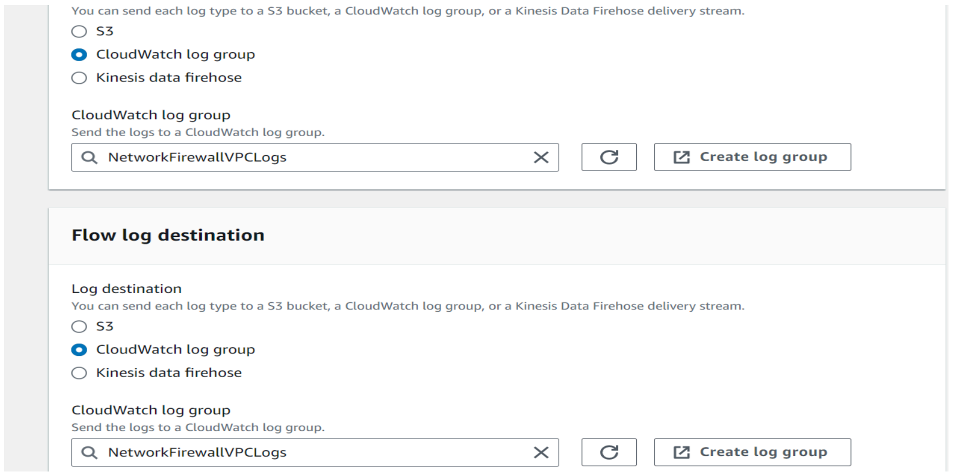


Explicit subnet associations (1)

Name	Subnet ID	IPv4 CIDR	IPv6 CIDR
WebServer2Subnet	subnet-063591c857749f416	10.1.3.0/28	–

Task 2.9: Configure logging for the network firewall

Create a CloudWatch log group with 6 month retention settings. Configure alert and flow type logging for the firewall and point them to the cloudwatch group



You can send each log type to a S3 bucket, a CloudWatch log group, or a Kinesis Data Firehose delivery stream.

S3 [✓ CloudWatch log group] Kinesis data firehose

CloudWatch log group
Send the logs to a CloudWatch log group.
NetworkFirewallVPCLogs

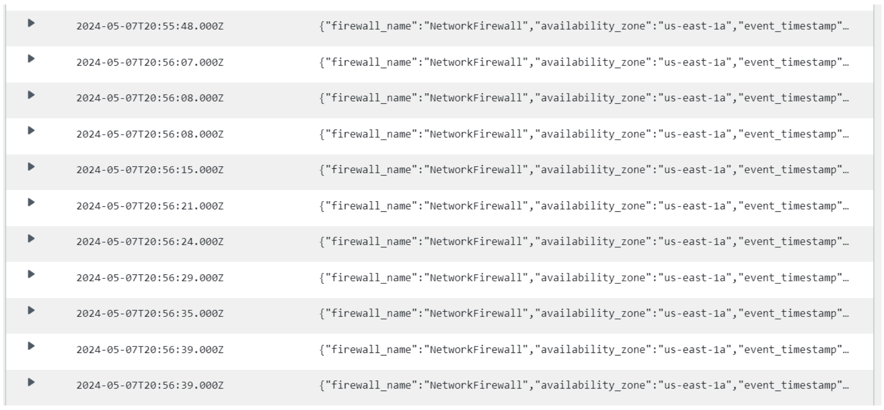
Flow log destination

Log destination
You can send each log type to a S3 bucket, a CloudWatch log group, or a Kinesis Data Firehose delivery stream.

S3 [✓ CloudWatch log group] Kinesis data firehose

CloudWatch log group
Send the logs to a CloudWatch log group.
NetworkFirewallVPCLogs

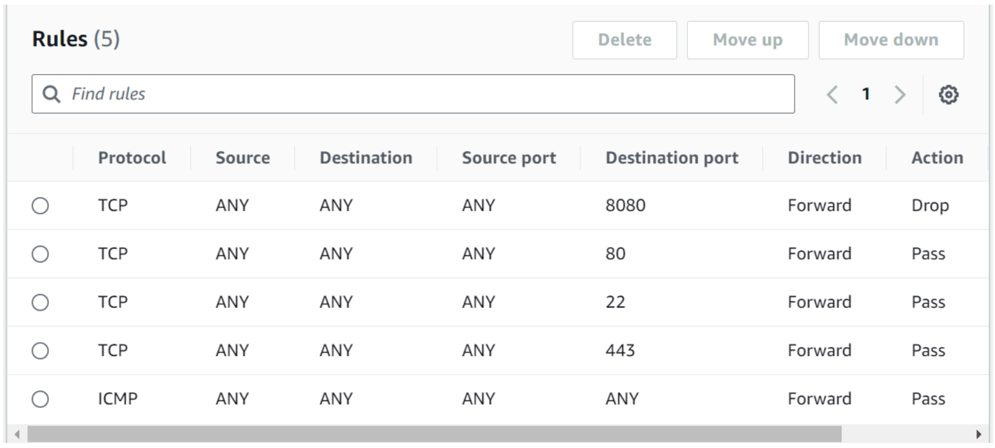
Attempt to access the public IP of WebServer2 and observe the logs generated in the newly created CloudWatch log group.



```
2024-05-07T20:55:48.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:07.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:08.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:08.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:15.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:21.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:24.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:29.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:35.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:39.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
2024-05-07T20:56:39.000Z    {"firewall_name":"NetworkFirewall","availability_zone":"us-east-1a","event_timestamp"…
```

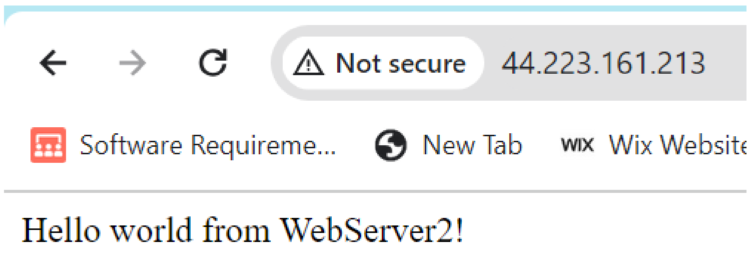
Task 2.10: Configure the firewall policy and test access

Create a stateful rule group and add 5 rules as per the specifications.



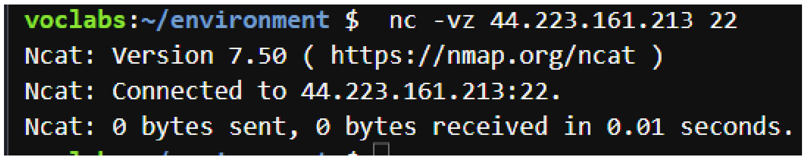
	Protocol	Source	Destination	Source port	Destination port	Direction	Action
○	TCP	ANY	ANY	ANY	8080	Forward	Drop
○	TCP	ANY	ANY	ANY	80	Forward	Pass
○	TCP	ANY	ANY	ANY	22	Forward	Pass
○	TCP	ANY	ANY	ANY	443	Forward	Pass
○	ICMP	ANY	ANY	ANY	ANY	Forward	Pass

Now, test multiple forms of access to the WebServer2 instance.
Browser access:



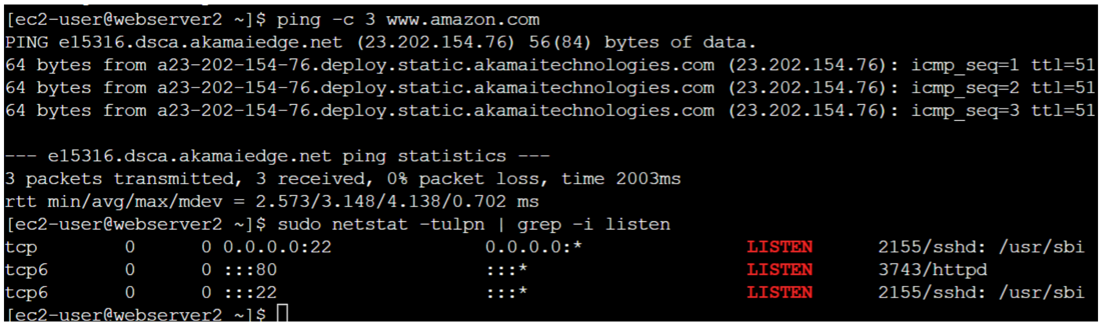
Hello world from WebServer2!

Netcat access:



```
voclabs:~/environment $  nc -vz 44.223.161.213 22
Ncat: Version 7.50 ( https://nmap.org/ncat )
Ncat: Connected to 44.223.161.213:22.
Ncat: 0 bytes sent, 0 bytes received in 0.01 seconds.
```

Instance connect and commands:



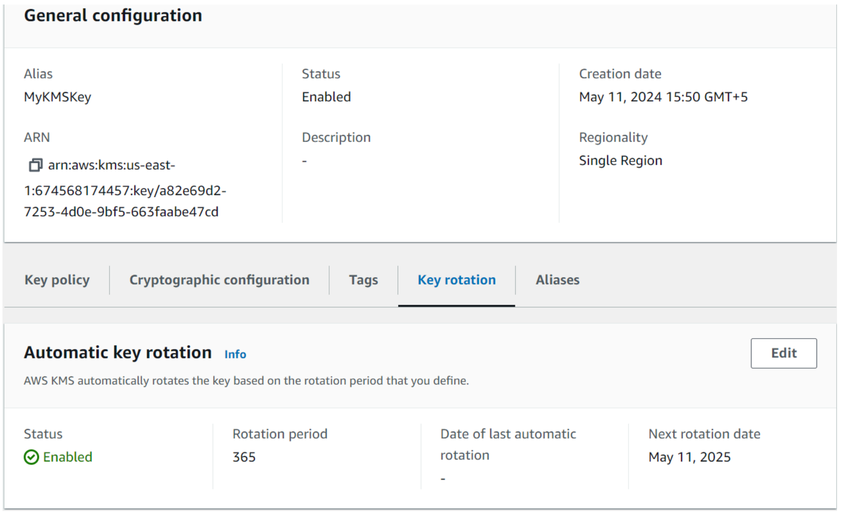
```
[ec2-user@webserver2 ~]$ ping -c 3 www.amazon.com
PING e15316.dsca.akamaiedge.net (23.202.154.76) 56(84) bytes of data.
64 bytes from a23-202-154-76.deploy.static.akamaitechnologies.com (23.202.154.76): icmp_seq=1 ttl=51
64 bytes from a23-202-154-76.deploy.static.akamaitechnologies.com (23.202.154.76): icmp_seq=2 ttl=51
64 bytes from a23-202-154-76.deploy.static.akamaitechnologies.com (23.202.154.76): icmp_seq=3 ttl=51

--- e15316.dsca.akamaiedge.net ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 2.573/3.148/4.138/0.702 ms
[ec2-user@webserver2 ~]$ sudo netstat -tulpn | grep -i listen
tcp        0      0 0.0.0.0:22              0.0.0.0:*               LISTEN      2155/sshd: /usr/sbi
tcp6       0      0 :::80                   :::*                    LISTEN      3743/httpd
tcp6       0      0 :::22                   :::*                    LISTEN      2155/sshd: /usr/sbi
[ec2-user@webserver2 ~]$
```

And finally, confirm that access through port 8080 is not available.

Task 3:

Task 3.1: Create a customer managed key and configure key rotation

Create an AWS customer managed key, grants permissions to the voclabs role and turn on key rotation



General configuration

Alias: MyKMSKey	Status: Enabled	Creation date: May 11, 2024 15:50 GMT+5
ARN: arn:aws:kms:us-east-1:674568174457:key/a82e69d2-7253-4d0e-9bf5-663faabe47cd	Description: -	Regionality: Single Region

Automatic key rotation

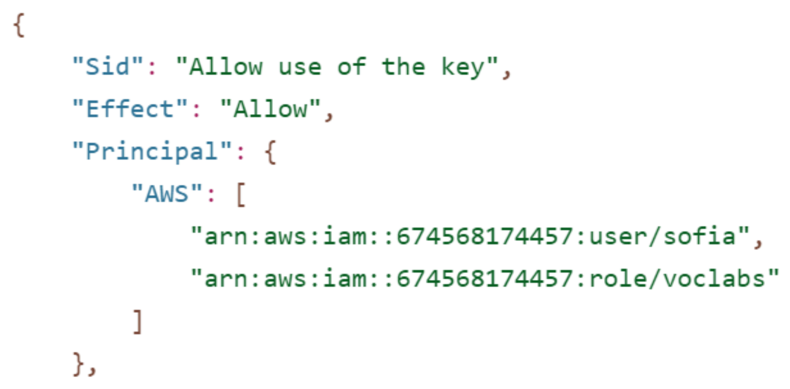
AWS KMS automatically rotates the key based on the rotation period that you define.

Status	Rotation period	Date of last automatic rotation	Next rotation date
✓ Enabled	365	-	May 11, 2025

AWS managed key

Task 3.2: Update the AWS KMS key policy and analyze an IAM policy

Update the AWS key policy and add a statement to the Principal section under “Allow Use of Key”



```
{
    "Sid": "Allow use of the key",
    "Effect": "Allow",
    "Principal": {
        "AWS": [
            "arn:aws:iam::674568174457:user/sofia",
            "arn:aws:iam::674568174457:role/voclabs"
        ]
    },
```

Allow key usage for Sofia

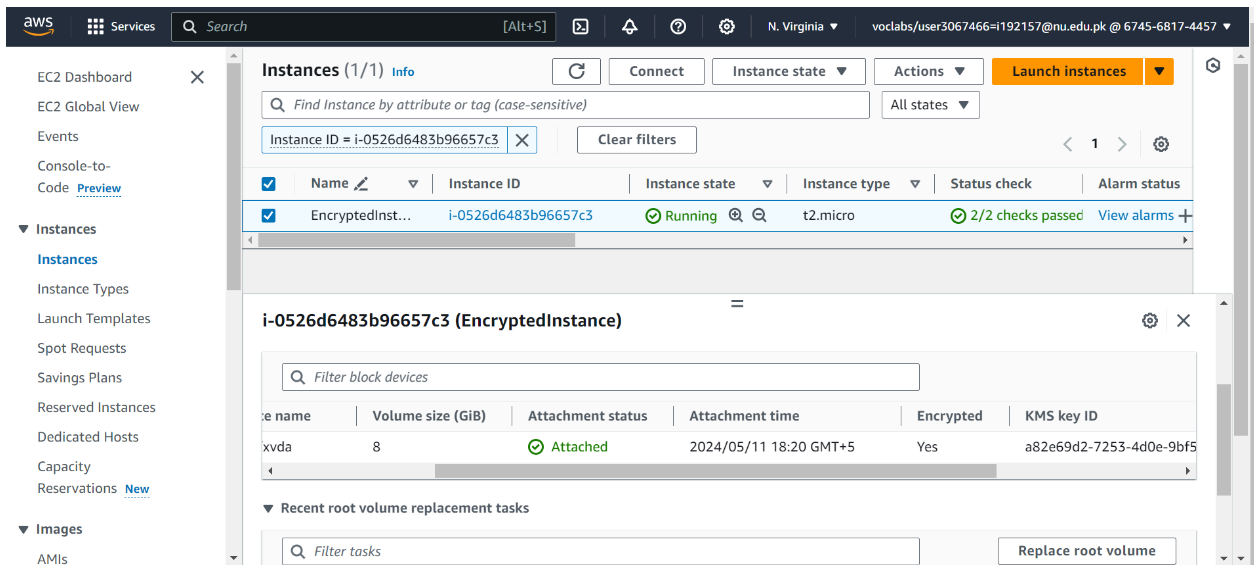
Analyze the given policy

Task 3.3: Use AWS KMS to encrypt data in Amazon S3

Modify data-bucket to use SSE-KMS encryption. Log in as Sofia and upload a csv file to data-bucket. Check to see how the new encryption status on the file and confirm that it can be downloaded by Sofia. Now, upon trying to access the file as Paulo, the access is denied.

Task 3.4: Use AWS KMS to encrypt the root volume of an EC2 instance

Create an Instance and configure the storage with the KMS key created earlier



Instances (1/1) Info

Find Instance by attribute or tag (case-sensitive)

Instance ID = i-0526d6483b96657c3

Name	Instance ID	Instance state	Instance type	Status check	Alarm status
EncryptedInst…	i-0526d6483b96657c3	Running	t2.micro	2/2 checks passed	View alarms

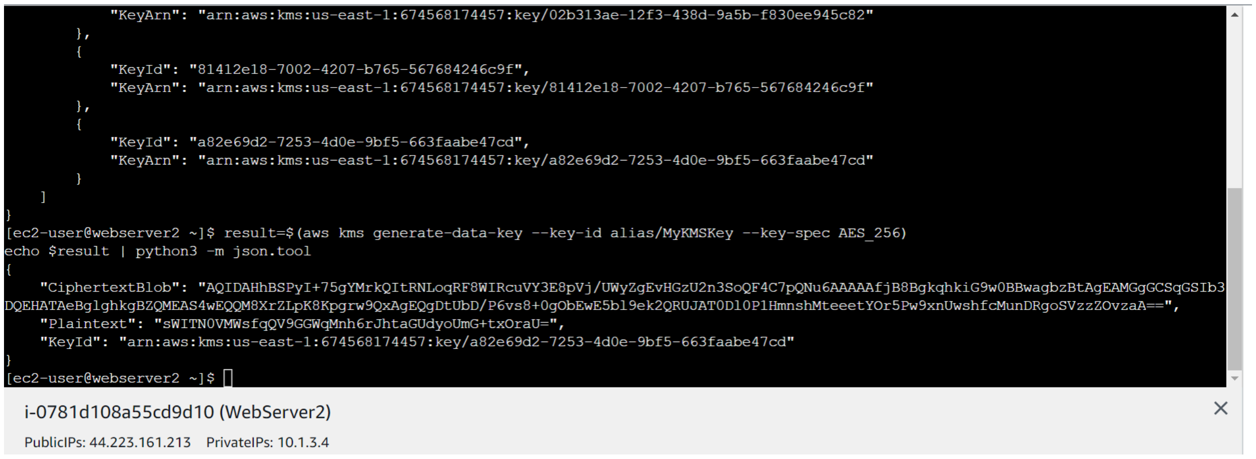
i-0526d6483b96657c3 (EncryptedInstance)

Filter block devices

e name	Volume size (GiB)	Attachment status	Attachment time	Encrypted	KMS key ID
xvda	8	Attached	2024/05/11 18:20 GMT+5	Yes	a82e69d2-7253-4d0e-9bf5

Task 3.5: Use AWS KMS envelope encryption to encrypt data in place

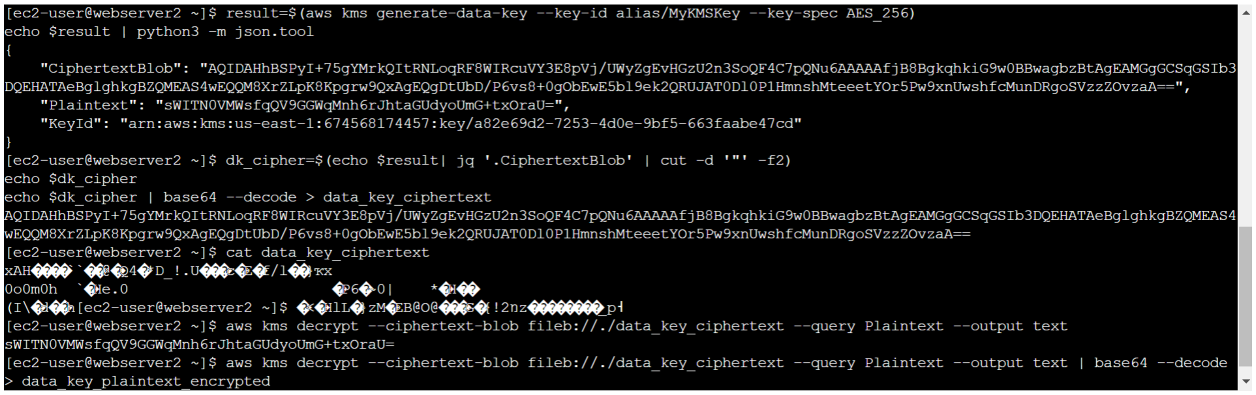
We Instance connect into the WebServer2 instance and create a text file with sample content in it. Afterwards, we run commands to configure the AWS Keys to encrypt this content, view the encrypted content and then decrypt it again to show the original content.



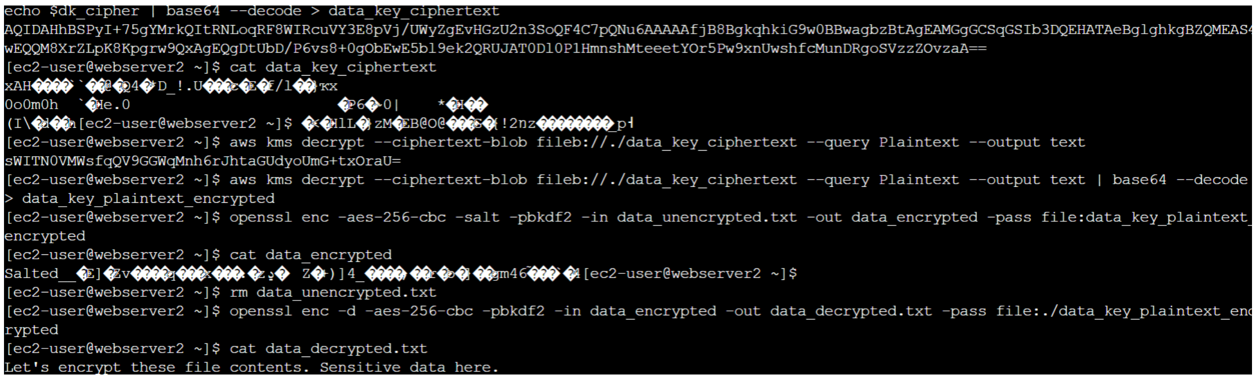
```
            "KeyArn": "arn:aws:kms:us-east-1:674568174457:key/02b313ae-12f3-438d-9a5b-f830ee945c82"
        },
        {
            "KeyId": "81412e18-7002-4207-b765-567684246c9f",
            "KeyArn": "arn:aws:kms:us-east-1:674568174457:key/81412e18-7002-4207-b765-567684246c9f"
        },
        {
            "KeyId": "a82e69d2-7253-4d0e-9bf5-663faabe47cd",
            "KeyArn": "arn:aws:kms:us-east-1:674568174457:key/a82e69d2-7253-4d0e-9bf5-663faabe47cd"
        }
    ]
}
[ec2-user@webserver2 ~]$ result=$(aws kms generate-data-key --key-id alias/MyKMSKey --key-spec AES_256)
echo $result | python3 -m json.tool
{
    "CiphertextBlob": "AQIDAHhBSPyI+75gYMrkQItRNLoqRF8WIRcuVY3E8pVj/UWyZgEvHGzU2n3SoQF4C7pQNu6AAAAAfjB8BgkqhkiG9w0BBwagbzBtAgEAMGgGCSqGSIb3
DQEHATAeBglghkgBZQMEAS4wEQQM8XrZLpK8Kpgrw9QxAgEQgDtUbD/P6vs8+0gObEwE5bl9ek2QRUJAT0Dl0P1HmnshMteeetYOr5Pw9xnUwshfcMunDRgoSVzzZOvzaA==",
    "Plaintext": "sWITN0VMWsfqQV9GGWqMnh6rJhtaGUdyoUmG+txOraU=",
    "KeyId": "arn:aws:kms:us-east-1:674568174457:key/a82e69d2-7253-4d0e-9bf5-663faabe47cd"
}
[ec2-user@webserver2 ~]$ 
```

i-0781d108a55cd9d10 (WebServer2)

PublicIPs: 44.223.161.213   PrivateIPs: 10.1.3.4



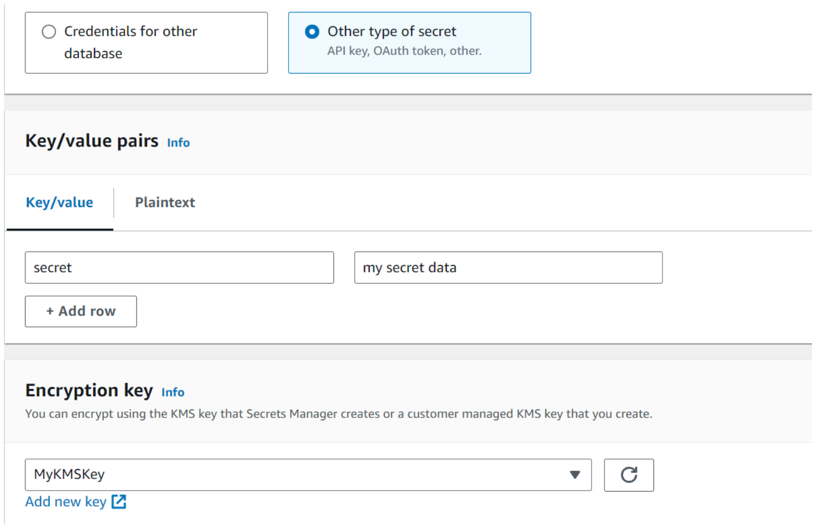
```
[ec2-user@webserver2 ~]$ result=$(aws kms generate-data-key --key-id alias/MyKMSKey --key-spec AES_256)
echo $result | python3 -m json.tool
{
    "CiphertextBlob": "AQIDAHhBSPyI+75gYMrkQItRNLoqRF8WIRcuVY3E8pVj/UWyZgEvHGzU2n3SoQF4C7pQNu6AAAAAfjB8BgkqhkiG9w0BBwagbzBtAgEAMGgGCSqGSIb3
DQEHATAeBglghkgBZQMEAS4wEQQM8XrZLpK8Kpgrw9QxAgEQgDtUbD/P6vs8+0gObEwE5bl9ek2QRUJAT0Dl0P1HmnshMteeetYOr5Pw9xnUwshfcMunDRgoSVzzZOvzaA==",
    "Plaintext": "sWITN0VMWsfqQV9GGWqMnh6rJhtaGUdyoUmG+txOraU=",
    "KeyId": "arn:aws:kms:us-east-1:674568174457:key/a82e69d2-7253-4d0e-9bf5-663faabe47cd"
}
[ec2-user@webserver2 ~]$ dk_cipher=$(echo $result| jq '.CiphertextBlob' | cut -d '"' -f2)
echo $dk_cipher
echo $dk_cipher | base64 --decode > data_key_ciphertext
AQIDAHhBSPyI+75gYMrkQItRNLoqRF8WIRcuVY3E8pVj/UWyZgEvHGzU2n3SoQF4C7pQNu6AAAAAfjB8BgkqhkiG9w0BBwagbzBtAgEAMGgGCSqGSIb3DQEHATAeBglghkgBZQMEAS4
wEQQM8XrZLpK8Kpgrw9QxAgEQgDtUbD/P6vs8+0gObEwE5bl9ek2QRUJAT0Dl0P1HmnshMteeetYOr5Pw9xnUwshfcMunDRgoSVzzZOvzaA==
[ec2-user@webserver2 ~]$ cat data_key_ciphertext
xAH���� `��@�Q4�D_!.U���c��E�£/l��}кx
0o0m0h  `�He.0                  �P6�~0|    *�H��
(I\�d��h[ec2-user@webserver2 ~]$ �<�HlL�}zM�EB@O@���G�{!2nz��������_p┤
[ec2-user@webserver2 ~]$ aws kms decrypt --ciphertext-blob fileb://./data_key_ciphertext --query Plaintext --output text
sWITN0VMWsfqQV9GGWqMnh6rJhtaGUdyoUmG+txOraU=
[ec2-user@webserver2 ~]$ aws kms decrypt --ciphertext-blob fileb://./data_key_ciphertext --query Plaintext --output text | base64 --decode
> data_key_plaintext_encrypted
```



```
echo $dk_cipher | base64 --decode > data_key_ciphertext
AQIDAHhBSPyI+75gYMrkQItRNLoqRF8WIRcuVY3E8pVj/UWyZgEvHGzU2n3SoQF4C7pQNu6AAAAAfjB8BgkqhkiG9w0BBwagbzBtAgEAMGgGCSqGSIb3DQEHATAeBglghkgBZQMEAS4
wEQQM8XrZLpK8Kpgrw9QxAgEQgDtUbD/P6vs8+0gObEwE5bl9ek2QRUJAT0Dl0P1HmnshMteeetYOr5Pw9xnUwshfcMunDRgoSVzzZOvzaA==
[ec2-user@webserver2 ~]$ cat data_key_ciphertext
xAH���� `��@�Q4�D_!.U���c��E�£/l��}кx
0o0m0h  `�He.0                  �P6�~0|    *�H��
(I\�d��h[ec2-user@webserver2 ~]$ �<�HlL�}zM�EB@O@���G�{!2nz��������_p┤
[ec2-user@webserver2 ~]$ aws kms decrypt --ciphertext-blob fileb://./data_key_ciphertext --query Plaintext --output text
sWITN0VMWsfqQV9GGWqMnh6rJhtaGUdyoUmG+txOraU=
[ec2-user@webserver2 ~]$ aws kms decrypt --ciphertext-blob fileb://./data_key_ciphertext --query Plaintext --output text | base64 --decode
> data_key_plaintext_encrypted
[ec2-user@webserver2 ~]$ openssl enc -aes-256-cbc -salt -pbkdf2 -in data_unencrypted.txt -out data_encrypted -pass file:data_key_plaintext_
encrypted
[ec2-user@webserver2 ~]$ cat data_encrypted
Salted__�E]�Zv����q���x���.�z̤�  Z�+)]4_����,��r�b�]��gm46���`�4[ec2-user@webserver2 ~]$
[ec2-user@webserver2 ~]$ rm data_unencrypted.txt
[ec2-user@webserver2 ~]$ openssl enc -d -aes-256-cbc -pbkdf2 -in data_encrypted -out data_decrypted.txt -pass file:./data_key_plaintext_enc
rypted
[ec2-user@webserver2 ~]$ cat data_decrypted.txt
Let's encrypt these file contents. Sensitive data here.
```

Task 3.6: Use AWS KMS to encrypt a Secrets Manager secret

Use Secrets Manager to create a secret and encrypt it with our newly created key


Credentials for other database

Other type of secret [✓]
API key, OAuth token, other.

Key/value pairs Info

Key/value | Plaintext

secret	my secret data

+ Add row

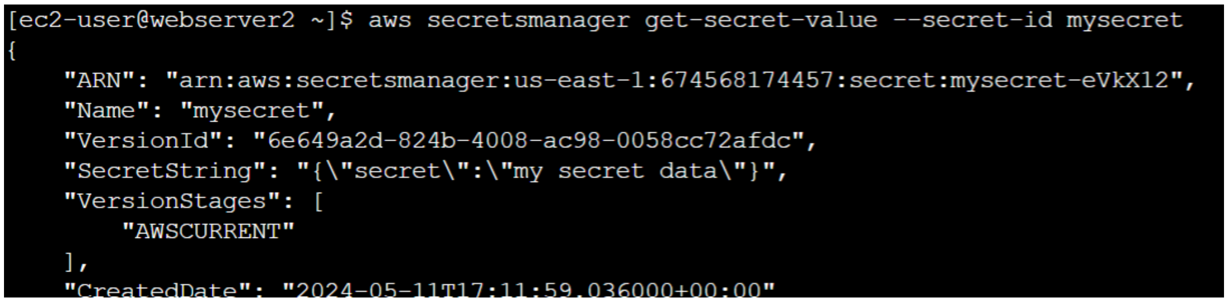
Encryption key Info
You can encrypt using the KMS key that Secrets Manager creates or a customer managed KMS key that you create.

MyKMSKey

Add new key

Creating a secret and encrypting it using a key

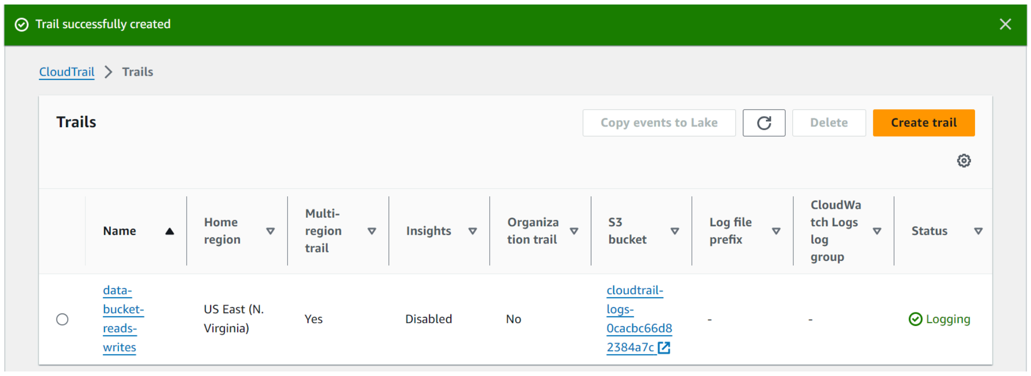
Connect to the WebServer2 instance and fetch the secret


```
[ec2-user@webserver2 ~]$ aws secretsmanager get-secret-value --secret-id mysecret
{
    "ARN": "arn:aws:secretsmanager:us-east-1:674568174457:secret:mysecret-eVkX12",
    "Name": "mysecret",
    "VersionId": "6e649a2d-824b-4008-ac98-0058cc72afdc",
    "SecretString": "{\"secret\":\"my secret data\"}",
    "VersionStages": [
        "AWSCURRENT"
    ],
    "CreatedDate": "2024-05-11T17:11:59.036000+00:00"
```
Fetch secret

Task 4:

Task 4.1: Use CloudTrail to record Amazon S3 API calls

We need to create a Trail through CloudTrail console


Trail successfully created

CloudTrail > Trails

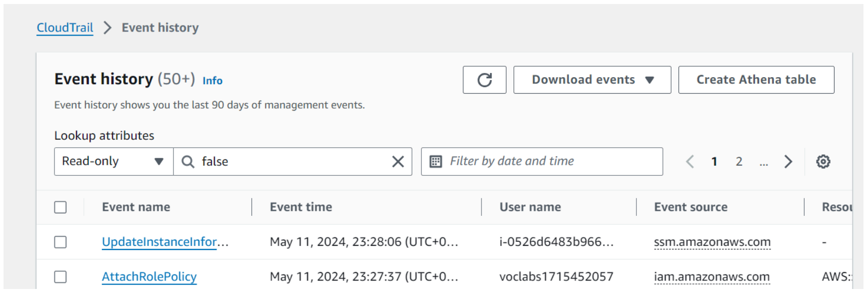
Trails

Name	Home region	Multi-region trail	Insights	Organization trail	S3 bucket	Log file prefix	CloudWatch Logs log group	Status
data-bucket-reads-writes	US East (N. Virginia)	Yes	Disabled	No	cloudtrail-logs-0cacbc66d82384a7c	-	-	Logging

Creating a trail

Upload a csv dataset to data-bucket and open it in the S3 console to generate a cloudtrail log.

In the CloudTrail console, we go to event history and create an Athena table and select the cloudtrail-logs bucket for storage.

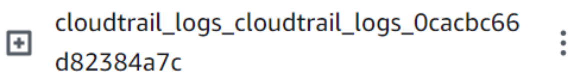

CloudTrail > Event history

Event history (50+) Info

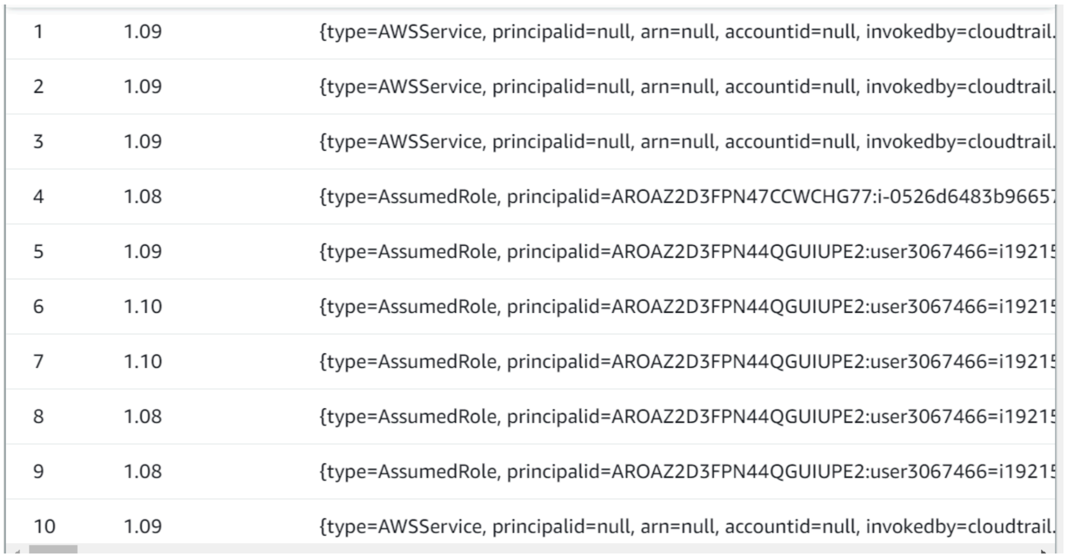
Event history shows you the last 90 days of management events.

Lookup attributes: Read-only | false

Event name	Event time	User name	Event source	Resou
UpdateInstanceInfor...	May 11, 2024, 23:28:06 (UTC+0...	i-0526d6483b966...	ssm.amazonaws.com	-
AttachRolePolicy	May 11, 2024, 23:27:37 (UTC+0...	voclabs1715452057	iam.amazonaws.com	AWS:


cloudtrail_logs_cloudtrail_logs_0cacbc66d82384a7c

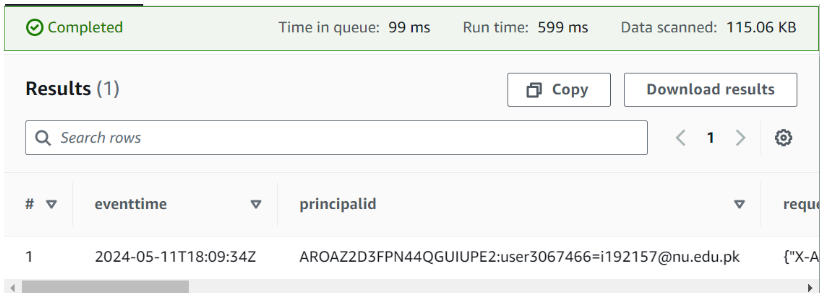
This resulting table and query generates cloudtrail logs in athena



1	1.09	{type=AWSService, principalid=null, arn=null, accountid=null, invokedby=cloudtrail.
2	1.09	{type=AWSService, principalid=null, arn=null, accountid=null, invokedby=cloudtrail.
3	1.09	{type=AWSService, principalid=null, arn=null, accountid=null, invokedby=cloudtrail.
4	1.08	{type=AssumedRole, principalid=AROAZ2D3FPN47CCWCHG77:i-0526d6483b9665
5	1.09	{type=AssumedRole, principalid=AROAZ2D3FPN44QGUIUPE2:user3067466=i19215
6	1.10	{type=AssumedRole, principalid=AROAZ2D3FPN44QGUIUPE2:user3067466=i19215
7	1.10	{type=AssumedRole, principalid=AROAZ2D3FPN44QGUIUPE2:user3067466=i19215
8	1.08	{type=AssumedRole, principalid=AROAZ2D3FPN44QGUIUPE2:user3067466=i19215
9	1.08	{type=AssumedRole, principalid=AROAZ2D3FPN44QGUIUPE2:user3067466=i19215
10	1.09	{type=AWSService, principalid=null, arn=null, accountid=null, invokedby=cloudtrail.

10 lines of logs

Run the provided query with the new table

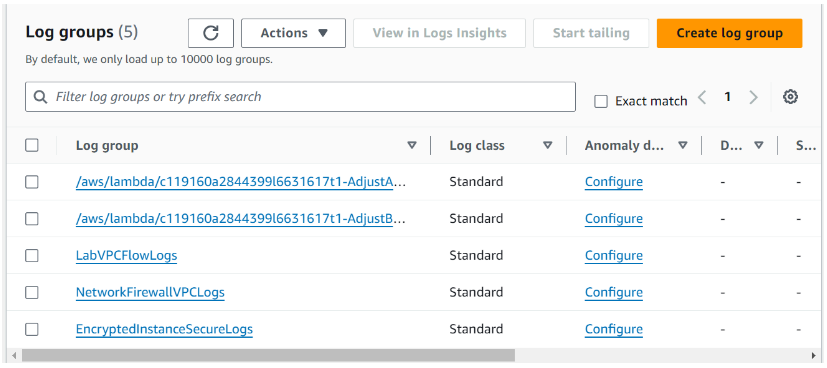

Completed Time in queue: 99 ms Run time: 599 ms Data scanned: 115.06 KB

Results (1)

#	eventtime	principalid	requ
1	2024-05-11T18:09:34Z	AROAZ2D3FPN44QGUIUPE2:user3067466=i192157@nu.edu.pk	{"X-A

Task 4.2: Use CloudWatch Logs to monitor secure logs

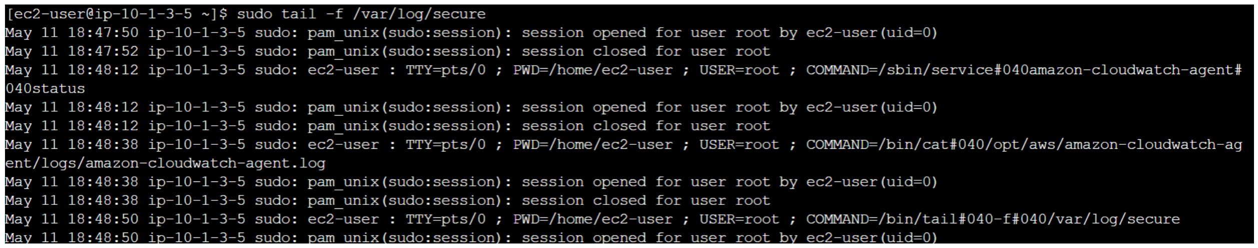
Create a log group names EncryptedInstanceSecureLogs


Log groups (5)
Actions
View in Logs Insights
Start tailing
Create log group
By default, we only load up to 10000 log groups.
Filter log groups or try prefix search
Exact match
1

Log group	Log class	Anomaly d...	D...	S...
/aws/lambda/c119160a2844399l6631617t1-AdjustA...	Standard	Configure	-	-
/aws/lambda/c119160a2844399l6631617t1-AdjustB...	Standard	Configure	-	-
LabVPCFlowLogs	Standard	Configure	-	-
NetworkFirewallVPCLogs	Standard	Configure	-	-
EncryptedInstanceSecureLogs	Standard	Configure	-	-

Connect to the EncryptedInstance and run commands
Commands to be run for the following tasks:

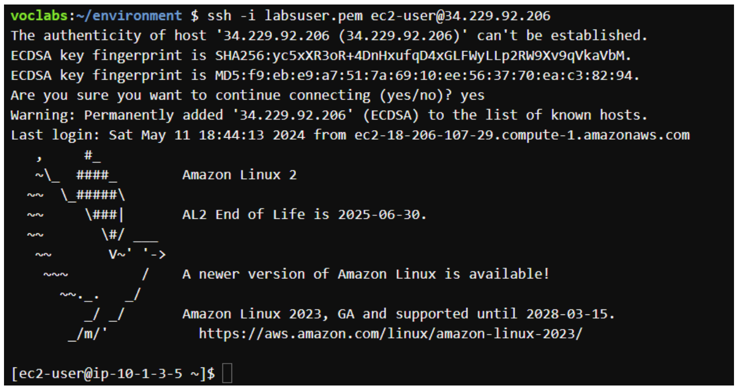
Install cloudwatch packages and a Linux daemon.
Download a template JSON file for a CloudWatch configuration template
Start CloudWatch agent and confirm it is active and running
View 10 lines of security logs



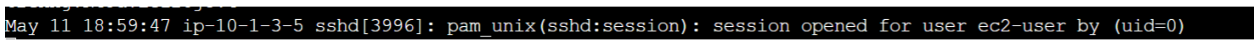
```
[ec2-user@ip-10-1-3-5 ~]$ sudo tail -f /var/log/secure
May 11 18:47:50 ip-10-1-3-5 sudo: pam_unix(sudo:session): session opened for user root by ec2-user(uid=0)
May 11 18:47:52 ip-10-1-3-5 sudo: pam_unix(sudo:session): session closed for user root
May 11 18:48:12 ip-10-1-3-5 sudo: ec2-user : TTY=pts/0 ; PWD=/home/ec2-user ; USER=root ; COMMAND=/sbin/service#040amazon-cloudwatch-agent#
040status
May 11 18:48:12 ip-10-1-3-5 sudo: pam_unix(sudo:session): session opened for user root by ec2-user(uid=0)
May 11 18:48:12 ip-10-1-3-5 sudo: pam_unix(sudo:session): session closed for user root
May 11 18:48:38 ip-10-1-3-5 sudo: ec2-user : TTY=pts/0 ; PWD=/home/ec2-user ; USER=root ; COMMAND=/bin/cat#040/opt/aws/amazon-cloudwatch-ag
ent/logs/amazon-cloudwatch-agent.log
May 11 18:48:38 ip-10-1-3-5 sudo: pam_unix(sudo:session): session opened for user root by ec2-user(uid=0)
May 11 18:48:38 ip-10-1-3-5 sudo: pam_unix(sudo:session): session closed for user root
May 11 18:48:50 ip-10-1-3-5 sudo: ec2-user : TTY=pts/0 ; PWD=/home/ec2-user ; USER=root ; COMMAND=/bin/tail#040-f#040/var/log/secure
May 11 18:48:50 ip-10-1-3-5 sudo: pam_unix(sudo:session): session opened for user root by ec2-user(uid=0)
```

Download the PEM file from the lab details and upload to the Cloud9IDE before running some commands that perform the following tasks:

Ssh into EncryptedInstance through C9IDE

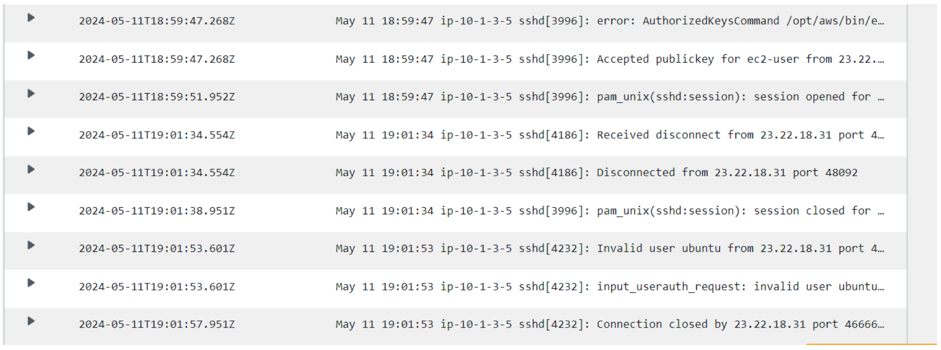


```
voclabs:~/environment $ ssh -i labsuser.pem ec2-user@34.229.92.206
The authenticity of host '34.229.92.206 (34.229.92.206)' can't be established.
ECDSA key fingerprint is SHA256:yc5xXR3oR+4DnHxufqD4xGLFWyLLp2RW9Xv9qVkaVbM.
ECDSA key fingerprint is MD5:f9:eb:e9:a7:51:7a:69:10:ee:56:37:70:ea:c3:82:94.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '34.229.92.206' (ECDSA) to the list of known hosts.
Last login: Sat May 11 18:44:13 2024 from ec2-18-206-107-29.compute-1.amazonaws.com
   ,     #_
   ~\_  ####_        Amazon Linux 2
  ~~  \_#####\
  ~~     \###|       AL2 End of Life is 2025-06-30.
  ~~       \#/ ___
   ~~       V~' '->
    ~~~         /    A newer version of Amazon Linux is available!
      ~~._.   _/
         _/ _/       Amazon Linux 2023, GA and supported until 2028-03-15.
       _/m/'           https://aws.amazon.com/linux/amazon-linux-2023/

[ec2-user@ip-10-1-3-5 ~]$
```



```
May 11 18:59:47 ip-10-1-3-5 sshd[3996]: pam_unix(sshd:session): session opened for user ec2-user by (uid=0)
```

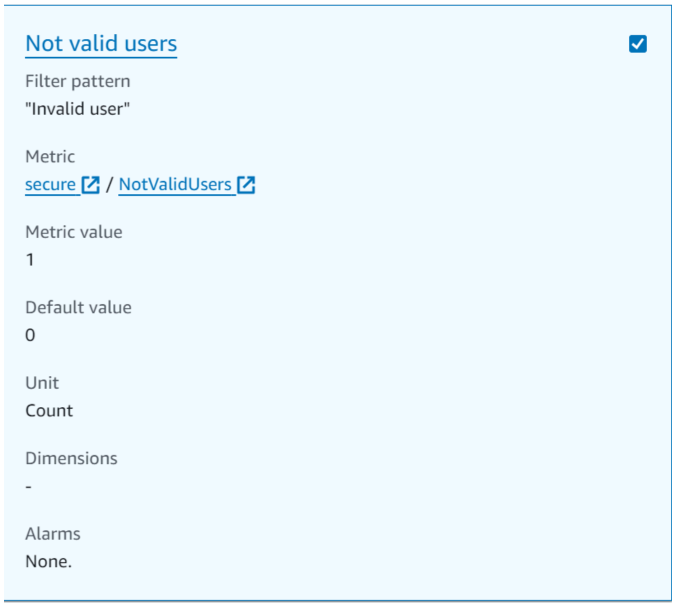
Similarly, initiate a failed ssh by using the wrong username “ubuntu”
Now, confirm log entries into the cloudwatch group



```
2024-05-11T18:59:47.268Z    May 11 18:59:47 ip-10-1-3-5 sshd[3996]: error: AuthorizedKeysCommand /opt/aws/bin/e…
2024-05-11T18:59:47.268Z    May 11 18:59:47 ip-10-1-3-5 sshd[3996]: Accepted publickey for ec2-user from 23.22.…
2024-05-11T18:59:51.952Z    May 11 18:59:47 ip-10-1-3-5 sshd[3996]: pam_unix(sshd:session): session opened for …
2024-05-11T19:01:34.554Z    May 11 19:01:34 ip-10-1-3-5 sshd[4186]: Received disconnect from 23.22.18.31 port 4…
2024-05-11T19:01:34.554Z    May 11 19:01:34 ip-10-1-3-5 sshd[4186]: Disconnected from 23.22.18.31 port 48092
2024-05-11T19:01:38.951Z    May 11 19:01:34 ip-10-1-3-5 sshd[3996]: pam_unix(sshd:session): session closed for …
2024-05-11T19:01:53.601Z    May 11 19:01:53 ip-10-1-3-5 sshd[4232]: Invalid user ubuntu from 23.22.18.31 port 4…
2024-05-11T19:01:53.601Z    May 11 19:01:53 ip-10-1-3-5 sshd[4232]: input_userauth_request: invalid user ubuntu…
2024-05-11T19:01:57.951Z    May 11 19:01:53 ip-10-1-3-5 sshd[4232]: Connection closed by 23.22.18.31 port 46666…
```

Task 4.3: Create a CloudWatch alarm to send notifications for security incidents

Go to the EncryptedInstanceSecureLogs CloudWatch log group and create a metric filter with some metrics. Also, create a CloudWatch alarm for a 1 day period



Not valid users

Filter pattern
"Invalid user"

Metric
secure / NotValidUsers

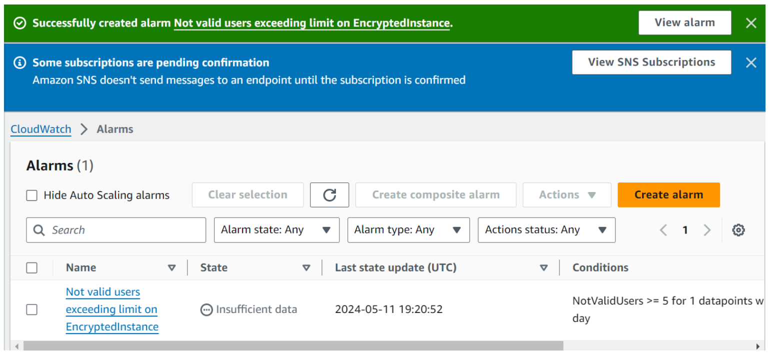
Metric value
1

Default value
0

Unit
Count

Dimensions
-

Alarms
None.


Successfully created alarm Not valid users exceeding limit on EncryptedInstance.

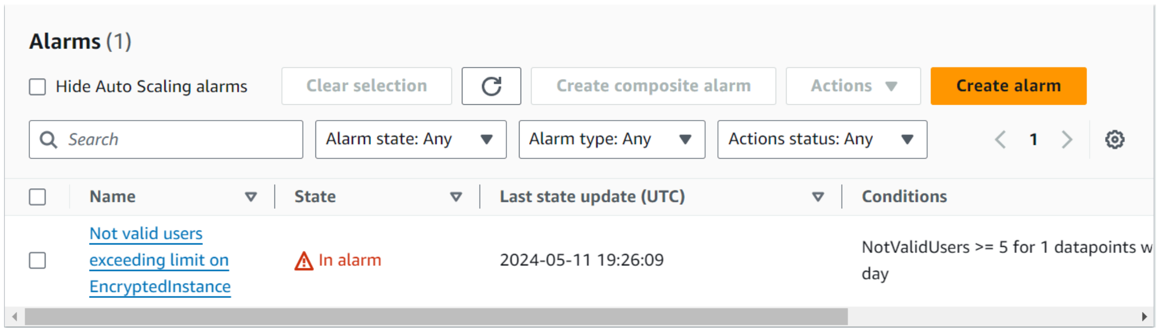
Some subscriptions are pending confirmation
Amazon SNS doesn't send messages to an endpoint until the subscription is confirmed

CloudWatch > Alarms

Alarms (1)

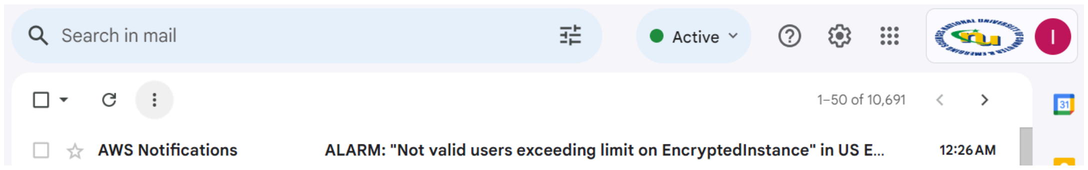
	Name	State	Last state update (UTC)	Conditions
☐	Not valid users exceeding limit on EncryptedInstance	Insufficient data	2024-05-11 19:20:52	NotValidUsers >= 5 for 1 datapoints w day

Confirm the subscription through email and test alarm through at least 5 Cloud9IDE invalid ssh requests. This causes the alarm to trigger


Alarms (1)

	Name	State	Last state update (UTC)	Conditions
☐	Not valid users exceeding limit on EncryptedInstance	In alarm	2024-05-11 19:26:09	NotValidUsers >= 5 for 1 datapoints w day

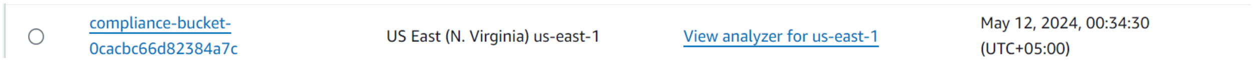
Confirm that the email was received


1–50 of 10,691

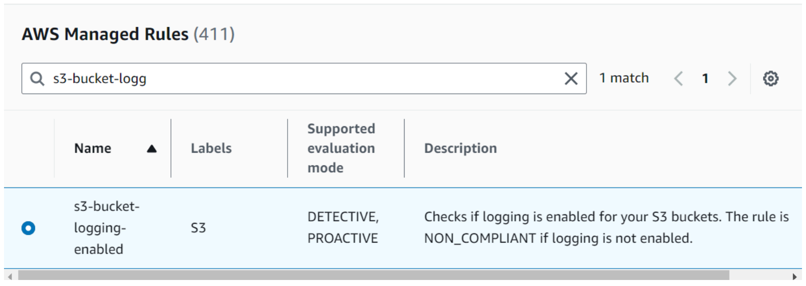
AWS Notifications ALARM: "Not valid users exceeding limit on EncryptedInstance" in US E... 12:26 AM

Task 4.4: Configure AWS Config to assess security settings and remediate the configuration of AWS resources

Review roles created by the lab to grants various permissions. Create an S3 bucket.


compliance-bucket-0cacbc66d82384a7c	US East (N. Virginia) us-east-1	View analyzer for us-east-1	May 12, 2024, 00:34:30 (UTC+05:00)

Now, change the object ownership settings of the objects-access-logs bucket to enable ACLs. Go to AWS Config console and set up a config. Then, set up a managed rule.

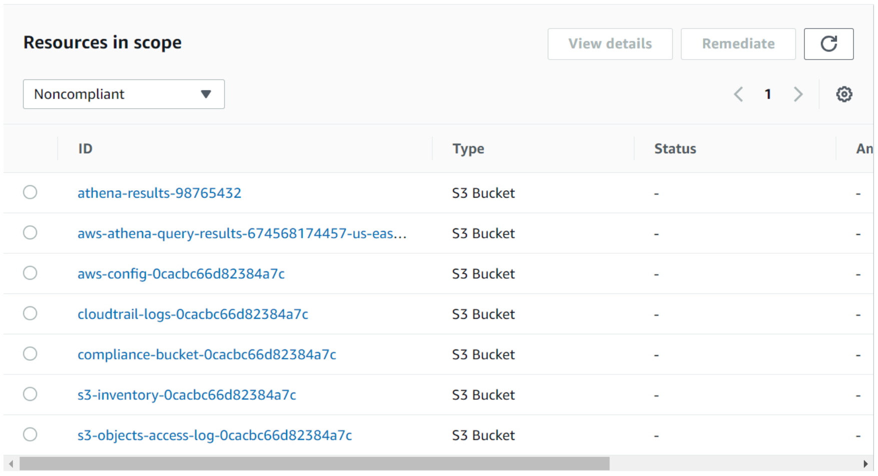


AWS Managed Rules (411)

s3-bucket-logg — 1 match — 1

	Name	Labels	Supported evaluation mode	Description
●	s3-bucket-logging-enabled	S3	DETECTIVE, PROACTIVE	Checks if logging is enabled for your S3 buckets. The rule is NON_COMPLIANT if logging is not enabled.

Noncompliant buckets according to the role:

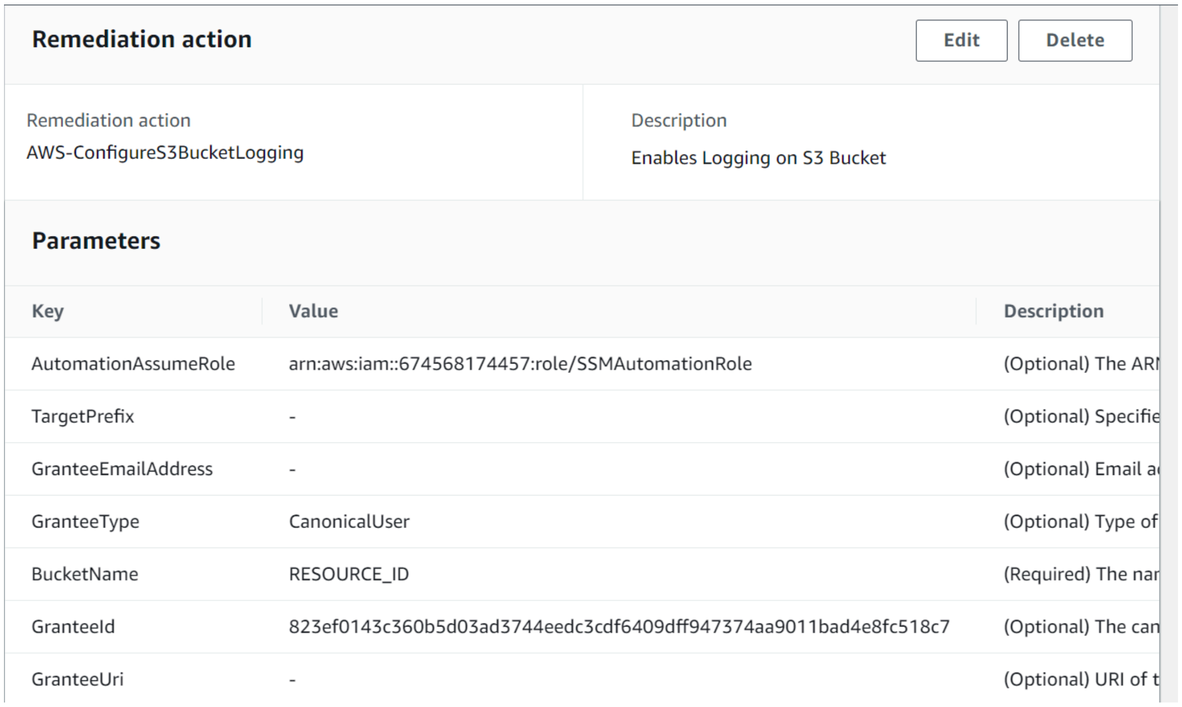


Resources in scope

Noncompliant

	ID	Type	Status	An
○	athena-results-98765432	S3 Bucket	-	-
○	aws-athena-query-results-674568174457-us-eas...	S3 Bucket	-	-
○	aws-config-0cacbc66d82384a7c	S3 Bucket	-	-
○	cloudtrail-logs-0cacbc66d82384a7c	S3 Bucket	-	-
○	compliance-bucket-0cacbc66d82384a7c	S3 Bucket	-	-
○	s3-inventory-0cacbc66d82384a7c	S3 Bucket	-	-
○	s3-objects-access-log-0cacbc66d82384a7c	S3 Bucket	-	-

The compliance bucket is listed under noncompliant due to server access logging being disabled. We configure manual remediation under the AWS Config we created to fix this.



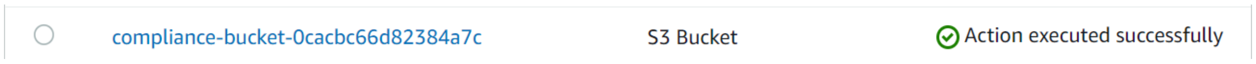
Remediation action

Remediation action	Description
AWS-ConfigureS3BucketLogging	Enables Logging on S3 Bucket

Parameters

Key	Value	Description
AutomationAssumeRole	arn:aws:iam::674568174457:role/SSMAutomationRole	(Optional) The ARI
TargetPrefix	-	(Optional) Specifie
GranteeEmailAddress	-	(Optional) Email a
GranteeType	CanonicalUser	(Optional) Type of
BucketName	RESOURCE_ID	(Required) The nar
GranteeId	823ef0143c360b5d03ad3744eedc3cdf6409dff947374aa9011bad4e8fc518c7	(Optional) The can
GranteeUri	-	(Optional) URI of t

Now, choose compliance-bucket from within the role details and remediate it.



○	compliance-bucket-0cacbc66d82384a7c	S3 Bucket	✓ Action executed successfully

The action was successfully executed.