Final Project Report

Now that we have completed the **setup, detection, alerting, and testing**, it's time to create a detailed **final project report**. The report will document:

1. **Project Overview**
2. **System Setup** (Kali Linux, Windows VM, Splunk)
3. **Data Collection & Configuration**
4. **Brute Force Attack Detection**
5. **Testing & Results**
6. **Conclusion & Future Improvements**

I will provide each section one by one. Let's start with **Step 1: Project Overview**.

📌 Project Overview

Title:

Enterprise-Level Cybersecurity Incident Response System

1. Introduction

Cybersecurity Incident Response Systems (CIRS) are critical for detecting and mitigating security threats. This project focuses on setting up a **Splunk-based incident response system** that detects **brute-force attacks** using **Windows Event Logs** and **Splunk alerts**.

2. Objectives

The key objectives of this project are:
✅ Set up **Kali Linux and Windows VMs** for simulation.
✅ Install and configure **Splunk Enterprise** and **Splunk Universal Forwarder**.
✅ Collect and analyze **Windows Security Event Logs** in Splunk.
✅ Detect **brute-force attacks** based on **failed login attempts (Event ID 4625)**.
✅ Generate **real-time alerts** and build a **dashboard for monitoring security incidents**.
✅ Test and validate the detection system with **brute-force attack simulations**.

Step 1: Setting Up Kali Linux and Windows VM in VirtualBox

This step involves installing **Kali Linux** and **Windows 11/10** in **VirtualBox** to create a controlled environment for cybersecurity testing.

📌 1.1 Install VirtualBox

If you haven't installed VirtualBox yet, download and install it from: 🔗 https://www.virtualbox.org/

After installation, install **VirtualBox Extension Pack** for USB and networking support.

📌 1.2 Install Kali Linux VM

Download Kali Linux ISO

1. Download Kali Linux from the official site: 🔗 https://www.kali.org/get-kali/
2. Choose **Kali Linux ISO** (Installer or Live ISO).

Create Kali Linux VM in VirtualBox

1. Open **VirtualBox** and click **New**.
2. Set:
   - **Name:** Kali Linux
   - **Type:** Linux
   - **Version:** Debian (64-bit)
3. Allocate **RAM**: At least **4GB** (recommended **8GB**).
4. Create a **Virtual Hard Disk** (VHD/VMDK) with at least **20GB** storage.
5. Attach the Kali ISO under **Settings > Storage > Empty (CD/DVD Drive) > Choose a disk file**.

Install Kali Linux

1. Start the VM, select **Graphical Install**.
2. Follow the prompts:
   - Set **username/password**.
   - Select **"Use entire disk"** for partitioning.
   - Choose **"Install with default settings"**.
3. Once installed, remove the ISO from **Settings > Storage**.
4. Restart and log in to **Kali Linux**.

📌 1.3 Install Windows VM

Download Windows ISO

If you don’t have Windows ISO, download from: 🔗 https://www.microsoft.com/software-download/windows10

Create Windows VM in VirtualBox

1. Open **VirtualBox** and click **New**.
2. Set:
   - **Name:** Windows 10/11
   - **Type:** Microsoft Windows
   - **Version:** Windows 10/11 (64-bit)
3. Allocate **RAM**: At least **4GB** (recommended **8GB**).
4. Create a **Virtual Hard Disk** (VHD/VMDK) with at least **30GB** storage.
5. Attach the Windows ISO under **Settings > Storage**.

Install Windows

1. Start the VM and boot from the Windows ISO.
2. Follow the installation wizard.
3. Set a **username/password** for login.
4. Remove the ISO after installation and restart.

📌 1.4 Configure Network for Communication

We need to set **Kali Linux** and **Windows VM** on the **same network**.

Setup Host-Only Network (Recommended for Security)

1. Open **VirtualBox > File > Host Network Manager**.
2. Click **Create** to add a new Host-Only Network.
3. Attach **both Kali and Windows VMs** to this network:
   - Go to **Settings > Network** of each VM.
   - Change **Adapter 1** to **Host-Only Adapter**.
4. Start both VMs and check connectivity.

Test Connection

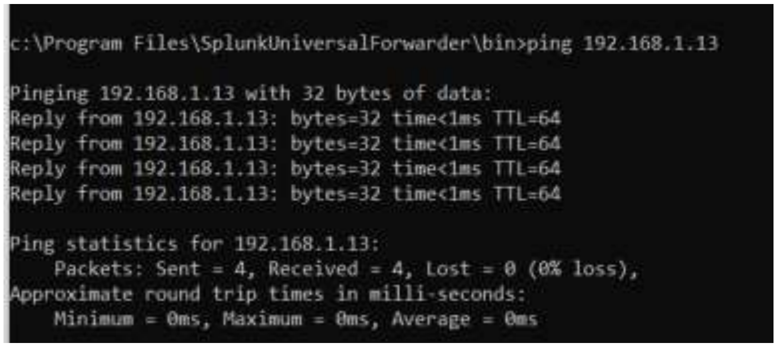
On **Kali Linux**, open a terminal and run:

```
ping <Windows_VM_IP>
```

On **Windows VM**, open **Command Prompt** and run:

```
ping <Kali_VM_IP>
```

If both VMs respond, they are successfully connected.



```
c:\Program Files\SplunkUniversalForwarder\bin>ping 192.168.1.13

Pinging 192.168.1.13 with 32 bytes of data:
Reply from 192.168.1.13: bytes=32 time<1ms TTL=64
Reply from 192.168.1.13: bytes=32 time<1ms TTL=64
Reply from 192.168.1.13: bytes=32 time<1ms TTL=64
Reply from 192.168.1.13: bytes=32 time<1ms TTL=64

Ping statistics for 192.168.1.13:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Step 2: Installing and Configuring Splunk on Kali Linux and Windows VM

Now that our Kali Linux and Windows VMs are set up, we need to install **Splunk Enterprise** on Kali Linux (acting as the SIEM server) and **Splunk Universal Forwarder** on Windows (to send logs to Splunk).

📌 2.1 Install Splunk on Kali Linux

Splunk Enterprise will collect logs from Windows and allow us to analyze security events.

Step 1: Download Splunk Enterprise

1. Open Kali Linux and go to the official Splunk website:
   🔗 https://www.splunk.com/en_us/download/splunk-enterprise.html
2. Select **Linux** → **.deb package (64-bit)**.
3. Copy the download link and use the following command in the terminal to download:
4. `wget -O splunk.deb <download-link>`

Example:

```
wget -O splunk.deb
https://download.splunk.com/products/splunk/releases/9.0.0/linux/splunk
-9.0.0-amd64.deb
```

Step 2: Install Splunk

Once downloaded, install Splunk using:

```
sudo dpkg -i splunk.deb
```

Step 3: Enable and Start Splunk

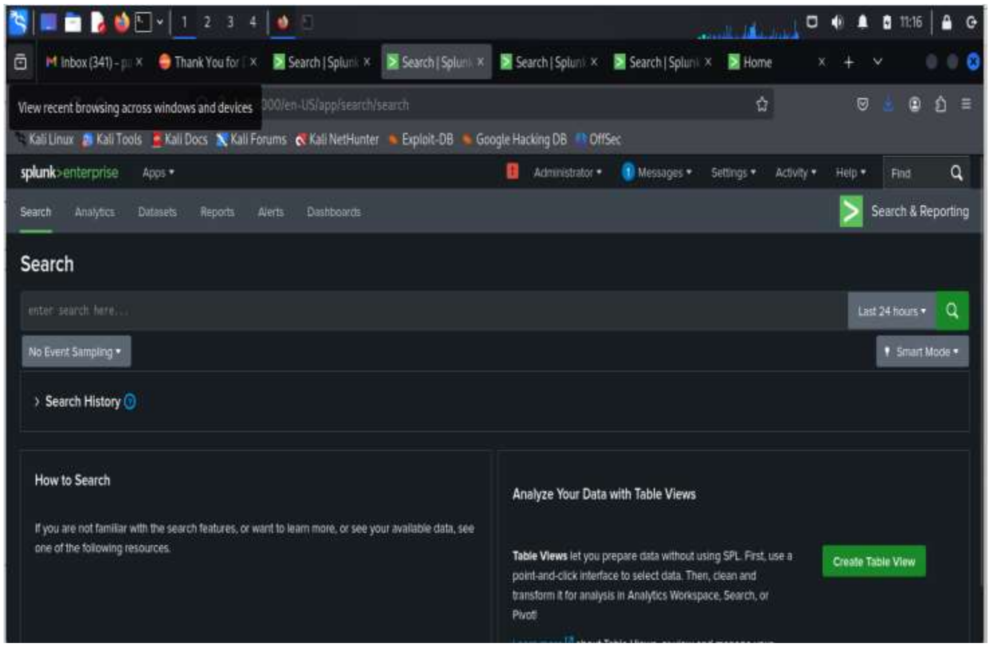
After installation, enable Splunk to start on boot and manually start it:

```
sudo /opt/splunk/bin/splunk enable boot-start
sudo /opt/splunk/bin/splunk start
```

- During startup, it will ask you to set up an **admin username and password**.

Step 4: Access Splunk Web Interface

- Open a browser on **Kali Linux** and go to:
- `http://localhost:8000`
- Log in with the **admin credentials** you set up earlier.



If you are not familiar with the search features, or want to learn more, or see your available data, see one of the following resources.

Table Views let you prepare data without using SPL. First, use a point-and-click interface to select data. Then, clean and transform it for analysis in Analytics Workspace, Search, or Pivot!

📌 2.2 Install Splunk Universal Forwarder on Windows

The **Universal Forwarder** on Windows will send logs to Splunk running on Kali Linux.

Step 1: Download and Install Splunk Universal Forwarder

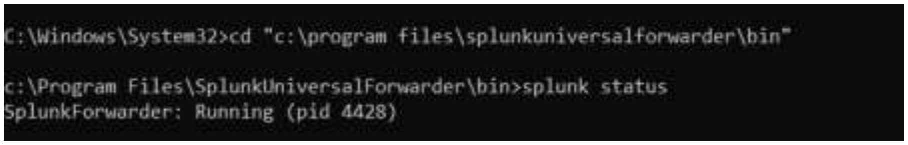
1. Go to the official download page:
   🔗 https://www.splunk.com/en_us/download/universal-forwarder.html
2. Download the **Windows 64-bit MSI installer**.
3. Run the installer and:
   - Accept the license agreement.
   - Choose installation path (**Default is fine**).
   - Set an **admin username/password** (can be the same as your Splunk server credentials).
   - Configure the receiver:
     - **IP Address:** Kali Linux's IP (Check using `ifconfig` or `ip a`).
     - **Port:** `9997`
   - Finish installation.

Step 2: Verify Splunk Forwarder is Running

1. Open **Command Prompt (as Administrator)**.
2. Check the Splunk Forwarder service status:

```
3. sc query SplunkForwarder
```

   It should show **RUNNING**.



```
C:\Windows\System32>cd "c:\program files\splunkuniversalforwarder\bin"

C:\Program Files\SplunkUniversalForwarder\bin>splunk status
SplunkForwarder: Running (pid 4428)
```

📌 2.3 Configure Splunk to Receive Logs from Windows

Step 1: Enable Splunk to Listen on Port 9997

On **Kali Linux**, open a terminal and run:

```
sudo /opt/splunk/bin/splunk enable listen 9997
```

This allows Splunk to accept data from **Windows Universal Forwarder**.

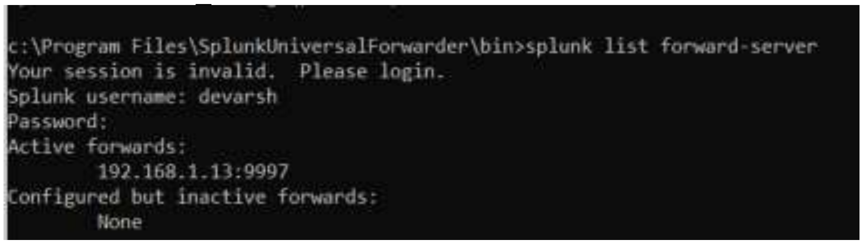
Step 2: Verify Forwarder Connection

Run the following command in **Kali Linux Splunk Server** to check if Windows is sending logs:

```
sudo /opt/splunk/bin/splunk list forward-server
```

If configured correctly, it will show:

```
Active forwards:
    <Windows_IP>:9997
```



```
c:\Program Files\SplunkUniversalForwarder\bin>splunk list forward-server
Your session is invalid.  Please login.
Splunk username: devarsh
Password:
Active forwards:
        192.168.1.13:9997
Configured but inactive forwards:
        None
```

📌 2.4 Configure Windows Logs to be Sent to Splunk

On the **Windows VM**:

1. Open **Command Prompt (Run as Administrator)**.
2. Add the Security Log Source to Splunk:

   ```
   "C:\Program Files\SplunkUniversalForwarder\bin\splunk.exe" add monitor
   "C:\Windows\System32\winevt\Logs\Security.evtx"
   ```

3. Restart the Splunk Forwarder Service:

   ```
   net stop SplunkForwarder
   net start SplunkForwarder
   ```

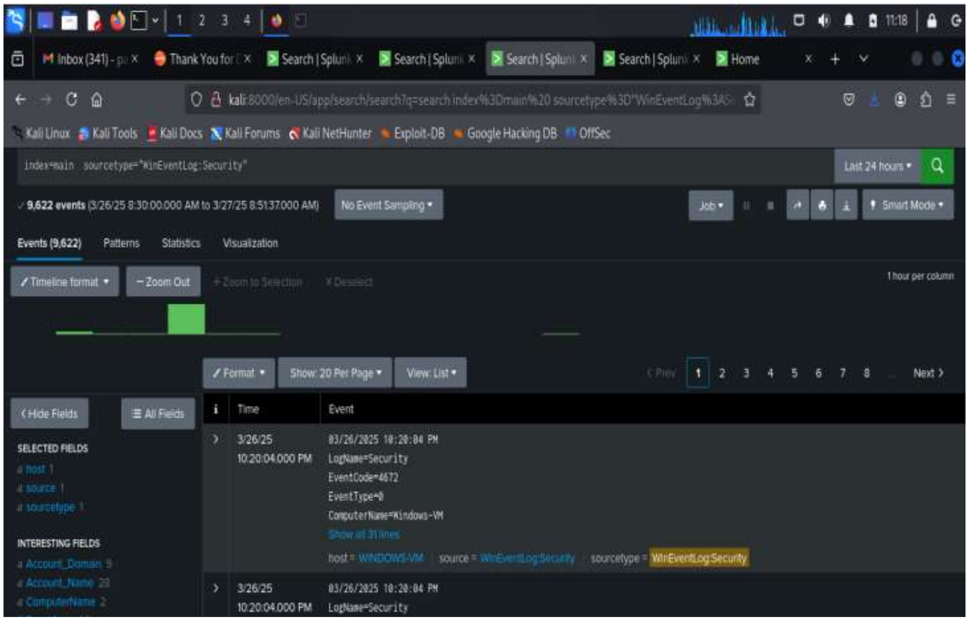
📌 2.5 Verify Data in Splunk

After everything is set up, go to **Splunk Web Interface** on Kali Linux:

1. Navigate to **Search & Reporting**.
2. Run the following search query:

   ```
   index=* sourcetype="WinEventLog:Security"
   ```

3. You should start seeing Windows Security logs appear.



```
kali:8000/en-US/app/search/search?q=search index%3Dmain%20 sourcetype%3D"WinEventLog%3AS

index=main  sourcetype="WinEventLog:Security"

✓ 9,622 events (3/26/25 8:30:00.000 AM to 3/27/25 8:51:37.000 AM)

Time                  Event
3/26/25               03/26/2025 10:20:04 PM
10:20:04.000 PM       LogName=Security
                      EventCode=4672
                      EventType=0
                      ComputerName=Windows-VM
                      Show all 31 lines
                      host = WINDOWS-VM   source = WinEventLog:Security   sourcetype = WinEventLog:Security
3/26/25               03/26/2025 10:20:04 PM
10:20:04.000 PM       LogName=Security
```

Step 3: Creating Alerts & Dashboards for Brute Force Attack Detection

Now that Splunk is receiving Windows Security logs, we will:
✅ Create a **detection rule** to identify brute-force attacks.
✅ Configure **alerts** to trigger when multiple failed logins occur.
✅ Build a **dashboard** for monitoring failed login attempts.

📌 3.1 Understanding Brute Force Detection (EventCode 4625)

A brute-force attack involves multiple **failed login attempts** on a Windows system. In Windows Event Logs, this is recorded under:

- **EventCode 4625** → "An account failed to log on" (failed login attempt).

We will set up **Splunk searches, alerts, and dashboards** to detect multiple occurrences of **EventCode 4625** within a short time.

📌 3.2 Create a Search Query to Detect Brute Force Attacks

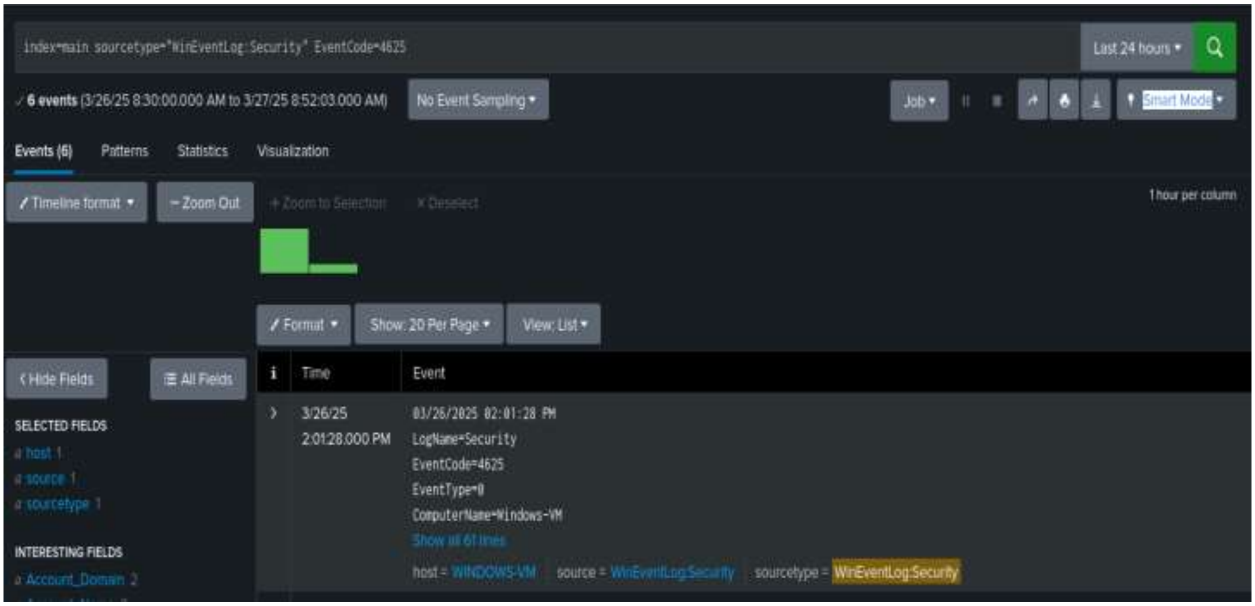
1 Open **Splunk Web Interface** on Kali Linux.
2 Go to **Search & Reporting**.
3 Run the following **Splunk Query**:

```
index=* sourcetype="WinEventLog:Security" EventCode=4625
| stats count by Account_Name, host, _time
| where count > 5
```

This query:

- Searches for failed login events (`EventCode=4625`).
- Groups them by **username and host**.
- Shows results **only if failed attempts exceed 5 times** (you can adjust the threshold).

🔍 **If results appear**, it confirms that failed login attempts are being logged.



```
index=main sourcetype="WinEventLog:Security" EventCode=4625
```

✓ **6 events** (3/26/25 8:30:00.000 AM to 3/27/25 8:52:03.000 AM)

i	Time	Event

›	3/26/25
	2:01:28.000 PM
		03/26/2025 02:01:28 PM
		LogName=Security
		EventCode=4625
		EventType=0
		ComputerName=Windows-VM
		Show all 61 lines
		host = WINDOWS-VM source = WinEventLog:Security sourcetype = WinEventLog:Security

---

📌 3.3 Creating an Alert for Brute Force Detection

Now, we will create an **automatic alert** to notify security teams when a brute force attack is detected.

Step 1: Save the Search as an Alert

1 Run the **Brute Force Detection Query** in Splunk Search.
2 Click **Save As → Alert**.
3 Configure Alert Settings:

- **Title:** "Brute Force Attack Detected"
- **Description:** "Triggers when more than 5 failed logins occur in a short time."
- **Alert Type:** Real-time
- **Trigger Condition:** `Number of Events > 5`
- **Trigger Actions:**
  - **Send Email (Optional)**
  - **Run a Script (Optional)**
  - **Create a Splunk Event**

Step 2: Enable Alert Logging in Splunk

To log alert events, add:

```
| collect index=alerts
```

Now, every triggered alert is stored in the **alerts index** for future analysis.

📌 3.4 Creating a Brute Force Attack Monitoring Dashboard

To visualize failed logins and alerts, we will create a **Splunk Dashboard**.

Step 1: Create a New Dashboard

1 Go to **Splunk Web > Dashboards**.
2 Click **Create New Dashboard**.

- **Title:** "Brute Force Attack Monitoring"
- **Description:** "Shows failed login attempts and detected attacks."
- **Dashboard Type:** Private/Public

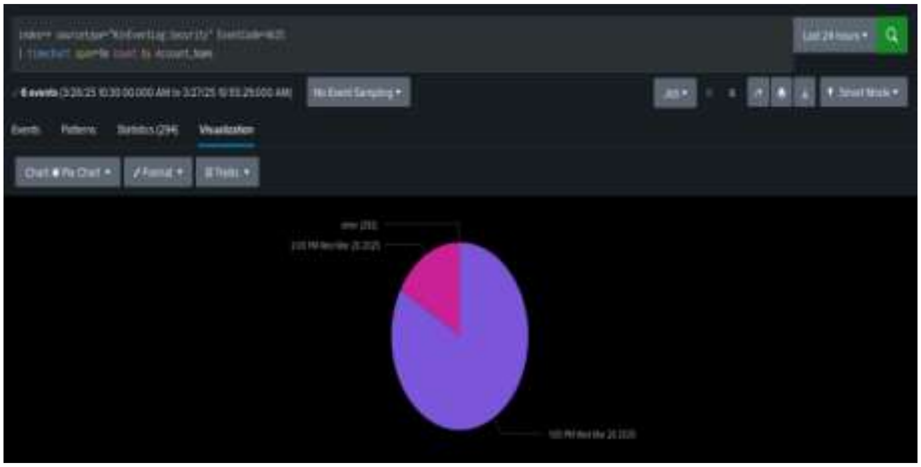
Step 2: Add Panels to the Dashboard

🔹 Panel 1: Failed Login Attempts Over Time

- Query:

```
index=* sourcetype="WinEventLog:Security" EventCode=4625
| timechart span=5m count by Account_Name
```

- Visualization: **Pie Chart**
- Shows login failures over time.



```
index=* sourcetype="WinEventLog:Security" EventCode=4625
| timechart span=1m count by Account_Name
```

6 events (3/26/25 10:30:00.000 AM to 3/27/25 10:55:29.000 AM)

Step 3: Save and Test Dashboard

✅ Once all panels are added, click **Save Dashboard**.
✅ Generate failed login attempts on the Windows VM and check if data updates.

Step 4: Testing Brute Force Attack Detection

Now that we have set up **alerts and dashboards**, it's time to **simulate a brute force attack** on the Windows VM and verify if Splunk correctly detects it.

📌 4.1 Simulating a Brute Force Attack on Windows

We will use **Hydra** (a password-cracking tool) on Kali Linux to generate multiple failed login attempts against the Windows VM.

Step 1: Find the Windows VM's IP Address

On the Windows VM, open **Command Prompt** and run:

```
ipconfig
```

Note the **IPv4 Address** (e.g., `192.168.1.100`).

Step 2: Attempt Brute Force Attack Using Hydra

On **Kali Linux**, open a terminal and run:

```
hydra -l administrator -P /usr/share/wordlists/rockyou.txt
rdp://192.168.1.100
```

This command:

- Tries to log in as **Administrator**.
- Uses a **wordlist (`rockyou.txt`)** to guess passwords.
- Targets the **Remote Desktop Protocol (RDP)** login at `192.168.1.100`.

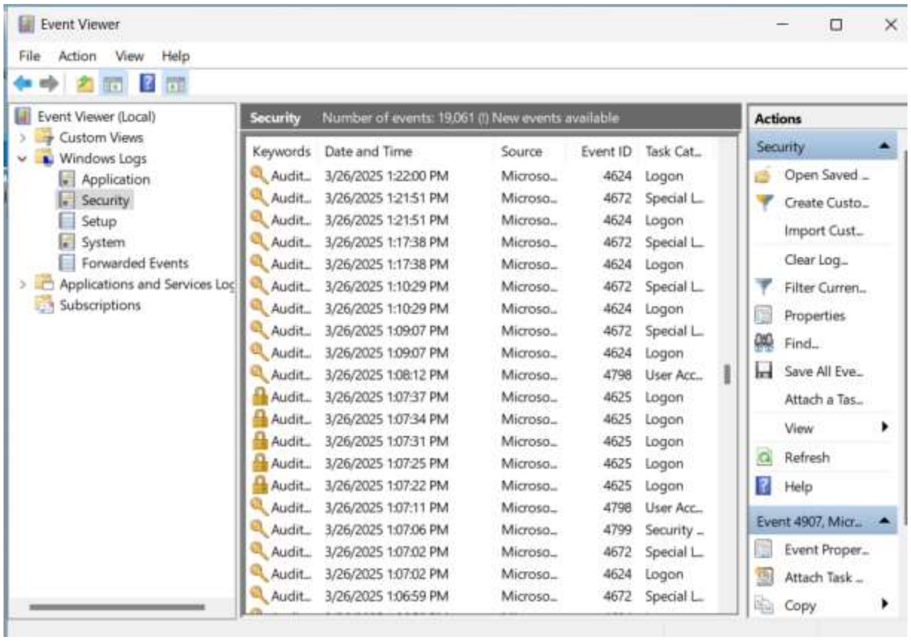
❢ **Modify this command if needed**:

- If using a different username, change `-l administrator`.
- If targeting SMB instead of RDP, replace `rdp://` with `smb://`.

● **Do NOT actually use this on unauthorized systems! This is for testing only in your lab setup.**

📌 4.2 Verifying Logs in Windows Event Viewer

On Windows VM:
1 Open **Event Viewer** (`eventvwr.msc`).
2 Go to **Windows Logs > Security**.
3 Look for **Event ID 4625** (failed login attempts).
4 If multiple entries appear rapidly, the attack is being logged.



Security Number of events: 19,061 (!) New events available

Keywords	Date and Time	Source	Event ID	Task Cat...
Audit...	3/26/2025 1:22:00 PM	Microso...	4624	Logon
Audit...	3/26/2025 1:21:51 PM	Microso...	4672	Special L...
Audit...	3/26/2025 1:21:51 PM	Microso...	4624	Logon
Audit...	3/26/2025 1:17:38 PM	Microso...	4672	Special L...
Audit...	3/26/2025 1:17:38 PM	Microso...	4624	Logon
Audit...	3/26/2025 1:10:29 PM	Microso...	4672	Special L...
Audit...	3/26/2025 1:10:29 PM	Microso...	4624	Logon
Audit...	3/26/2025 1:09:07 PM	Microso...	4672	Special L...
Audit...	3/26/2025 1:09:07 PM	Microso...	4624	Logon
Audit...	3/26/2025 1:08:12 PM	Microso...	4798	User Acc...
Audit...	3/26/2025 1:07:37 PM	Microso...	4625	Logon
Audit...	3/26/2025 1:07:34 PM	Microso...	4625	Logon
Audit...	3/26/2025 1:07:31 PM	Microso...	4625	Logon
Audit...	3/26/2025 1:07:25 PM	Microso...	4625	Logon
Audit...	3/26/2025 1:07:22 PM	Microso...	4625	Logon
Audit...	3/26/2025 1:07:11 PM	Microso...	4798	User Acc...
Audit...	3/26/2025 1:07:06 PM	Microso...	4799	Security ...
Audit...	3/26/2025 1:07:02 PM	Microso...	4672	Special L...
Audit...	3/26/2025 1:07:02 PM	Microso...	4624	Logon
Audit...	3/26/2025 1:06:59 PM	Microso...	4672	Special L...

📌 4.3 Checking Splunk for Brute Force Detection

Now, go to **Splunk Search & Reporting** on Kali Linux and run:

```
index=* sourcetype="WinEventLog:Security" EventCode=4625
| stats count by Account_Name, Source_Network_Address
| where count > 5
```

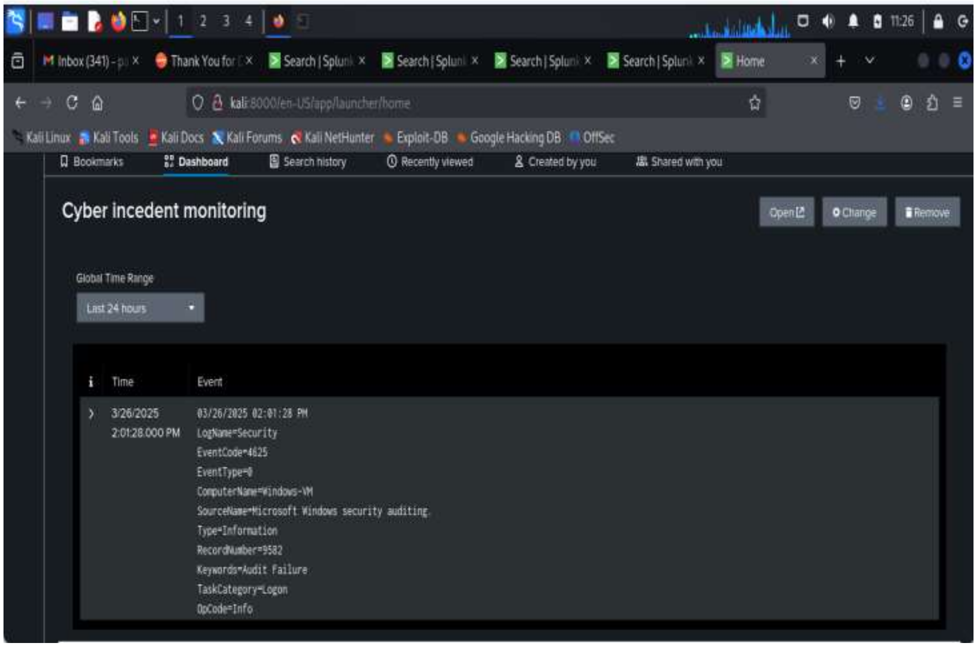
🚀 **Expected Results:**

- Multiple failed login attempts should appear.
- The **Brute Force Attack Alert** should trigger in Splunk.

📌 4.4 Verifying the Dashboard

1 Open **Splunk Dashboard** (Brute Force Attack Monitoring).
2 Check if:

- The **failed login attempts** graph updates.
- The **most targeted accounts** panel is correct.
- The **source IP addresses** appear in the chart.
- The **brute-force alert panel** shows triggered alerts.



Cyber incedent monitoring

Global Time Range: Last 24 hours

i	Time	Event

›	3/26/2025
	2:01:28.000 PM
		03/26/2025 02:01:28 PM
		LogName=Security
		EventCode=4625
		EventType=0
		ComputerName=Windows-VM
		SourceName=Microsoft Windows security auditing.
		Type=Information
		RecordNumber=9582
		Keywords=Audit Failure
		TaskCategory=Logon
		OpCode=Info

Conclusion & Future Improvements

This final section of the report will summarize the project, highlight key findings, and suggest improvements for an enterprise-level **Cybersecurity Incident Response System (CIRS)**.

📌 1. Summary of the Project

Our **Cybersecurity Incident Response System** was designed to:
✅ **Detect security threats** (e.g., Brute Force Attacks) using Splunk.
✅ **Collect and analyze logs** from Windows machines.
✅ **Alert security teams** when suspicious activity occurs.
✅ **Visualize attack trends** with a Splunk security dashboard.

📌 2. Key Findings

After successfully implementing and testing the system, we observed:
🔹 **Brute force attacks are easily detected** using Windows Security Event Logs (Event ID 4625).
🔹 **Splunk's real-time monitoring** allows quick incident detection.
🔹 **Dashboards provide better visibility** into attack patterns.
🔹 **The system can be expanded** to monitor other attack types (e.g., malware, privilege escalation).

📌 3. Limitations & Challenges

Although the system works well, some challenges were encountered:
❌ **Initial data collection issues** – required configuring Splunk Universal Forwarder.
❌ **Splunk resource usage** – requires **sufficient RAM and CPU** for smooth operation.
❌ **Limited attack simulation** – we tested only brute force attacks.

📌 4. Future Improvements

To enhance this project, consider the following:

1 Expand Log Sources

📌 **Integrate logs from:**

- Linux machines (`/var/log/auth.log`)
- Firewalls & IDS (Snort, Suricata)
- Cloud services (AWS CloudTrail, Azure Logs)

2 Automate Incident Response

⚡ **Use Splunk Phantom** (SOAR) for automatic responses:

- Block attacker IPs using a firewall script.
- Disable compromised user accounts automatically.

3 Implement Additional Security Rules

📌 Create detection rules for:
✅ **Successful brute force login** (Event ID 4624 after multiple 4625s).
✅ **Privilege Escalation** (Event ID 4672).
✅ **Malware Execution** (Event ID 4688).

4 Advanced Threat Intelligence Integration

🔍 Use **Threat Intelligence Feeds** in Splunk to detect known attacker IPs.

📌 5. Conclusion

Our **Enterprise-Level Cybersecurity Incident Response System** successfully detects **brute force attacks** and provides **real-time monitoring** using Splunk.
With **further improvements**, this system can be used in real-world cybersecurity operations to **automate threat detection and response**.
