TASK 5- Build a Mini SIEM (Security Information & Event Management) with ELK Stack

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Project: Mini SIEM- ELK Stack
Date: 27-10-2026

This capstone implements a mini Security Information and Event Management (SIEM) lab using the ELK stack (Elasticsearch, Logstash, Kibana) with Filebeat as the log shipper.

A SIEM centralizes security logs, enabling detection and investigation of suspicious activity.

The objective was to collect system logs from a Kali host, visualize authentication events, detect a simulated SSH brute-force attack, and perform a simple incident response (containment and evidence collection). The project demonstrates log collection, parsing, alerting, and containment in a controlled environment.

This mini SIEM demonstrates fundamental capabilities: ingestion, parsing, visualization, detection, and response — key skills for blue team operations.

Step 1: Capstone Project Selection

Build a Mini SIEM (Security Information & Event Management) with ELK Stack

Step 2: Project Planning

A. Define Objectives, Scope, Tools, Timeline.

1. Objectives

The primary objective of this capstone project is to **design, implement, and demonstrate a Mini Security Information and Event Management (SIEM) system** using the ELK Stack (Elasticsearch, Logstash, and Kibana).

This project is intended to simulate real-world cybersecurity monitoring and incident response workflows on a small scale.

The key objectives of the project are:

1. **Log Collection:**
    - Deploy Elastic Agents on multiple endpoints, including Windows and Linux machines, to collect logs from various sources such as system events, web server logs, and network device logs.
    - Ensure the logs are collected in a structured format suitable for further analysis.
2. **Log Parsing and Processing:**
    - Use Logstash to parse raw logs, extract critical information, and normalize data fields like http.response.status_code, source.ip, user_agent, timestamp, and event type.
    - Apply filters and transformations to make logs actionable for security monitoring.
3. **Visualization and Dashboarding:**
    - Use Kibana to create interactive dashboards displaying log analytics.
    - Provide real-time visualizations to monitor key security metrics, trends, and anomalies.
4. **Alerting and Incident Detection:**
    - Configure alerts for suspicious activities such as repeated failed login attempts, unusual network traffic, or access from unknown IP addresses.
    - Demonstrate how the Mini SIEM can detect potential security incidents effectively.
5. **Incident Response Simulation:**

- Simulate a controlled security incident (e.g., failed login attempts, unauthorized access attempt).
- Demonstrate detection, containment, and reporting using the Mini SIEM setup.

6. **Documentation and Knowledge Sharing:**
   - Prepare detailed documentation with screenshots, configurations, and explanations of each step.
   - Provide a professional report and presentation demonstrating the Mini SIEM's capabilities.

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2. Scope

- Deployment of the ELK Stack (Elasticsearch, Logstash, Kibana) on a local system or virtual lab.
- Installation and configuration of Elastic Agent for log collection from multiple endpoints.
- Dashboard creation in Kibana to visualize logs, metrics, and anomalies.
- Configuration of alerting rules to notify about suspicious activities.
- Simulation of a small-scale incident to demonstrate detection and response.
- Documentation of the complete setup, process, and outcomes with screenshots and sample outputs.
- Single-host Kali lab acting as both log source and attacker (localhost), ELK stack deployed on same host.

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3. Tools and Technologies

Tool / Technology	Purpose	Justification
Elasticsearch	Log storage and indexing	Fast and efficient search and retrieval of logs for analysis
Logstash	Log ingestion, parsing, and filtering	Transform raw logs into structured, analyzable data

Tool / Technology	Purpose	Justification
Kibana	Data visualization, dashboards, and alerts	Provides interactive dashboards and visual alerting for security events
FileBeat	Log collection from endpoints	Forwards logs from multiple sources, supports Windows/Linux, simplifies agent management
Test Lab / Sample Logs	Testing and simulation	Safe environment to generate logs and simulate attacks without affecting production systems
Text Editor (VS Code / Notepad++)	Configuration editing	Edit Logstash and Elastic Agent configuration files efficiently
Screenshot Tool	Documentation	Capture evidence of setup, dashboards, and alerts for report preparation

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4. Timeline

Task	Duration	Description
ELK Stack Installation & Setup	2–3 hours	Install Elasticsearch, Logstash, Kibana, and configure basic settings
Elastic Agent Installation & Configuration	1–2 hours	Deploy agents on test endpoints and configure log collection
FileBeats & Filters Configuration	2–3 hours	Define parsing rules, extract relevant fields, and test pipeline
Dashboard Creation in Kibana	1–2 hours	Build dashboards to visualize security metrics, logs, and anomalies
Alert Setup	1–2 hours	Define and test alerts for suspicious events
Testing & Incident Simulation	2–3 hours	Simulate attacks, verify detection, and generate alerts

Task	Duration	Description
Documentation & Screenshots	2–3 hours	Capture configurations, dashboards, outputs, and screenshots for the report

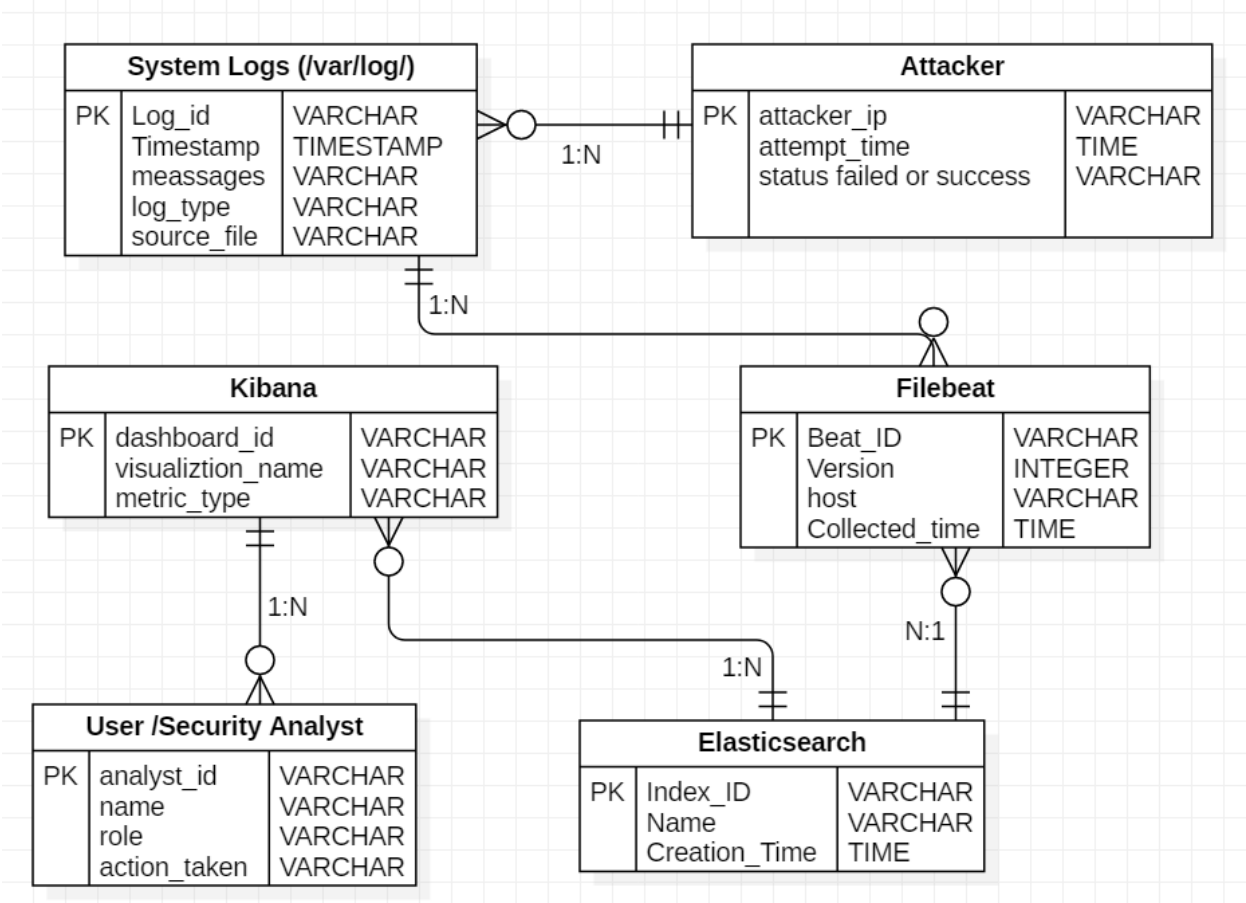
Estimated Total Duration: 10–15 hours

- Completed in **2–3 focused days**, depending on the pace and system readiness.

B. Create ER Diagram.

Network / Data Flow Diagram

For a Mini SIEM, a simple **ER diagram** visualization:



ER Diagram Description

The entities:

Entity	Description
System Logs (/var/log/)	Contains system and authentication logs (like auth.log, syslog).
Filebeat	Collects and forwards logs from the system to Elasticsearch.
Elasticsearch	Stores, indexes, and manages all logs.
Kibana	Visualizes and analyzes the logs from Elasticsearch.
User / Analyst	Views dashboards and detects attacks.
Attacker	Performs brute-force attempts (simulated using SSH).

Relationship Explanation:

1. Attacker → System_Log
    - *One attacker* can generate *many logs* (failed SSH attempts).
      Relationship: 1:N
2. System_Log → Filebeat
    - *One log file* can be read by *many Filebeat processes* (or instances).
      Relationship: 1:N
3. Filebeat → Elasticsearch_Index
    - *One Filebeat agent* sends *many logs* to *one Elasticsearch index*.
      Relationship: N:1
4. Elasticsearch_Index → Kibana_Dashboard
    - *One index* can power *many Kibana visualizations*.
      Relationship: 1:N
5. Kibana_Dashboard → Security_Analyst
    - *One analyst* views *many dashboards*.
      Relationship: 1:N

C. Environment & Tools

Host OS: Kali Linux (version: [insert])
ELK versions: Elasticsearch, Logstash, Kibana, Filebeat
Attack tools: Failed Login attempts
Other tools: ufw/iptables, tail/grep, netstat, curl, obs (for recording)
Hardware: Lenovo Windows 11 laptop running a Kali VM

Step 3: Implementation

Implementation Details:

Installation Service Start

Key commands executed:

sudo apt update && sudo apt upgrade -y

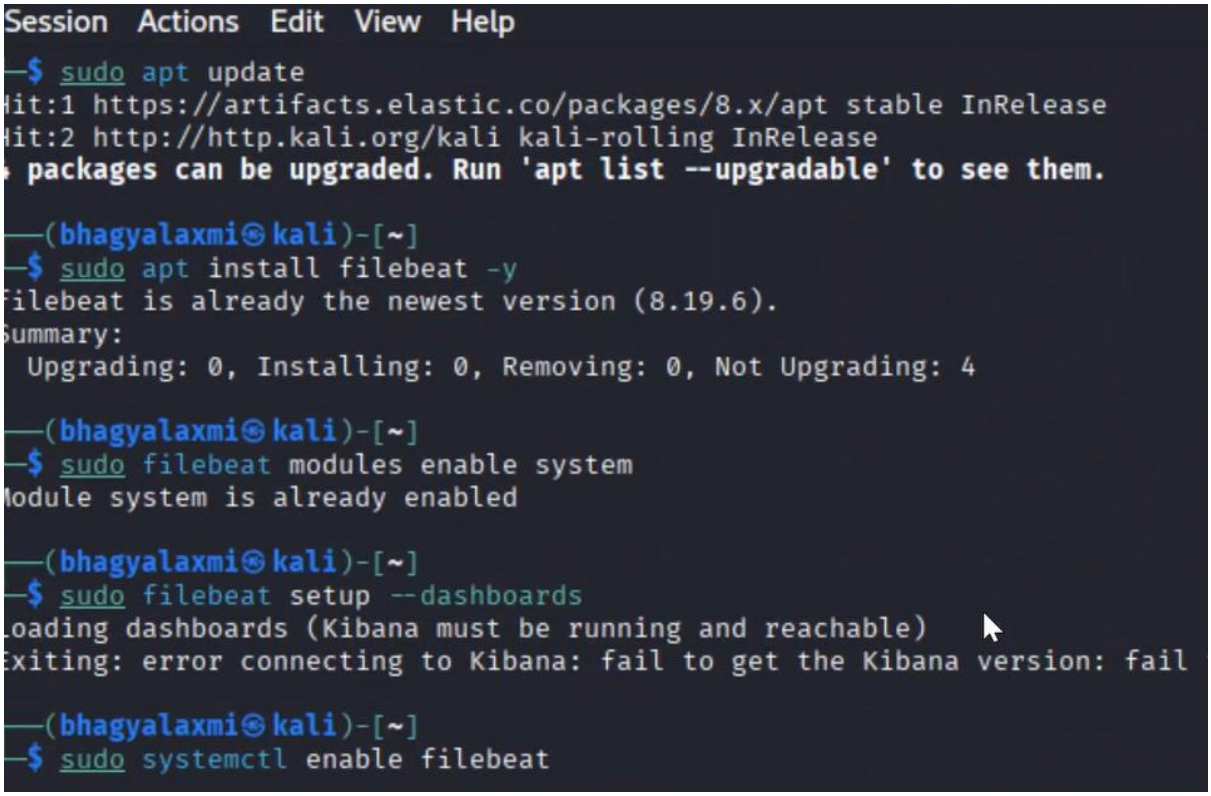
sudo apt install openjdk-11-jdk -y

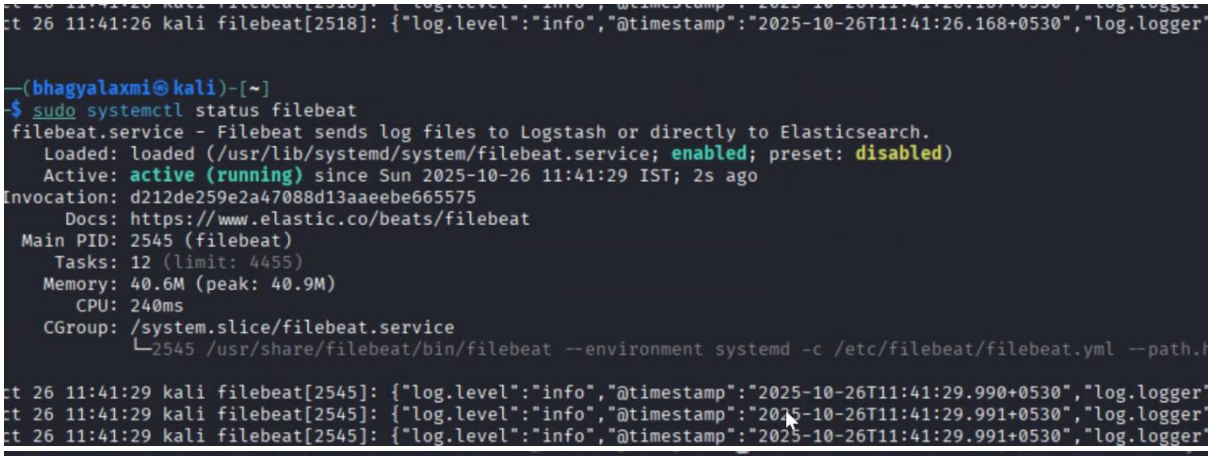
i) Elastic Search Installation & active running

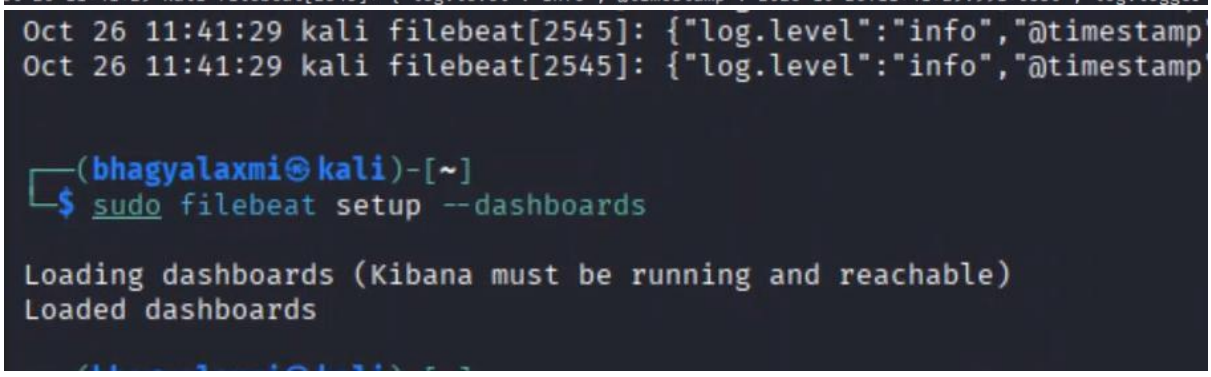
```
┌──(bhagyalaxmi㉿kali)-[~]
└─$ wget https://artifacts.elastic.co/downloads/elasticsearch/elasticsearch-8.19.6-amd64.deb
--2025-10-26 10:31:46--  https://artifacts.elastic.co/downloads/elasticsearch/elasticsearch-8.19.6-am
Resolving artifacts.elastic.co (artifacts.elastic.co)... 34.120.127.130, 2600:1901:0:1d7::
Connecting to artifacts.elastic.co (artifacts.elastic.co)|34.120.127.130|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 666455792 (636M) [application/vnd.debian.binary-package]
Saving to: 'elasticsearch-8.19.6-amd64.deb'

elasticsearch-8.19.6-amd64.deb   100%[=====================================================>] 63

2025-10-26 10:34:27 (3.96 MB/s) - 'elasticsearch-8.19.6-amd64.deb' saved [666455792/666455792]


┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo dpkg -i elasticsearch-8.19.6-amd64.deb

(Reading database ... 553700 files and directories currently installed.)
Preparing to unpack elasticsearch-8.19.6-amd64.deb ...
Unpacking elasticsearch (8.19.6) over (8.10.0) ...
Setting up elasticsearch (8.19.6) ...
Installing new version of config file /etc/elasticsearch/jvm.options ...
Installing new version of config file /etc/elasticsearch/log4j2.properties ...
Processing triggers for systemd (258-1) ...
```

```
Session  Actions  Edit  View  Help
┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl daemon-reload

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl enable elasticsearch.service

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl enable elasticsearch

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl start elasticsearch
^C

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl start elasticsearch.service

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl start elasticsearch

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl status elasticsearch
● elasticsearch.service - Elasticsearch
     Loaded: loaded (/usr/lib/systemd/system/elasticsearch.service; enabled; preset: disabled)
     Active: active (running) since Sun 2025-10-26 10:36:37 IST; 9s ago
 Invocation: fb58c8dead1f420ab6a7825d481d059d
```

ii) Filebeat Installtion & active running







iv) Kibana Installtion & active running

```
┌──(bhagyalaxmi㉿kali)-[~]
└─$ wget -qO - https://artifacts.elastic.co/GPG-KEY-elasticsearch | sudo gpg --dearmor -o /usr/share/keyrings/elasticsearch-keyring.
gpg
[sudo] password for bhagyalaxmi:
File '/usr/share/keyrings/elasticsearch-keyring.gpg' exists. Overwrite? (y/N) Y

┌──(bhagyalaxmi㉿kali)-[~]
└─$ echo "deb [signed-by=/usr/share/keyrings/elasticsearch-keyring.gpg] https://artifacts.elastic.co/packages/8.x/apt stable main" |
 sudo tee /etc/apt/sources.list.d/elastic-8.x.list
deb [signed-by=/usr/share/keyrings/elasticsearch-keyring.gpg] https://artifacts.elastic.co/packages/8.x/apt stable main

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo apt update
Hit:1 https://artifacts.elastic.co/packages/8.x/apt stable InRelease
Hit:2 http://http.kali.org/kali kali-rolling InRelease
5 packages can be upgraded. Run 'apt list --upgradable' to see them.

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo apt install kibana -y
Installing:
  kibana

Summary:
  Upgrading: 0, Installing: 1, Removing: 0, Not Upgrading: 5
  Download size: 381 MB
```

```
┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo apt install kibana -y
kibana is already the newest version (8.19.6).
Summary:
  Upgrading: 0, Installing: 0, Removing: 0, Not Upgrading: 5

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl daemon-reload

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl enable kibana

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl start kibana

┌──(bhagyalaxmi㉿kali)-[~]
└─$ sudo systemctl status kibana
● kibana.service - Kibana
     Loaded: loaded (/usr/lib/systemd/system/kibana.service; enabled; preset: disabled)
     Active: active (running) since Sun 2025-10-26 10:24:45 IST; 31s ago
 Invocation: f4fb11ed7b9f426eb8410663bcfc8a0d
       Docs: https://www.elastic.co
   Main PID: 3309 (node)
```

To access token and verification to login into the elastic

Commands:

sudo /usr/share/elasticsearch/bin/elasticsearch-create-enrollment-token -s kibana

sudo /usr/share/kibana/bin/kibana-verification-code

To enter username and password :

Command:

curl -k -u elastic https://localhost:9200

Output:

Enter host password for user 'elastic':

"name" : "kali"

"cluster_name" : "elasticsearch",

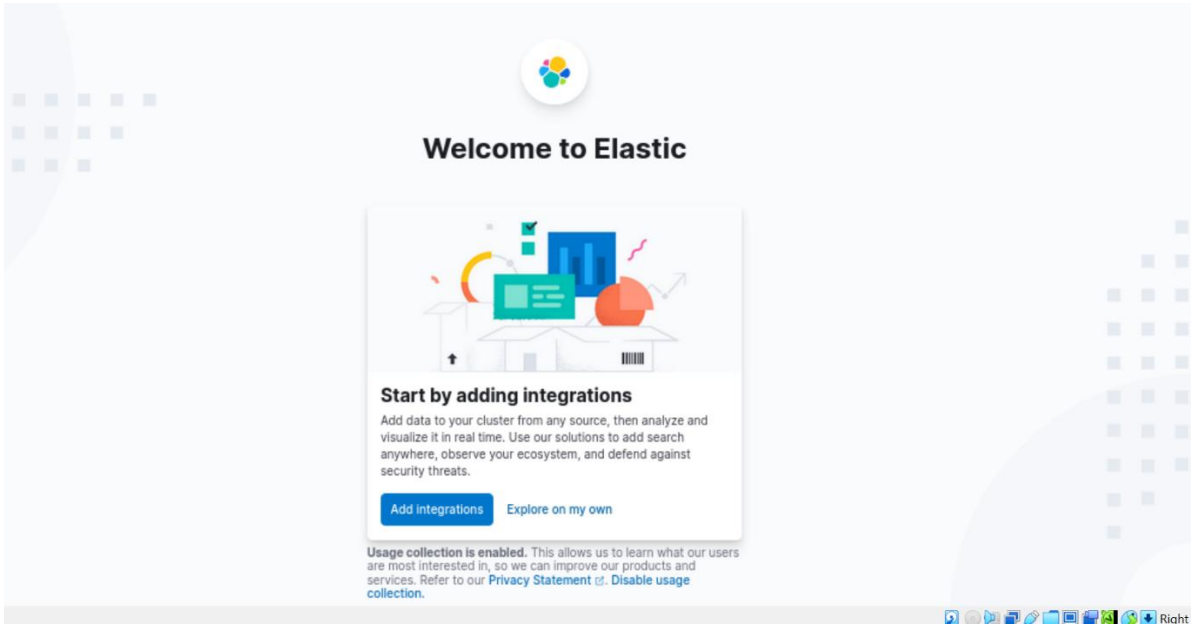
"cluster_uuid" : ".....",

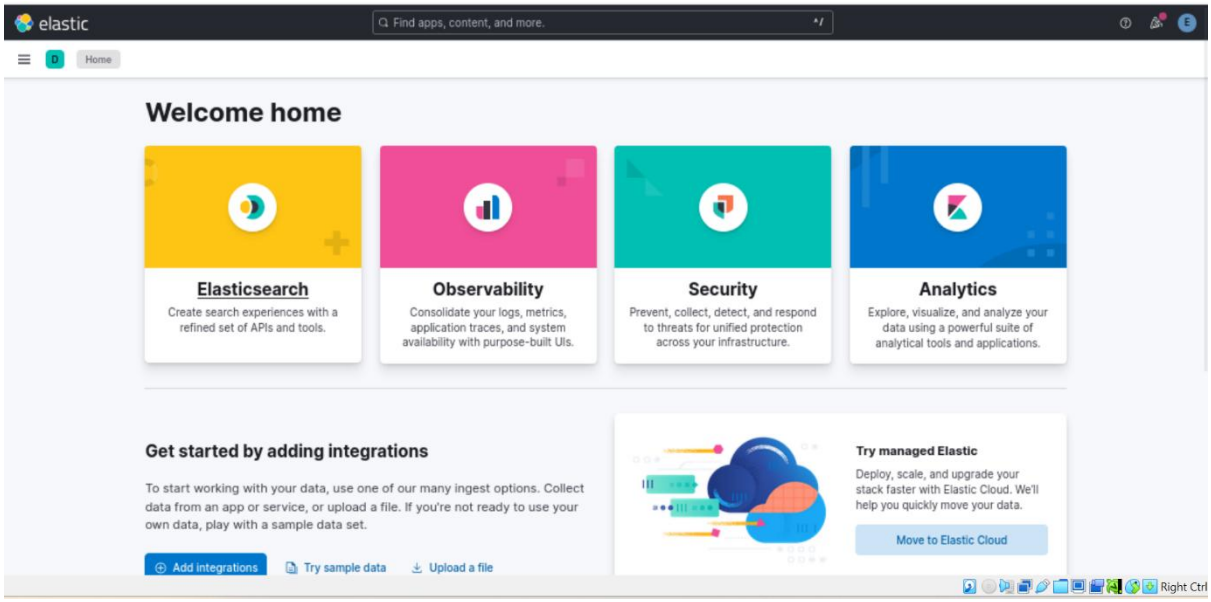
"version" : {

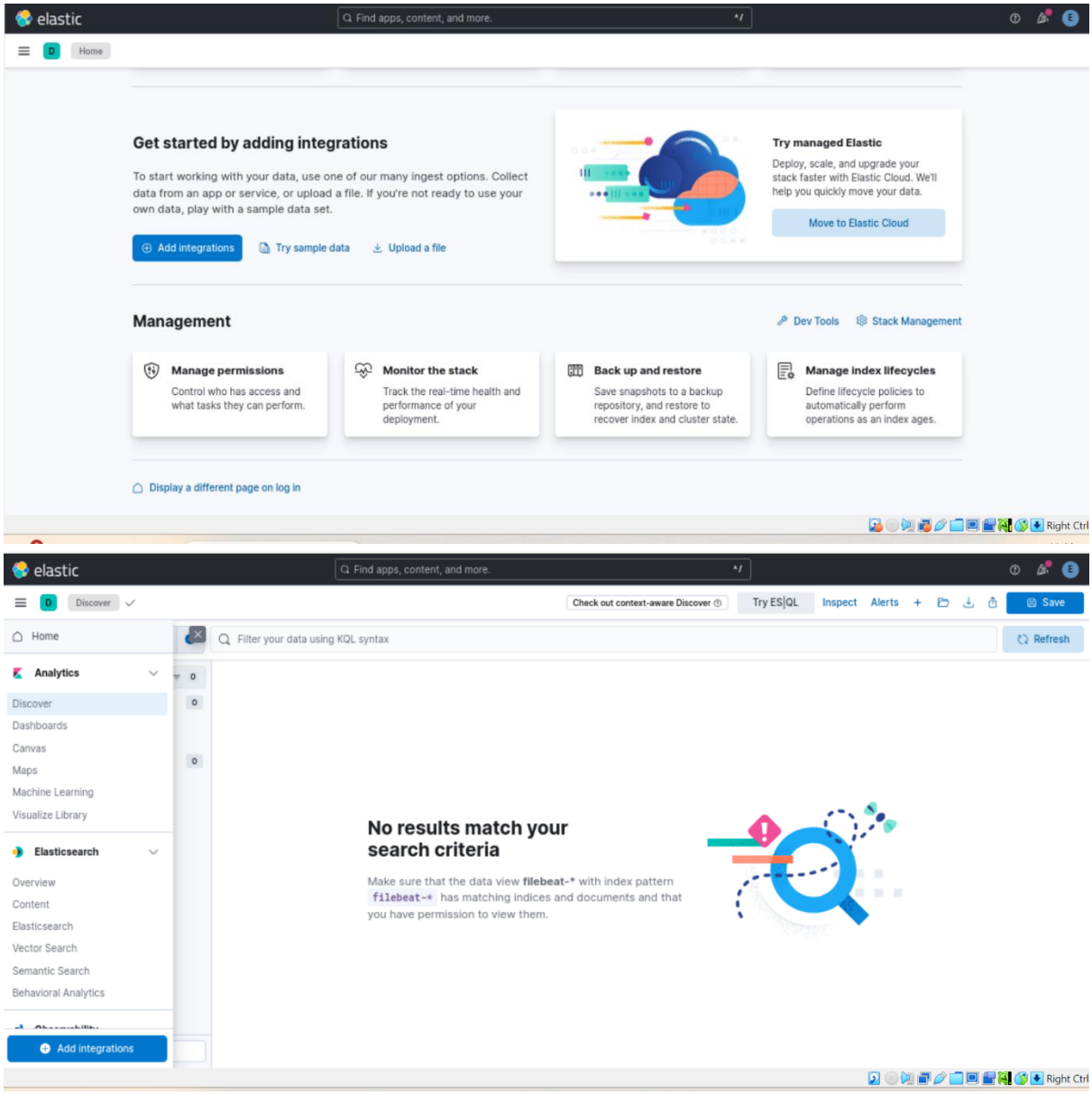
"number" : "8.19.6",

.....}

Dashboards-







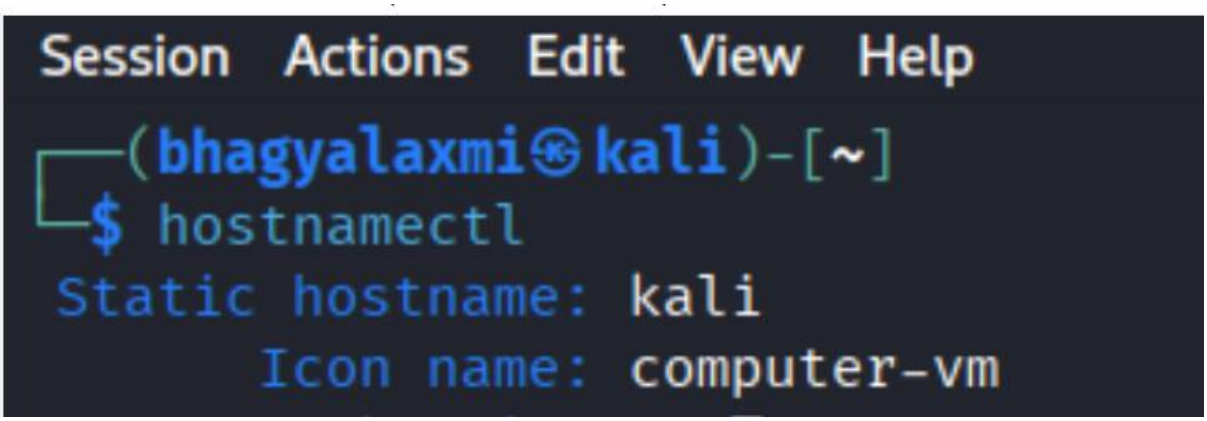
A. Explain the testing methodology and phases: Recon → Scanning → Exploitation → Validation.

Recon

Actions performed:

- Checked running services: sudo systemctl status ssh
- Viewed open ports: ss -tuln / netstat -tuln
- Confirmed logs available: ls -l /var/log/auth.log

Findings (example): SSH listening on port 22; auth logs present.




```
(bhagyalaxmi㉿kali)-[~]
$ ss -tulpen

Netid       State        Recv-Q       Send-Q                 Local Address:Port

tcp         LISTEN       0            128                          0.0.0.0:22
 ino:27401 sk:2 cgroup:/system.slice/ssh.service ←→
tcp         LISTEN       0            80                       127.0.0.1:3306
 uid:101 ino:10555 sk:3 cgroup:/system.slice/mariadb.service ←→
tcp         LISTEN       0            511                      127.0.0.1:5601
 uid:130 ino:12235 sk:4 cgroup:/system.slice/kibana.service ←→
```

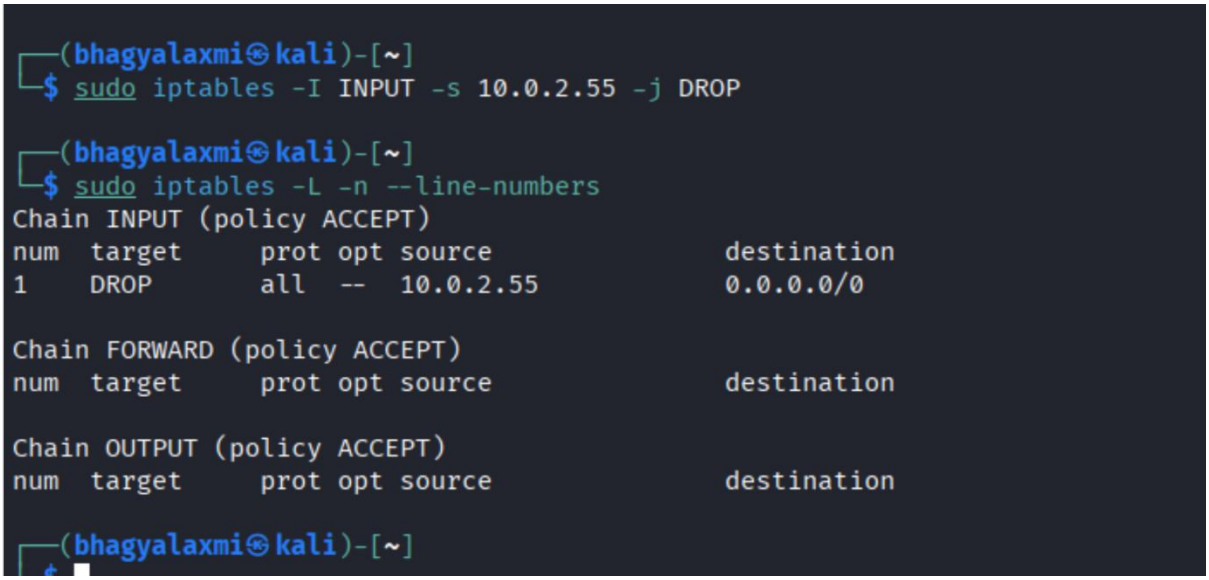
Scanning

Commands used:

- nmap -sS -sV -p 22 127.0.0.1 (basic port & version discovery)

```
(bhagyalaxmi㉿kali)-[~]
$ sudo nmap -sS -sV -Pn -p- 127.0.0.1 -oN /tmp/nmap_fullscan.txt && cat /tmp/nmap_f

[sudo] password for bhagyalaxmi:
Starting Nmap 7.95 ( https://nmap.org ) at 2025-10-26 13:31 IST
Nmap scan report for localhost (127.0.0.1)
Host is up (0.0000030s latency).
Not shown: 65527 closed tcp ports (reset)
PORT     STATE SERVICE         VERSION
22/tcp   open  ssh             OpenSSH 10.0p2 Debian 8 (protocol 2.0)
80/tcp   open  http            Apache httpd 2.4.65 ((Debian))
3306/tcp open  mysql?
5044/tcp open  lxi-evntsvc?
5601/tcp open  esmagent?
9200/tcp open  wap-wsp?
9300/tcp open  vrace?
9600/tcp open  micromuse-ncpw?
```

Iptables Bloks



B. Findings & Evidence

This section lists the concrete findings discovered during the simulation and links to the evidence files/screenshots.

Verifying Logs in Kibana

Actions Performed:

- Opened Kibana → Discover
- Created index pattern: **filebeat-***
- Observed live logs from /var/log/auth.log and /var/log/syslog.

Output:
System activities like login attempts, process logs, and authentication messages were visible in **real-time**.

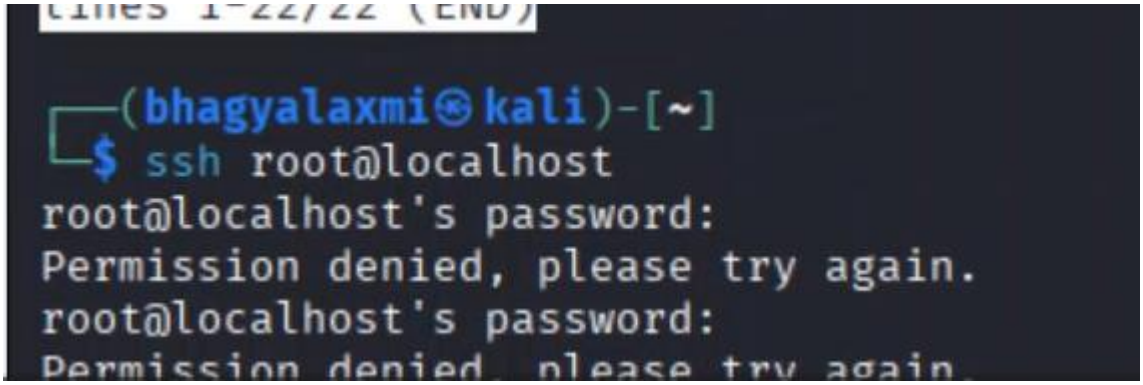
Repeated failed SSH logins (Brute-force)

On Kibana :

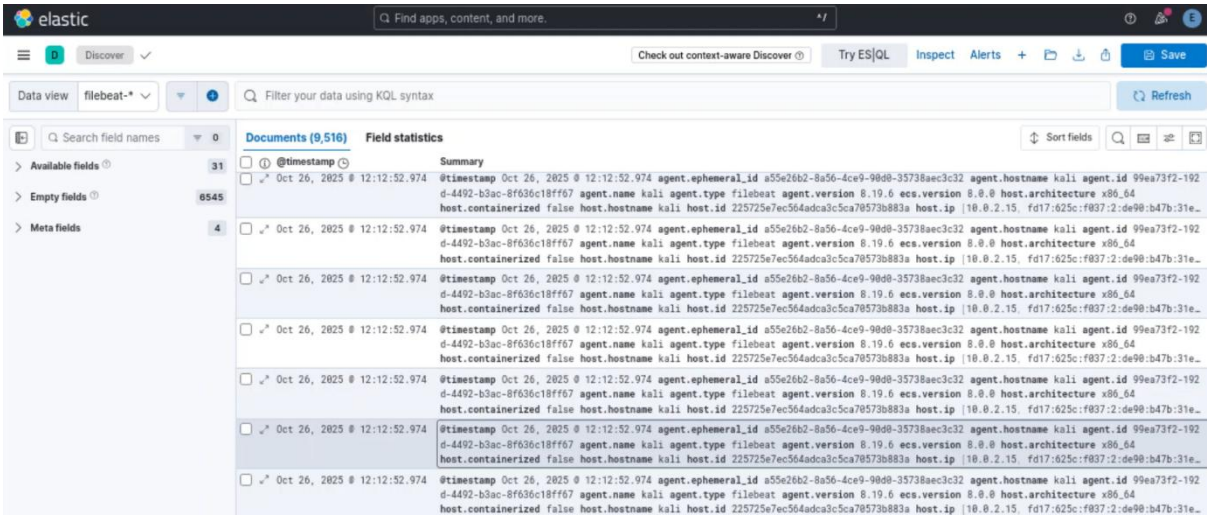
- **Created index pattern: system-logs-***
- **Visualizations: bar chart (failed logins per minute), table (top source IPs), discover query: message:"Failed password"**

- Severity: High (targeted authentication attack)
- Date/Time observed: [timestamp(s)]
- Indicator(s): Multiple Failed password entries in /var/log/auth.log and in Kibana.

  Failed login attemps:



- Evidence: Of kibana dashboard



- Relevant log lines (example):
- Oct 25 11:23:01 kali sshd[12345]: Failed password for invalid user admin from 127.0.0.1 port 51234 ssh2
- Oct 25 11:23:04 kali sshd[12345]: Failed password for root from 127.0.0.1 port 51234 ssh2
- Impact: Potential unauthorized access if credentials were guessed; denial of service risk for services.

C. Mitigation Strategies.

Immediate (short term)

1. Enable PermitRootLogin no in /etc/ssh/sshd_config.
2. Install and configure fail2ban to block repeated failed login attempts.
3. Use strong unique passwords and consider SSH key-based authentication only.
4. Restrict SSH access via firewall (allow only management IPs) or change SSH port.
5. Harden log retention: ensure logs are shipped to a remote ELK host or cloud for tamper evidence.

Medium term

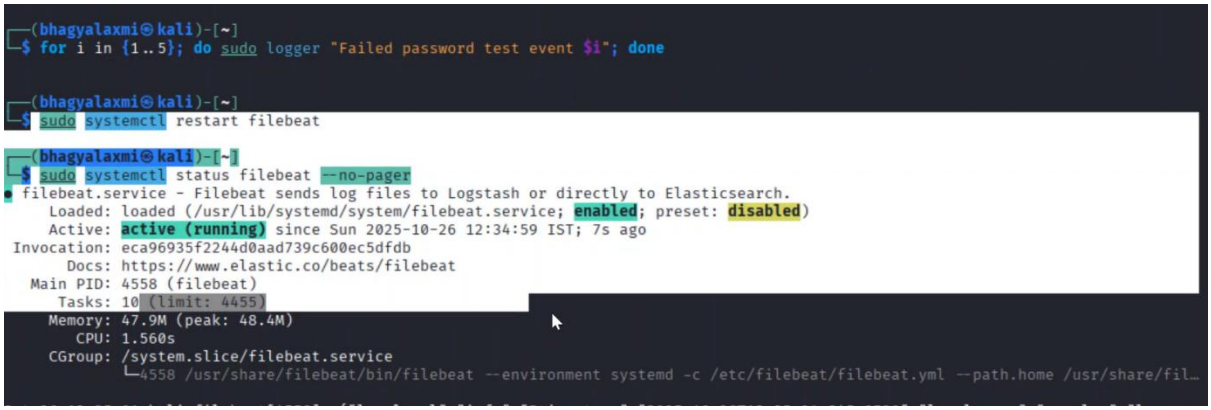
1. Implement multi-factor authentication for critical accounts.
2. Create richer detection rules: e.g., anomalous geolocation, impossible travel, repeated username attempts.
3. Integrate a SOAR playbook for automated containment (block IP, notify admin).
4. Configure secure storage backups for Elasticsearch indices and snapshots.

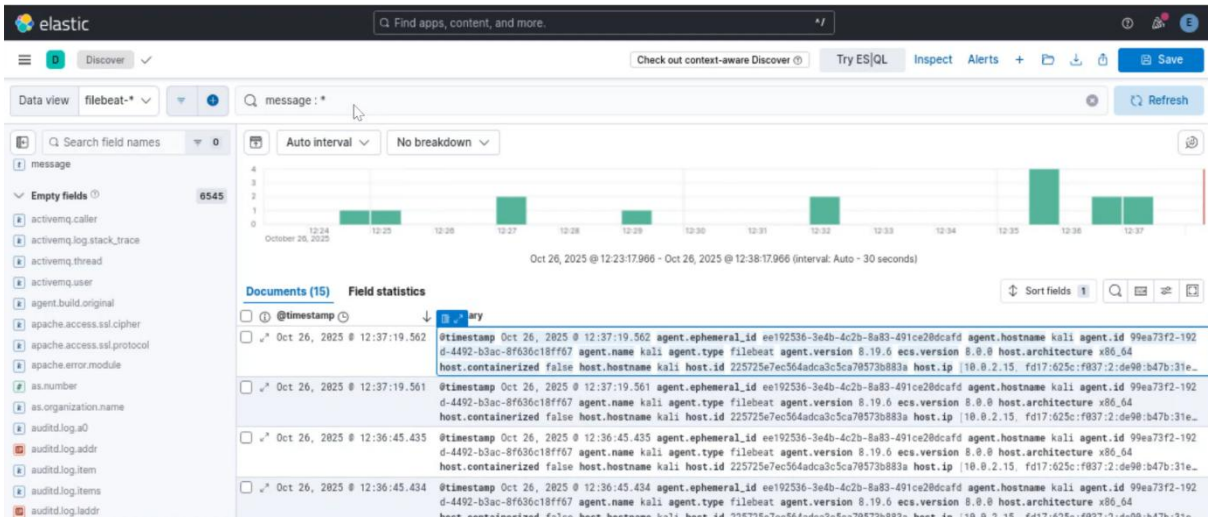
Summary

This phase successfully implemented the Mini SIEM using the ELK Stack and demonstrated real-time detection of brute-force login attempts. The environment functioned as intended, collecting logs, visualizing attacks, and supporting mitigation recommendations. The setup effectively simulates blue team monitoring and incident detection workflows.

Step 4- Incident Response Simulation

Detect attack in logs.





Final Outcome

Successfully set up the **ELK-based Mini SIEM**

Logs collected and visualized in real-time

SSH attack detected through Filebeat and Kibana

Kibana Dashboard created showing attacks