

Title: Analysis and Mitigation of SSH Misconfiguration in Cloud Environment using AWS

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Abstract

This project focuses on identifying, analyzing, and mitigating a common cloud security misconfiguration related to unrestricted SSH access. An AWS cloud environment was created using EC2 and VPC services. A security group was intentionally misconfigured to allow SSH access from the internet. AWS CloudTrail was enabled for monitoring and logging. The issue was later mitigated by restricting SSH access to a specific IP address.

INTRODUCTION

Cloud computing provides scalable and flexible infrastructure but also introduces security challenges if not configured properly. One of the most common cloud security issues is misconfigured network access rules. This project demonstrates how unrestricted SSH access can expose cloud servers to attacks and how such risks can be mitigated.

PROBLEM STATEMENT

The problem addressed in this project is a misconfigured security group that allows unrestricted SSH (port 22) access from the internet. Such configuration can lead to brute-force attacks and unauthorized access to cloud servers.

CLOUD ARCHITECTURE

The cloud architecture consists of an AWS VPC with a public subnet, an EC2 instance running Ubuntu Linux, and a security group controlling inbound traffic. The EC2 instance hosts a web server and is accessible through a public IP address.

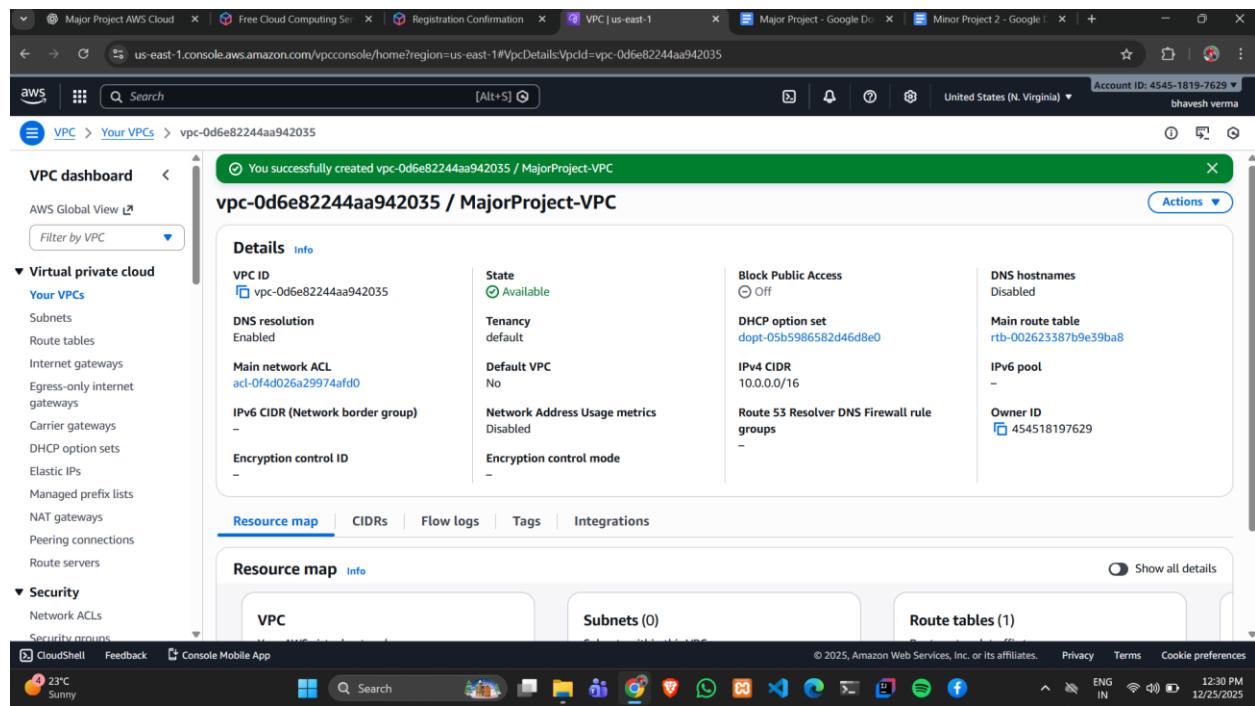


Figure 1: AWS VPC architecture with public subnet

IMPLEMENTATION DETAILS

An EC2 instance was launched in a public subnet using Ubuntu Server.

A security group was created with inbound rules allowing SSH and HTTP traffic.

Apache web server was installed on the EC2 instance to verify public access.

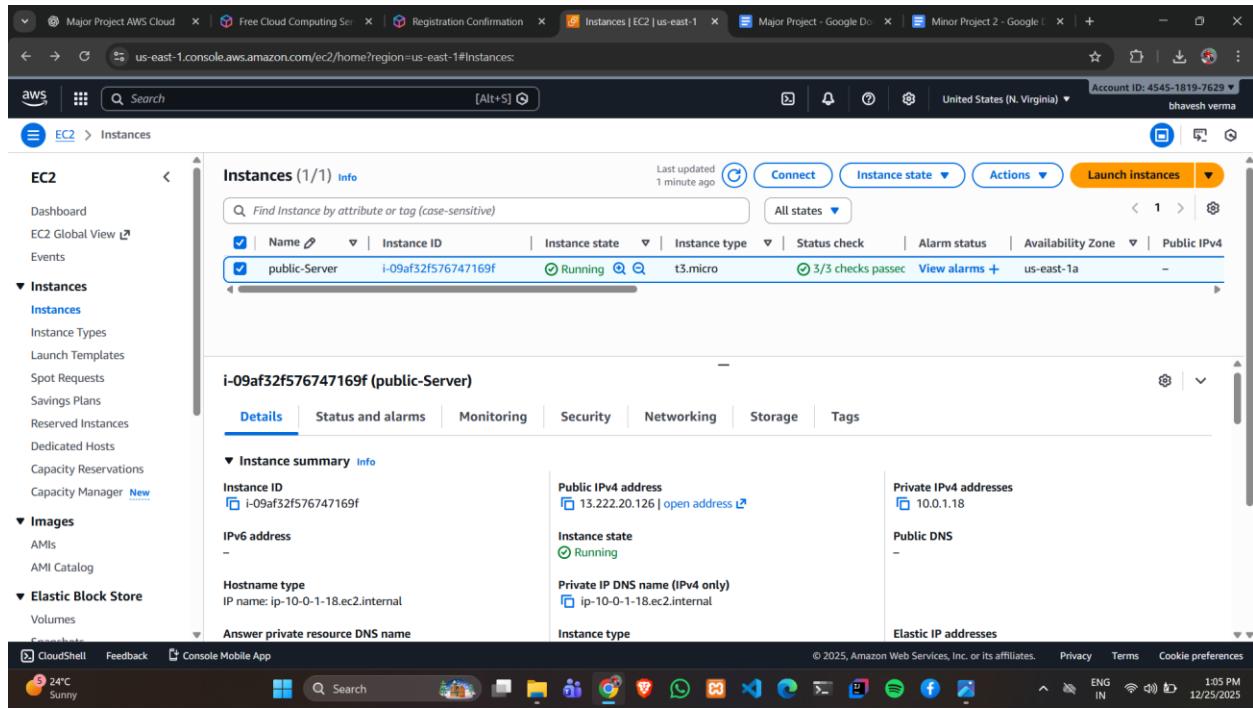
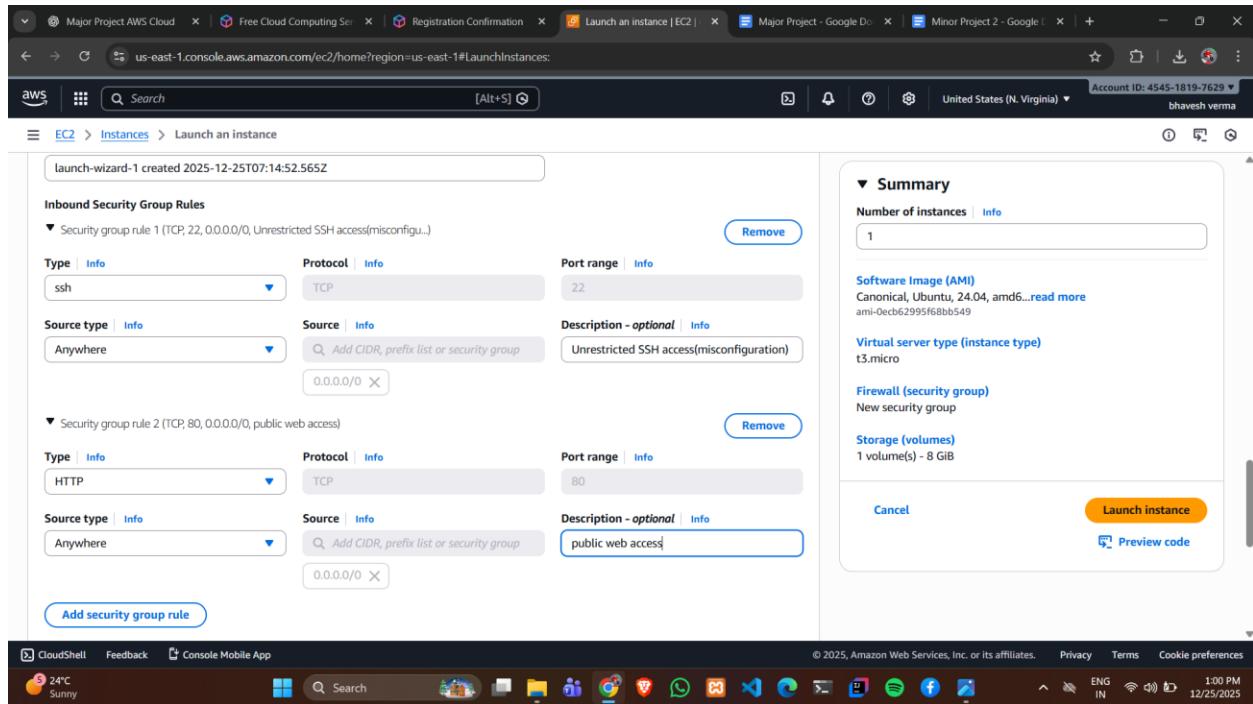


Figure 2: EC2 instance running with public IP address

ATTACK SIMULATION (NO REAL ATTACK)

No real attack was performed due to ethical and legal considerations. The attack was simulated by intentionally misconfiguring the security group to allow SSH access from anywhere (0.0.0.0/0), which represents a real-world attack surface for brute-force SSH login attempts.



Security Group – SSH 0.0.0.0/0 (Before Fix)

Figure 3: Misconfigured security group allowing unrestricted SSH access

SERVICE DEPLOYMENT VERIFICATION

Apache web server was installed and successfully accessed through the public IP address of the EC2 instance, confirming that the server was publicly reachable due to open inbound rules.

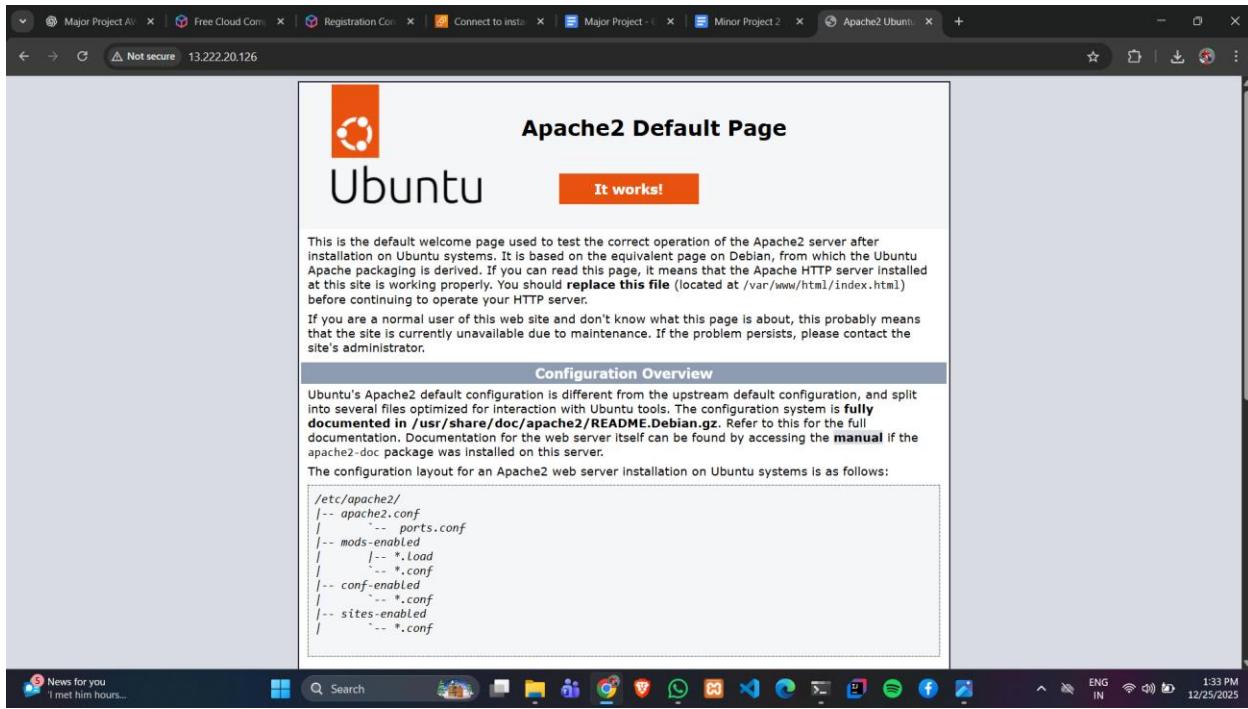


Figure 4: Publicly accessible web server running on EC2 instance

DETECTION AND LOGGING

AWS CloudTrail was enabled as a multi-region trail to monitor and log all management events. Any unauthorized access attempts or configuration changes would be recorded for analysis.

The screenshot shows the AWS CloudTrail console interface. At the top, there are several tabs open in the browser, including 'Major Project AWS', 'Free Cloud Compute', 'Registration Confirm', 'Trails | CloudTrail', 'Major Project - Go', 'Minor Project 2 - Go', and 'Apache2 Ubuntu D'. The main window title is 'Trails | CloudTrail | us-east-1.console.aws.amazon.com'. The user is signed in as 'bhavesh verma' from 'United States (N. Virginia)' with account ID '4545-1819-7629'. A search bar at the top has '[Alt+S]'. Below the header, there's a navigation bar with 'CloudTrail > Trails'. A blue banner message says: 'You can now enrich CloudTrail events with additional information by adding resource tags and IAM global keys in CloudTrail Lake. Learn more' with a link icon.

The main content area is titled 'Trails' and contains a table with the following columns: Name, Home region, Multi-region trail, ARN, Insights, Organization trail, S3 bucket, Log file prefix, CloudWatch Logs log group, and Status. One row is visible, representing the 'MajorProject-Trial' trail. The details for this trail are:

Name	Home region	Multi-region trail	ARN	Insights	Organization trail	S3 bucket	Log file prefix	CloudWatch Logs log group	Status
MajorProject-Trial	US East (N. Virginia)	Yes	arn:aws:cloudtrail:us-east-1:454518197629:trail/MajorProject-Trial	Disabled	No	aws-cloudtrail-logs-454518197629-2ee393e0	-	-	Logging

At the bottom of the page, there's a footer with links for 'CloudShell', 'Feedback', 'Console Mobile App', and social media icons. The footer also includes copyright information: '© 2025, Amazon Web Services, Inc. or its affiliates.', 'Privacy', 'Terms', 'Cookie preferences', and language settings: 'ENG IN'.

Figure 5: AWS CloudTrail enabled with multi-region logging

10 MITIGATION / SOLUTION

To mitigate the identified vulnerability, SSH access was restricted to the administrator's IP address. This ensured that only authorized users could access the server, eliminating the risk of external brute-force attacks.

The screenshot shows the AWS CloudWatch Metrics Insights interface. A search bar at the top contains the query: `CloudWatch Metrics Insights: *{*}`. Below the search bar, there are two tabs: `Metrics` and `Logs`. Under the `Metrics` tab, there is a table with three columns: `Series`, `Time Range`, and `Actions`. The table shows three series: `CloudWatch Metrics Insights: *{*}` (Last 1 hour), `CloudWatch Metrics Insights: *{*}` (Last 2 hours), and `CloudWatch Metrics Insights: *{*}` (Last 24 hours). In the `Actions` column, there are three buttons: `View Metrics`, `View Metrics`, and `View Metrics` respectively. At the bottom of the interface, there is a footer with the text: `© 2025, Amazon Web Services, Inc. or its affiliates.` and links to `Privacy`, `Terms`, and `Cookie preferences`.

Figure 6: SSH access restricted to administrator IP as a mitigation step

CONCLUSION

This project demonstrated how simple cloud misconfigurations can expose systems to security risks. By identifying the vulnerability, enabling logging, and applying proper mitigation techniques, the cloud environment was secured following best security practices.